

PHILIPPINE BIDDING DOCUMENTS

(As Harmonized with Development Partners)

Construction of Provincial Warehouse with Multi-Purpose Drying Pavement in Bugallon

**Identification No. PRDP-SU-IB-R001-PAN-004-000-000-2023-
VCI**

Fifth Edition

April 30, 2024

BID OPENING CHECKLIST

Envelope 1

ELIGIBILITY DOCUMENTS
a. Registration Certification of the Company (from SEC or DTI or CDA)
b. Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid and average Annual Turnover as specified in ITB Clause 5.4 hereof: Basis of Critical Eligibility and Qualification Criteria: - At least one (1) work of a nature and complexity equivalent to the Works generally within the last ten (10) years with at least fifty percent (50%) of the Estimated Project Cost (EPC) in the amount of Php21,041,000.00 ; and - Average Annual turnover of Construction Income for the last three (3) years of at least 100% of the EPC in the amount of Php42,082,000.00 as evidenced by the submitted Audited Financial Statements for the last three (3) years.
c. Audited Financial Statements for the last three (3) years [with supporting Income Tax Return stamped "received" by BIR or its duly accredited and authorized institutions or eBIR Tax Return Receipt Confirmation (if submitted through eBIR), and eFPS]
d. In case of Joint Venture, a duly notarized Joint Venture agreement and a copy of the duly accomplished application form for Special License of the Joint Venture filed with the PCAB, or a copy of the Special License of the Joint Venture if already issued.
e. Qualification Information (please follow the link https://bit.ly/prdppangQInfo for the template)
TECHNICAL DOCUMENTS
f. Bid Security, in the form of Bid Securing Declaration (please follow the link https://bit.ly/prdppangBSD for the template)
g. Project requirements, which shall include the following: (i) List of Contractor's personnel, viz: a. Project Engineer – Licensed Civil/Agricultural Engineer with minimum of five (5) years' experience as a Licensed Civil/Agricultural Engineer and has at least two (2) building construction project handled as Project Engineer with a value of at least twenty percent (20%) of the EPC/ Component and must be related to the nature of Works being procured; b. Materials Engineer – Licensed Civil Engineer duly accredited by DPWH following DPWH D.O. 98, S. of 2016 as Materials Engineer I (<i>as required under SCC Clause 6.5</i>), to be assigned to the contract to be bid, with their complete qualifications and experience data (ii) List of Bidder's major and critical equipment units, which are owned and are supported by proof of ownership, such as, without limitation, Deed of Sale, Official Receipt/Certificate of Registration, Sales Invoice, Charge Invoice or Delivery Receipt, which must meet the minimum requirement for the contract set in the Bid Data Sheet

Pass (if all the above documents are present)

Fail (if non-historical documents are absent, such as JV agreement, Bid Securing Declaration, Bid Form and Bill of Quantities)

Notwithstanding the BAC's declaration of non-responsiveness of the first bid envelope, the financial proposals contained in the second bid envelopes of all the bidders shall be read. The first and second envelopes shall not be returned to the bidders.

Foreign bidders may submit the equivalent documents, if any, issued by the country of the foreign bidder.

Envelope 2

FINANCIAL PROPOSAL
Bid price in approved Bid form (please follow the link https://bit.ly/prdppangBF for the template) and Bid prices in the Bill of Quantities (please follow the link https://bit.ly/bugallon_warehouse_BOQ for the Bill of Quantities)

BID DATA SHEET

Clause 20.3 Each bidder shall submit one (1) original and four (4) copies of the first and second components of its bid. An electronic copy of the bid should also be submitted in PDF file format in a flash drive. Should there be discrepancies, the original copy would prevail.

BID OPENING CHECKLIST (JOINT VENTURE)

Envelope 1

ELIGIBILITY DOCUMENTS
a. Registration Certification of the Company (from SEC or DTI or CDA) <i>(each partner)</i>
b. Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid and average Annual Turnover as specified in ITB Clause 5.4 hereof <i>(each partner/ either one of the partners)</i> : Basis of Critical Eligibility and Qualification Criteria: - At least one (1) work of a nature and complexity equivalent to the Works generally within the last ten (10) years with at least fifty percent (50%) of the Estimated Project Cost (EPC) in the amount of Php21,041,000.00 <i>(each partner/ either one of the partners)</i> and 25% of the EPC in the amount of Php10,520,500.00 <i>for the rest of the partners</i> ; and - Average Annual Turnover of Construction Income for the last three (3) years of at least 100% of the EPC in the amount of Php42,082,000.00 as evidenced by the submitted Audited Financial Statements for the last three (3) years <i>(each partner/ either one of the partners)</i> and 50% of the EPC for the rest of the partners.
c. Audited Financial Statements for the last three (3) years [with supporting Income Tax Return stamped "received" by BIR or its duly accredited and authorized institutions or eBIR Tax Return Receipt Confirmation (if submitted through eBIR), and eFPS] <i>(each partner)</i>
d. In case of Joint Venture, a duly notarized Joint Venture agreement and a copy of the duly accomplished application form for Special License of the Joint Venture filed with the PCAB, or a copy of the Special License of the Joint Venture if already issued.
e. Qualification Information (please follow the link https://bit.ly/prdppangQInfo for the template)
TECHNICAL DOCUMENTS
f. Bid Security, in a form of Bid Securing Declaration (please follow the link https://bit.ly/prdppangBSD for the template) <i>(prescribed template in the name of the Joint Venture)</i>
g. Project requirements, which shall include the following <i>(pooling of resources or combination among partners)</i> : (i) List of Contractor's personnel, viz: a. Project Engineer – Licensed Civil/Agricultural Engineer with minimum of five (5) years' experience as a Licensed Civil/Agricultural Engineer and has at least two (2) building construction project handled as Project Engineer with a value of at least twenty percent (20%) of the EPC/ Component and must be related to the nature of Works being procured; b. Materials Engineer – Licensed Civil Engineer duly accredited by DPWH following DPWH D.O. 98, S. of 2016 as Materials Engineer I <i>(as required under SCC Clause 6.5)</i> , to be assigned to the contract to be bid, with their complete qualifications and experience data (ii) List of Bidder's major and critical equipment units, which are owned and are supported by proof of ownership, such as, without limitation, Deed of Sale, Official Receipt/Certificate of Registration, Sales Invoice, Charge Invoice or Delivery Receipt, which must meet the minimum requirement for the contract set in the Bid Data Sheet

Pass (if all the above documents are present)

Fail (if non-historical documents are absent, such as JV agreement, Bid Securing Declaration, Bid Form and Bill of Quantities)

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Bid price in approved Bid form (please follow the link https://bit.ly/prdppangBF for the template) and Bid prices in the Bill of Quantities (please follow the link https://bit.ly/bugallon_warehouse_BOQ for the Bill of Quantities)

BID DATA SHEET

Clause 20.3 Each Bidder shall submit one (1) original and four (4) copies of the first and second components of its bid. An electronic copy of the bid should also be submitted in PDF file format in a flash drive. Should there be discrepancies, the original copy would prevail.

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Section I. Invitation to Bid

**Republic of the Philippines
Philippine Rural Development Project Scale Up
Invitation to Bid for the**

Construction of Provincial Warehouse with Multi-Purpose Drying Pavement in Bugallon

**Identification No. PRDP-SU-IB-R001-PAN-004-000-000-2023-VCI
Loan No. 9577-PH**

30 April 2024

1. The Government of the Philippines (GoP) has received a Loan from the World Bank towards the cost of Philippine Rural Development Project Scale Up and it intends to apply part of the proceeds of this Loan to payments under the contract for the **Construction of Provincial Warehouse with Multi-Purpose Drying Pavement in Bugallon / PRDP-SU-IB-R001-PAN-004-000-000-2023-VCI**.
2. The **Provincial Government of Pangasinan**, implementing partner of the Department of Agriculture, now invites bids for the **Construction of Provincial Warehouse with Multi-Purpose Drying Pavement in Bugallon**. Completion of the Works is required by **395 calendar days**. Bidders should have completed, within the last ten (10) years, a contract similar to the Project. The description of an eligible bidder is contained in the Bidding Documents, particularly, in Section II. Instructions to Bidders.
3. Bidding will be conducted in accordance with relevant procedures for open competitive bidding as specified in the IRR of RA 9184 (R.A. 9184), with some amendments, as stated in these bidding documents and is open to all bidders from eligible source countries as defined in the applicable procurement regulations of the World Bank. The contract shall be awarded to the Lowest Calculated Responsive Bidder (LCRB) who was determined as such during post-qualification. The Estimated Project Cost for this project is **Forty-Two Million Eighty-Two Thousand pesos (Php42,082,000.00)**.
4. Interested bidders may obtain further information from the Bids and Awards Committee of the Provincial Government of Pangasinan and inspect the Bidding Documents at the address given below and also at the PRDP Regional Project Coordination Office 1 at DA RFO 1, Aguila Road, Sevilla, San Fernando City, La Union and at the PRDP Project Support Office North Luzon A Cluster with address at Sto. Niño City of San Fernando, Pampanga and at the National Project Coordination Office (NPCO) with address at Elliptical Road, Diliman, Quezon City from **8:00 a.m. to 5:00 p.m.**, Mondays to Fridays.

5. A complete set of Bidding Documents may be purchased by interested Bidders starting **30 April 2024** from the Bids and Awards Committee of the Provincial Government of Pangasinan with address below, from PRDP RPCO 1 or PRDP PSO North Luzon A Cluster and upon payment or depositing to the **Provincial Government of Pangasinan – LBP Lingayen Branch Acct# 2422-1000-51** a non-refundable fee for the bidding documents in the amount of **Ten Thousand Pesos (PhP10,000.00) not later than the submission of their bids**. The LGU Treasurer’s official receipt, the bank teller’s validated deposit slip or printed receipt from digital payment serves as the proof of payment.

Digital payment shall mean payment using the likes of PayMaya, IAccess, Smart Money, GCash, Coins.ph and other means of digital payment.

Bidding Documents may also be downloaded free of charge from the website of the Philippine Government Electronic Procurement System (PhilGEPS) and the PRDP website (prdp.da.gov.ph). For Detailed Engineering Design (DED), Drawings and Plans, please follow the link <https://bit.ly/bugallonwarehouseDED>

As part of the transparency measures being instituted by the Department of Agriculture (DA) the bidders can virtually visit the site of the above-described subproject at prdp.da.gov.ph where geotagged base photographs are viewable. The DA, however, requires that all potential contractors who will be awarded contract under the project shall have undergone geotagging training provided by the PRDP Project Support Office.

6. The Provincial Government of Pangasinan will hold a Pre-Bid Conference on **May 17, 2024 at 10:00 AM** at the **Multi-Purpose Hall, PESO Building, East Alvear St., Lingayen, Pangasinan,** with invitation link <https://us02web.zoom.us/j/87353312554?pwd=MjdPU3h1a1U0SWNRUktszczVLZEhrZz09> , which shall be open to all interested parties.
7. Bids must be duly received by the BAC Secretariat at the address below on or before **May 30, 2024 at 10:00 AM**. All bids must be accompanied by a **Bid Securing Declaration**.
8. Bids will be opened on **May 30, 2024 at 10:00 AM** at the **Multi-Purpose Hall, PESO Building, East Alvear St., Lingayen, Pangasinan** with invitation link <https://us02web.zoom.us/j/88549547789?pwd=S3JoRFVIMHdLMWp1T0pOY2lMSE16dz09> which shall be open to all interested parties. Bids will be opened in the presence of the bidders’ representatives who choose to attend at the address below. Late bids shall not be accepted.
9. The Provincial Government of Pangasinan reserves the right to accept or reject any bid, to annul the bidding process, and to reject all bids at any time prior to contract award, without thereby incurring any liability to the affected bidder or bidders.
10. For further information, please refer to:

RHODYN LUCHINVAR O. ORO
BAC Secretariat Head
Bids and Awards Committee
Provincial Government of Pangasinan
Tel. No. (075) 638 7840

MELICIO F. PATAGUE II
BAC Chairperson

Section II. Instruction to Bidders

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A. General

1. Scope of Bid

- 1.1. The Procuring Entity named in the BDS, invites bids for the construction of Works, as described in Section VI Specifications.
- 1.2. The name, identification, and number of lots specific to this bidding are provided in the BDS. The contracting strategy and basis of evaluation of lots is described in **ITB Clause 27**.
- 1.3. The successful Bidder will be expected to complete the Works by the intended completion date specified in **SCC Clause 1.17**.

2. Source of Funds

- 2.1. The Procuring Entity has a budget or received funds from the Funding Source named in the BDS, and in the amount indicated in the BDS. It intends to apply part of the funds received for the Project, as defined in the BDS, to cover eligible payments under the Contract for the Works.

3. Corrupt, Fraudulent, Collusive, Coercive, and Obstructive Practices

- 3.1. Unless otherwise specified in the BDS, the Procuring Entity, as well as bidders and contractors, shall observe the highest standard of ethics during the procurement and execution of the contract. In pursuance of this policy, the Funding Source:

- a) defines, for purposes of this provision, the terms set forth below as follows:

(i) "corrupt practice" means behavior on the part of officials in the public or private sectors by which they improperly and unlawfully enrich themselves, others, or induce others to do so, by misusing the position in which they are placed, and includes the offering, giving, receiving, or soliciting of anything of value to influence the action of any such official in the procurement process or in contract execution; entering, on behalf of the Procuring Entity, into any contract or transaction manifestly and grossly disadvantageous to the same, whether or not the public officer profited or will profit thereby, and similar acts as provided in Republic Act 3019;

(ii) "fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Procuring Entity, and includes collusive practices among Bidders (prior to or after Bid submission) designed to establish bid prices at artificial, non-competitive levels and to deprive the Procuring Entity of the benefits of free and open competition;

(iii) "collusive practices" means a scheme or arrangement between two or more Bidders, with or without the knowledge of the Procuring

Entity, designed to establish bid prices at artificial, non-competitive levels; and

(iv) “coercive practices” means harming or threatening to harm, directly or indirectly, persons, or their property to influence their participation in a procurement process, or affect the execution of a contract;

(v) “obstructive practice” is

(aa) deliberately destroying, falsifying, altering or concealing of evidence material to an administrative proceedings or investigation or making false statements to investigators in order to materially impede an administrative proceedings or investigation of the Procuring Entity or any foreign government/foreign or international financing institution into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the administrative proceedings or investigation or from pursuing such proceedings or investigation; or

(bb) acts intended to materially impede the exercise of the inspection and audit rights of the Procuring Entity or any foreign government/foreign or international financing institution herein.

b) will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the Contract; and

c) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded Contract funded by the Funding Source if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing or, or in executing, a Contract funded by the Funding Source.

3.2. Further, the Procuring Entity will seek to impose the maximum civil, administrative, and/or criminal penalties available under the applicable laws on individuals and organizations deemed to be involved in any of the practices mentioned in ITB Clause 3.1(a).

3.3. Furthermore, the Funding Source and the Procuring Entity reserve the right to inspect and audit records and accounts of a contractor in the bidding for and performance of a contract themselves or through independent auditors as reflected in the GCC Clause 34.

4. Conflict of Interest

- 4.1. All Bidders found to have conflicting interests shall be disqualified to participate in the procurement at hand, without prejudice to the imposition of appropriate administrative, civil, and criminal sanctions. A Bidder may be considered to have conflicting interests with another Bidder in any of the events described in paragraphs (a) through (c) and a general conflict of interest in any of the circumstances set out in paragraphs (d) through (g) below:
- (a) A Bidder has controlling shareholders in common with another Bidder;
 - (b) A Bidder receives or has received any direct or indirect subsidy from any other Bidder;
 - (c) A Bidder has the same legal representative as that of another Bidder for purposes of this Bid;
 - (d) A Bidder has a relationship, directly or through third parties, that puts them in a position to have access to information about or influence on the bid of another Bidder or influence the decisions of the Procuring Entity regarding this bidding process;
 - (e) A Bidder submits more than one bid in this bidding process. However, this does not limit the participation of subcontractors in more than one bid;
 - (f) A Bidder who participated as a consultant in the preparation of the design or technical specifications of the goods and related services that are the subject of the bid; or
 - (g) A Bidder who lends, or temporarily seconds, its personnel to firms or organizations which are engaged in consulting services for the preparation related to procurement for or implementation of the project, if the personnel would be involved in any capacity on the same project.
- 4.2. In accordance with Section 47 of the IRR of RA 9184, all Bidding Documents shall be accompanied by a sworn affidavit of the Bidder that it is not related to the Head of the Procuring Entity (HoPE), members of the Bids and Awards Committee (BAC), members of the Technical Working Group (TWG), members of the BAC Secretariat, the head of the Project Management Office (PMO) or the end-user unit, and the project consultants, by consanguinity or affinity up to the third civil degree. On the part of the Bidder, this Clause shall apply to the following persons:
- (a) If the Bidder is an individual or a sole proprietorship, to the Bidder himself;
 - (b) If the Bidder is a partnership, to all its officers and members;

- (c) If the Bidder is a corporation, to all its officers, directors, and controlling stockholders;
- (d) If the Bidder is a cooperative, to all its officers, directors, and controlling shareholders or members; and
- (e) If the Bidder is a joint venture (JV), the provisions of items (a), (b), (c) or (d) of this Clause shall correspondingly apply to each of the members of the said JV, as may be appropriate.

Relationship of the nature described above or failure to comply with this Clause will result in the automatic disqualification of a Bidder.

5. Eligible Bidders

5.1. Unless otherwise indicated in the BDS, the following persons shall be eligible to participate in this Bidding:

- (a) Duly licensed Filipino citizens/sole proprietorships;
- (b) Partnerships duly organized under the laws of the Philippines and of which at least seventy five percent (75%) of the interest belongs to citizens of the Philippines;
- (c) Corporations duly organized under the laws of the Philippines, and of which at least seventy five percent (75%) of the outstanding capital stock belongs to citizens of the Philippines;
- (d) Cooperatives duly organized under the laws of the Philippines.
- (e) Persons/entities forming themselves into a JV, i.e., a group of two (2) or more persons/entities that intend to be jointly and severally responsible or liable for a particular contract: Provided, however, that, in accordance with Letter of Instructions No. 630, Filipino ownership or interest of the joint venture concerned shall be at least seventy five percent (75%): Provided, further, that joint ventures in which Filipino ownership or interest is less than seventy five percent (75%) may be eligible where the structures to be built require the application of techniques and/or technologies which are not adequately possessed by a person/entity meeting the seventy five percent (75%) Filipino ownership requirement: Provided, finally, that in the latter case, Filipino ownership or interest shall not be less than twenty five percent (25%). For this purpose, Filipino ownership or interest shall be based on the contributions of each of the members of the joint venture as specified in their JVA.

- 5.2. The Procuring Entity may also invite foreign bidders when provided for under any Treaty or International or Executive Agreement as specified in the BDS.
- 5.3. Government owned or controlled corporations (GOCCs) may be eligible to participate only if they can establish that they (a) are legally and financially autonomous, (b) operate under commercial law, and (c) are not attached agencies of the Procuring Entity.
- 5.4. (a) The Bidder must have an experience of having completed a Single Largest Completed Contract (SLCC) that is similar to this Project, equivalent to at least fifty percent (50%) of the ABC adjusted, if necessary, by the Bidder to current prices using the Philippine Statistics Authority (PSA) consumer price index. However, contractors under Small A and Small B categories without similar experience on the contract to be bid may be allowed to bid if the cost of such contract is not more than the Allowable Range of Contract Cost (ARCC) of their registration based on the guidelines as prescribed by the PCAB.
- (b) For Foreign-funded Procurement, the Procuring Entity and the foreign government/foreign or international financing institution may agree on another track record requirement, as specified in the BDS.

For this purpose, contracts similar to the Project shall be those described in the BDS.

- 5.5. The Bidder must submit a computation of its Net Financial Contracting Capacity (NFCC), which must be at least equal to the ABC to be bid, calculated as follows:

$$\text{NFCC} = [(\text{Current assets minus current liabilities}) (15)] \text{ minus the value of all outstanding or uncompleted portions of the projects under ongoing contracts, including awarded contracts yet to be started coinciding with the contract for this Project.}$$

The values of the domestic bidder's current assets and current liabilities shall be based on the latest Audited Financial Statements (AFS) submitted to the BIR.

For purposes of computing the foreign bidders' NFCC, the value of the current assets and current liabilities shall be based on their audited financial statements prepared in accordance with international financial reporting standards.

6. Bidder's Responsibilities

- 6.1. The Bidder or its duly authorized representative shall submit a sworn statement in the form prescribed in Section IX Bidding Forms as required in ITB Clause 12.1(b)(ii.3).

6.2. The Bidder is responsible for the following:

- (a) Having taken steps to carefully examine all of the Bidding Documents;
- (b) Having acknowledged all conditions, local or otherwise, affecting the implementation of the contract;
- (c) Having made an estimate of the facilities available and needed for the contract to be bid, if any;
- (d) Having complied with its responsibility to inquire or secure Supplemental/Bid Bulletin/s as provided under **ITB** Clause 10.4.
- (e) Ensuring that it is not “blacklisted” or barred from bidding by the GoP or any of its agencies, offices, corporations, or LGUs, including foreign government/foreign or international financing institution whose blacklisting rules have been recognized by the GPPB;
- (f) Ensuring that each of the documents submitted in satisfaction of the bidding requirements is an authentic copy of the original, complete, and all statements and information provided therein are true and correct;
- (g) Authorizing the HoPE or its duly authorized representative/s to verify all the documents submitted;
- (h) Ensuring that the signatory is the duly authorized representative of the Bidder, and granted full power and authority to do, execute and perform any and all acts necessary to participate, submit the bid, and to sign and execute the ensuing contract, accompanied by the duly notarized Special Power of Attorney, Board/Partnership Resolution, or Secretary’s Certificate, whichever is applicable;
- (i) Complying with the disclosure provision under Section 47 of RA 9184 and its IRR in relation to other provisions of RA 3019;
- (j) Complying with existing labor laws and standards, in the case of procurement of services. Moreover, bidder undertakes to:
 - (i) Ensure the entitlement of workers to wages, hours of work, safety and health and other prevailing conditions of work as established by national laws, rules and regulations; or collective bargaining agreement; or arbitration award, if and when applicable.

In case there is a finding by the Procuring Entity or the DOLE of underpayment or non-payment of workers’ wage and wage-related benefits, bidder agrees that the performance security or portion of the contract amount shall be withheld in favor of the complaining workers pursuant to appropriate provisions

of Republic Act No. 9184 without prejudice to the institution of appropriate actions under the Labor Code, as amended, and other social legislations.

- (ii) Comply with occupational safety and health standards and to correct deficiencies, if any.

In case of imminent danger, injury or death of the worker, bidder undertakes to suspend contract implementation pending clearance to proceed from the DOLE Regional Office and to comply with Work Stoppage Order; and

- (iii) Inform the workers of their conditions of work, labor clauses under the contract specifying wages, hours of work and other benefits under prevailing national laws, rules and regulations; or collective bargaining agreement; or arbitration award, if and when applicable, through posting in two (2) conspicuous places in the establishment's premises; and

- (k) Ensuring that it did not give or pay, directly or indirectly, any commission, amount, fee, or any form of consideration, pecuniary or otherwise, to any person or official, personnel or representative of the;

Failure to observe any of the above responsibilities shall be at the risk of the Bidder concerned.

- 6.3. The Bidder, by the act of submitting its bid, shall be deemed to have inspected the site, determined the general characteristics of the contract works and the conditions for this Project and examine all instructions, forms, terms, and project requirements in the Bidding Documents.
- 6.4. It shall be the sole responsibility of the prospective bidder to determine and to satisfy itself by such means as it considers necessary or desirable as to all matters pertaining to this Project, including: (a) the location and the nature of the contract, project, or work; (b) climatic conditions; (c) transportation facilities; (c) nature and condition of the terrain, geological conditions at the site communication facilities, requirements, location and availability of construction aggregates and other materials, labor, water, electric power and access roads; and (d) other factors that may affect the cost, duration and execution or implementation of the contract, project, or work.
- 6.5. The Procuring Entity shall not assume any responsibility regarding erroneous interpretations or conclusions by the prospective or eligible bidder out of the data furnished by the procuring entity. However, the Procuring Entity shall ensure that all information in the Bidding Documents, including supplemental/bid bulletins issued are correct and consistent.

- 6.6. Before submitting their bids, the Bidders are deemed to have become familiar with all existing laws, decrees, ordinances, acts and regulations of the Philippines which may affect the contract in any way.
- 6.7. The Bidder shall bear all costs associated with the preparation and submission of his bid, and the Procuring Entity will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
- 6.8. The Bidder should note that the Procuring Entity will accept bids only from those that have paid the applicable fee for the Bidding Documents at the office indicated in the Invitation to Bid.

7. Origin of Goods and Services

There is no restriction on the origin of Goods, or Contracting of Works or Services other than those prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations.

8. Subcontracts

- 8.1. Unless otherwise specified in the BDS, the Bidder may subcontract portions of the Works to an extent as may be approved by the Procuring Entity and stated in the BDS. However, subcontracting of any portion shall not relieve the Bidder from any liability or obligation that may arise from the contract for this Project.
- 8.2. Subcontractors must submit the documentary requirements under ITB Clause 12 and comply with the eligibility criteria specified in the BDS. In the event that any subcontractor is found by the Procuring Entity to be ineligible, the subcontracting of such portion of the Works shall be disallowed.
- 8.3. The Bidder may identify the subcontractor to whom a portion of the Works will be subcontracted at any stage of the bidding process or during contract implementation. If the Bidder opts to disclose the name of the subcontractor during bid submission, the Bidder shall include the required documents as part of the technical component of its bid.

B. Contents of Bidding Documents

9. Pre-Bid Conference

- 9.1. (a) If so specified in the BDS, a pre-bid conference shall be held at the venue and on the date indicated therein, to clarify and address the Bidders' questions on the technical and financial components of this Project.

(b) The pre-bid conference shall be held at least twelve (12) calendar days before the deadline for the submission of and receipt of bids, but not earlier than seven (7) calendar days from the posting of the Invitation to Bid/Bidding Documents in the PhilGEPS website. If the Procuring Entity

determines that, by reason of the method, nature, or complexity of the contract to be bid, or when international participation will be more advantageous to the GoP, a longer period for the preparation of bids is necessary, the pre-bid conference shall be held at least thirty (30) calendar days before the deadline for the submission and receipt of bids, as specified in the **BDS**.

- 9.2. Bidders are encouraged to attend the pre-bid conference to ensure that they fully understand the Procuring Entity's requirements. Non-attendance of the Bidder will in no way prejudice its bid; however, the Bidder is expected to know the changes and/or amendments to the Bidding Documents as recorded in the minutes of the pre-bid conference and the Supplemental/Bid Bulletin. The minutes of the pre-bid conference shall be recorded and prepared not later than five (5) calendar days after the pre-bid conference. The minutes shall be made available to prospective bidders not later than five (5) days upon written request.
- 9.3. Decisions of the BAC amending any provision of the bidding documents shall be issued in writing through a Supplemental/Bid Bulletin at least seven (7) calendar days before the deadline for the submission and receipt of bids.

10. Clarification and Amendment of Bidding Documents

- 10.1. Prospective bidders may request for clarification(s) on and/or interpretation of any part of the Bidding Documents. Such a request must be in writing and submitted to the Procuring Entity at the address indicated in the BDS at least ten (10) calendar days before the deadline set for the submission and receipt of Bids.
- 10.2. The BAC shall respond to the said request by issuing a Supplemental/Bid Bulletin, to be made available to all those who have properly secured the Bidding Documents, at least seven (7) calendar days before the deadline for the submission and receipt of Bids.
- 10.3. Supplemental/Bid Bulletins may also be issued upon the Procuring Entity's initiative for purposes of clarifying or modifying any provision of the Bidding Documents not later than seven (7) calendar days before the deadline for the submission and receipt of Bids. Any modification to the Bidding Documents shall be identified as an amendment.
- 10.4. Any Supplemental/Bid Bulletin issued by the BAC shall also be posted in the PhilGEPS and the website of the Procuring Entity concerned, if available, and at any conspicuous place in the premises of the Procuring Entity concerned. It shall be the responsibility of all Bidders who have properly secured the Bidding Documents to inquire and secure Supplemental/Bid Bulletins that may be issued by the BAC. However, Bidders who have submitted bids before the issuance of the Supplemental/Bid Bulletin must be informed and allowed to modify or withdraw their bids in accordance with ITB Clause 23.

C. Preparation of Bids

11. Language of Bids

The eligibility requirements or statements, the bids, and all other documents to be submitted to the BAC must be in English. If the eligibility requirements or statements, the bids, and all other documents submitted to the BAC are in foreign language other than English, it must be accompanied by a translation of the documents in English. The documents shall be translated by the relevant foreign government agency, the foreign government agency authorized to translate documents, or a registered translator in the foreign bidder's country; and shall be authenticated by the appropriate Philippine foreign service establishment/post or the equivalent office having jurisdiction over the foreign bidder's affairs in the Philippines. The English translation shall govern, for purposes of interpretation of the bid.

12. Documents Comprising the Bid: Eligibility and Technical Components

12.1. Unless otherwise indicated in the BDS, the first envelope shall contain the following eligibility and technical documents:

(a) Eligibility Documents –

Class “A” Documents

- (i) PhilGEPS Certificate of Registration and Membership in accordance with Section 8.5.2 of the IRR, except for foreign bidders participating in the procurement by a Philippine Foreign Service Office or Post, which shall submit their eligibility documents under Section 23.1 of the IRR, provided, that the winning bidder shall register with the PhilGEPS in accordance with Section 37.1.4 of the IRR;
- (ii) Statement of all its ongoing government and private contracts, including contracts awarded but not yet started, if any, whether similar or not similar in nature and complexity to the contract to be bid; and

Statement of the Bidder's SLCC similar to the contract to be bid, in accordance with ITB Clause 5.4.

The two statements required shall indicate for each contract the following:

- (ii.1) name of the contract;
- (ii.2) date of the contract;

- (ii.3) contract duration;
- (ii.4) owner's name and address;
- (ii.5) nature of work;
- (ii.6) contractor's role (whether sole contractor, subcontractor, or partner in a JV) and percentage of participation;
- (ii.7) total contract value at award;
- (ii.8) date of completion or estimated completion time;
- (ii.9) total contract value at completion, if applicable;
- (ii.10) percentages of planned and actual accomplishments, if applicable; and
- (ii.11) value of outstanding works, if applicable.

The statement of the Bidder's SLCC shall be supported by the Notice of Award and/or Notice to Proceed, Project Owner's Certificate of Final Acceptance issued by the Owner other than the Contractor or the Constructors Performance Evaluation System (CPES) Final Rating, which must be at least satisfactory. In case of contracts with the private sector, an equivalent document shall be submitted;

- (iii) Unless otherwise provided in the BDS, a valid special PCAB License in case of joint ventures, and registration for the type and cost of the contract for this Project; and
- (iv) NFCC computation in accordance with ITB Clause 5.5.

Class "B" Documents

- (v) If applicable, Joint Venture Agreement (JVA) in accordance with RA 4566.

(b) Technical Documents –

- (i) Bid security in accordance with **ITB** Clause 18. If the Bidder opts to submit the bid security in the form of:
 - (i.1) a bank draft/guarantee or an irrevocable letter of credit issued by a foreign bank, it shall be

accompanied by a confirmation from a Universal or Commercial Bank; or

(i.2) a surety bond accompanied by a certification coming from the Insurance Commission that the surety or insurance company is authorized to issue such instruments.

(ii) Project Requirements, which shall include the following:

(ii.1) Organizational chart for the contract to be bid;

(ii.2) List of contractor's personnel (*e.g.*, Project Manager, Project Engineers, Materials Engineers, and Foremen), to be assigned to the contract to be bid, with their complete qualification and experience data. These personnel must meet the required minimum years of experience set in the **BDS**; and

(ii.3) List of contractor's major equipment units, which are owned, leased, and/or under purchase agreements, supported by proof of ownership, certification of availability of equipment from the equipment lessor/vendor for the duration of the project, as the case may be, which must meet the minimum requirements for the contract set in the **BDS**; and

(iii) Sworn statement in accordance with Section 25.3 of the IRR of RA 9184 and using the form prescribed in Section IX Bidding Forms.

13. Documents Comprising the Bid: Financial Component

13.1. Unless otherwise stated in the **BDS**, the financial component of the bid shall contain the following:

(a) Financial Bid Form, which includes bid prices and the bill of quantities, in accordance with **ITB** Clauses 15.1 and 15.3; and

(b) Any other document related to the financial component of the bid as stated in the **BDS**.

13.2. (a) Unless otherwise stated in the **BDS**, all Bids that exceed the ABC shall not be accepted.

(b) Unless otherwise indicated in the **BDS**, for foreign-funded procurement, a ceiling may be applied to bid prices provided the following conditions are met:

- (i) Bidding Documents are obtainable free of charge on a freely accessible website. If payment of Bidding Documents is required by the procuring entity, payment could be made upon the submission of bids.
- (ii) The procuring entity has procedures in place to ensure that the ABC is based on recent estimates made by the engineer or the responsible unit of the procuring entity and that the estimates are based on adequate detailed engineering (in the case of infrastructure projects) and reflect the quality, supervision and risk and inflationary factors, as well as prevailing market prices, associated with the types of works or goods to be procured.
- (iii) The procuring entity has trained cost estimators on estimating prices and analyzing bid variances. In the case of infrastructure projects, the procuring entity must also have trained quantity surveyors.
- (iv) The procuring entity has established a system to monitor and report bid prices relative to ABC and engineer's/procuring entity's estimate.
- (v) The procuring entity has established a monitoring and evaluation system for contract implementation to provide a feedback on actual total costs of goods and works.

14. Alternative Bids

- 14.1. Alternative Bids shall be rejected. For this purpose, alternative bid is an offer made by a Bidder in addition or as a substitute to its original bid which may be included as part of its original bid or submitted separately therewith for purposes of bidding. A bid with options is considered an alternative bid regardless of whether said bid proposal is contained in a single envelope or submitted in two (2) or more separate bid envelopes.
- 14.2. Bidders shall submit offers that comply with the requirements of the Bidding Documents, including the basic technical design as indicated in the drawings and specifications. Unless there is a value engineering clause in the BDS, alternative bids shall not be accepted.
- 14.3. Each Bidder shall submit only one Bid, either individually or as a partner in a JV. A Bidder who submits or participates in more than one bid (other than as a subcontractor if a subcontractor is permitted to participate in more than one bid) will cause all the proposals with the Bidder's participation to be disqualified. This shall be without prejudice to any applicable criminal, civil and administrative penalties that may be imposed upon the persons and entities concerned.

15. Bid Prices

- 15.1. The contract shall be for the whole Works, as described in ITB Clause 1.1, based on the priced Bill of Quantities submitted by the Bidder.
- 15.2. The Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Bids not addressing or providing all of the required

items in the Bidding Documents including, where applicable, Bill of Quantities, shall be considered non-responsive and, thus, automatically disqualified. In this regard, where a required item is provided, but no price is indicated, the same shall be considered as non-responsive, but specifying a zero (0) or a dash (-) for the said item would mean that it is being offered for free to the Government, except those required by law or regulations to be provided for.

- 15.3. All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, prior to the deadline for submission of bids, shall be included in the rates, prices, and total bid price submitted by the Bidder.
- 15.4. All bid prices for the given scope of work in the contract as awarded shall be considered as fixed prices, and therefore not subject to price escalation during contract implementation, except under extraordinary circumstances as specified in GCC Clause 48. Upon the recommendation of the Procuring Entity, price escalation may be allowed in extraordinary circumstances as may be determined by the National Economic and Development Authority in accordance with the Civil Code of the Philippines, and upon approval by the GPPB. Furthermore, in cases where the cost of the awarded contract is affected by any applicable new laws, ordinances, regulations, or other acts of the GoP, promulgated after the date of bid opening, a contract price adjustment shall be made or appropriate relief shall be applied on a no loss-no gain basis.

16. Bid Currencies

- 16.1. All bid prices shall be quoted in Philippine Pesos unless otherwise provided in the BDS. However, for purposes of bid evaluation, bids denominated in foreign currencies shall be converted to Philippine currency based on the exchange rate prevailing on the day of the Bid Opening.
- 16.2. If so allowed in accordance with ITB Clause 16.1, the Procuring Entity for purposes of bid evaluation and comparing the bid prices will convert the amounts in various currencies in which the bid price is expressed to Philippine Pesos at the exchange rate as published in the *Bangko Sentral ng Pilipinas* (BSP) reference rate bulletin on the day of the bid opening.
- 16.3. Unless otherwise specified in the BDS, payment of the contract price shall be made in Philippine Pesos.

17. Bid Validity

- 17.1. Bids shall remain valid for the period specified in the BDS which shall not exceed one hundred twenty (120) calendar days from the date of the opening of bids.
- 17.2. In exceptional circumstances, prior to the expiration of the bid validity period, the Procuring Entity may request Bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. The bid security described in ITB Clause 18 should also be extended

corresponding to the extension of the bid validity period at the least. A Bidder may refuse the request without forfeiting its bid security, but his bid shall no longer be considered for further evaluation and award. A Bidder granting the request shall not be required or permitted to modify its bid.

18. Bid Security

18.1. The Bidder shall submit a Bid Securing Declaration or any form of Bid Security in an amount stated in the BDS, which shall be not less than the percentage of the ABC in accordance with the following schedule:

Form of Bid Security	Amount of Bid Security (Not less than the Percentage of the ABC)
(a) Cash or cashier’s/manager’s check issued by a Universal or Commercial Bank.	Two percent (2%)
(b) Bank draft/guarantee or irrevocable letter of credit issued by a Universal or Commercial Bank: Provided, however, that it shall be confirmed or authenticated by a Universal or Commercial Bank, if issued by a foreign bank.	
(c) Surety bond callable upon demand issued by a surety or insurance company duly certified by the Insurance Commission as authorized to issue such security; and/or	Five percent (5%)
(d) Bid Securing Declaration	

The Bid Securing Declaration mentioned above is an undertaking which states, among others, that the Bidder shall enter into contract with the procuring entity and furnish the performance security required under ITB Clause 32.2, within ten (10) calendar days from receipt of the Notice of Award, and commits to pay the corresponding amount as fine, and be suspended for a period of time from being qualified to participate in any government procurement activity in the event it violates any of the conditions stated therein as provided in the guidelines issued by the GPPB.

18.2. The bid security should be valid for the period specified in the BDS. Any bid not accompanied by an acceptable bid security shall be rejected by the Procuring Entity as non-responsive.

18.3. No bid securities shall be returned to Bidders after the opening of bids and before contract signing, except to those that failed or declared as post-disqualified, upon submission of a written waiver of their right to file a request for reconsideration and/or protest, or lapse of the reglementary period without having filed a request for reconsideration or protest. Without prejudice on its forfeiture, Bid Securities shall be returned only after the Bidder with the Lowest Calculated Responsive Bid (LCRB) has signed the

contract and furnished the Performance Security, but in no case later than the expiration of the Bid Security validity period indicated in ITB Clause 18.2.

18.4. Upon signing and execution of the contract, pursuant to ITB Clause 31, and the posting of the performance security, pursuant to ITB Clause 32, the successful Bidder's Bid Security will be discharged, but in no case later than the Bid Security validity period as indicated in ITB Clause 18.2.

18.5. The bid security may be forfeited:

(a) if a Bidder:

(i) withdraws its bid during the period of bid validity specified in **ITB Clause 17**;

(ii) does not accept the correction of errors pursuant to **ITB Clause 27.3(b)**;

(iii) has a finding against the veracity of the required documents submitted in accordance with ITB Clause 28.2;

(iv) submission of eligibility requirements containing false information or falsified documents;

(v) submission of bids that contain false information or falsified documents, or the concealment of such information in the bids in order to influence the outcome of eligibility screening or any other stage of the public bidding;

(vi) allowing the use of one's name, or using the name of another for purposes of public bidding;

(vii) withdrawal of a bid, or refusal to accept an award, or enter into contract with the Government without justifiable cause, after the Bidder had been adjudged as having submitted the LCRB;

(viii) refusal or failure to post the required performance security within the prescribed time;

(ix) refusal to clarify or validate in writing its bid during post-qualification within a period of seven (7) calendar days from receipt of the request for clarification;

(x) any documented attempt by a Bidder to unduly influence the outcome of the bidding in his favor;

(xi) failure of the potential joint venture partners to enter into the joint venture after the bid is declared successful; or

(xii) all other acts that tend to defeat the purpose of the competitive bidding, such as habitually withdrawing from

bidding, submitting late Bids or patently insufficient bid, for at least three (3) times within a year, except for valid reasons.

(b) if the successful Bidder:

(i) fails to sign the contract in accordance with **ITB** Clause 31;

(ii) fails to furnish performance security in accordance with **ITB** Clause 32.

19. Format and Signing of Bids

- 19.1. Bidders shall submit their bids through their duly authorized representative using the appropriate forms provided in Section IX in the Bidding Forms on or before the deadline specified in the ITB Clause 21 in two (2) separate sealed bid envelopes, and which shall be submitted simultaneously. The first shall contain the technical component of the bid, including the eligibility requirements under ITB Clause 12.1, and the second shall contain the financial component of the bid. This shall also be observed for each lot in the case of lot procurement.
- 19.2. Forms as mentioned in ITB Clause 19.1 must be completed without any alterations to their format, and no substitute form shall be accepted. All blank spaces shall be filled in with the information requested.
- 19.3. The Bidder shall prepare and submit an original of the first and second envelopes as described in ITB Clauses 12 and 13. In addition, the Bidder shall submit copies of the first and second envelopes. In the event of any discrepancy between the original and the copies, the original shall prevail.
- 19.4. Each and every page of the Bid Form, including the Bill of Quantities, under Section IX hereof, shall be signed by the duly authorized representative/s of the Bidder. Failure to do so shall be a ground for the rejection of the bid.
- 19.5. Any interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the duly authorized representative/s of the Bidder.

20. Sealing and Marking of Bids

- 20.1. Bidders shall enclose their original eligibility and technical documents described in ITB Clause 12, in one sealed envelope marked "ORIGINAL - TECHNICAL COMPONENT," and the original of their financial component in another sealed envelope marked "ORIGINAL - FINANCIAL COMPONENT," sealing them all in an outer envelope marked "ORIGINAL BID."
- 20.2. Each copy of the first and second envelopes shall be similarly sealed duly marking the inner envelopes as "COPY NO. ___ - TECHNICAL COMPONENT" and "COPY NO. ___ - FINANCIAL COMPONENT" and the outer envelope as "COPY NO. ___," respectively. These envelopes containing the original and the copies shall then be enclosed in one single envelope.

- 20.3. The original and the number of copies of the bid as indicated in the BDS shall be typed or written in ink and shall be signed by the Bidder or its duly authorized representative/s.
- 20.4. All envelopes shall:
- (a) contain the name of the contract to be bid in capital letters;
 - (b) bear the name and address of the Bidder in capital letters;
 - (c) be addressed to the Procuring Entity's BAC in accordance with **ITB** Clause 20.1;
 - (d) bear the specific identification of this bidding process indicated in the **ITB** Clause 1.2; and
 - (e) bear a warning "DO NOT OPEN BEFORE..." the date and time for the opening of bids, in accordance with **ITB** Clause 21.
- 20.5. Bid envelopes that are not properly sealed and marked, as required in the bidding documents, shall not be rejected, but the Bidder or its duly authorized representative shall acknowledge such condition of the bid as submitted. The BAC or the Procuring Entity shall assume no responsibility for the misplacement of the contents of the improperly sealed or marked bid, or for its premature opening.

D. Submission and Opening of Bids

21. Deadline for Submission of Bids

Bids must be received by the Procuring Entity's BAC at the address and on or before the date and time indicated in the BDS.

22. Late Bids

Any bid submitted after the deadline for submission and receipt of bids prescribed by the Procuring Entity, pursuant to **ITB** Clause 21, shall be declared "Late" and shall not be accepted by the Procuring Entity. The BAC shall record in the minutes of Bid Submission and Opening, the Bidder's name, its representative and the time the late bid was submitted.

23. Modification and Withdrawal of Bids

- 23.1. The Bidder may modify its bid after it has been submitted; provided that the modification is received by the Procuring Entity prior to the deadline prescribed for submission and receipt of bids. The Bidder shall not be allowed to retrieve its original bid, but shall be allowed to submit another bid equally sealed and properly identified in accordance with Clause 20, linked to its original bid marked as "TECHNICAL MODIFICATION" or "FINANCIAL MODIFICATION" and stamped "received" by the BAC. Bid

modifications received after the applicable deadline shall not be considered and shall be returned to the Bidder unopened.

- 23.2. A Bidder may, through a Letter of Withdrawal, withdraw its bid after it has been submitted, for valid and justifiable reason; provided that the Letter of Withdrawal is received by the Procuring Entity prior to the deadline prescribed for submission and receipt of bids. The Letter of Withdrawal must be executed by the authorized representative of the Bidder identified in the Omnibus Sworn Statement, a copy of which should be attached to the letter.
- 23.3. Bids requested to be withdrawn in accordance with ITB Clause 23.1 shall be returned unopened to the Bidders. A Bidder, who has acquired the bidding documents may also express its intention not to participate in the bidding through a letter which should reach and be stamped by the BAC before the deadline for submission and receipt of bids. A Bidder that withdraws its bid shall not be permitted to submit another bid, directly or indirectly, for the same contract.
- 23.4. No bid may be modified after the deadline for submission of bids. No bid may be withdrawn in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Financial Bid Form. Withdrawal of a bid during this interval shall result in the forfeiture of the Bidder's bid security, pursuant to ITB Clause 18.5, and the imposition of administrative, civil, and criminal sanctions as prescribed by RA 9184 and its IRR.

24. Opening and Preliminary Examination of Bids

- 24.1. The BAC shall open the Bids in public, immediately after the deadline for the submission and receipt of bids in public, as specified in the BDS. In case the Bids cannot be opened as scheduled due to justifiable reasons, the BAC shall take custody of the Bids submitted and reschedule the opening of Bids on the next working day or at the soonest possible time through the issuance of a Notice of Postponement to be posted in the PhilGEPS website and the website of the Procuring Entity concerned.
- 24.2. Unless otherwise specified in the BDS, the BAC shall open the first bid envelopes and determine each Bidder's compliance with the documents prescribed in ITB Clause 12, using a non-discretionary "pass/fail" criterion. If a Bidder submits the required document, it shall be rated "passed" for that particular requirement. In this regard, bids that fail to include any requirement or are incomplete or patently insufficient shall be considered as "failed". Otherwise, the BAC shall rate the said first bid envelope as "passed".
- 24.3. Unless otherwise specified in the BDS, immediately after determining compliance with the requirements in the first envelope, the BAC shall forthwith open the second bid envelope of each remaining eligible Bidder whose first bid envelope was rated "passed." The second envelope of each complying Bidder shall be opened within the same day. In case one or more

of the requirements in the second envelope of a particular bid is missing, incomplete or patently insufficient, and/or if the submitted total bid price exceeds the ABC unless otherwise provided in **ITB** Clause 13.2, the BAC shall rate the bid concerned as “failed.” Only bids that are determined to contain all the bid requirements for both components shall be rated “passed” and shall immediately be considered for evaluation and comparison.

- 24.4. Letters of Withdrawal shall be read out and recorded during bid opening, and the envelope containing the corresponding withdrawn bid shall be returned to the Bidder unopened.
- 24.5. All members of the BAC who are present during bid opening shall initial every page of the original copies of all bids received and opened.
- 24.6. In the case of an eligible foreign bidder as described in **ITB** Clause 5, the following Class “A” Documents may be substituted with the appropriate equivalent documents, if any, issued by the country of the foreign bidder concerned, which shall likewise be uploaded and maintained in the PhilGEPS in accordance with Section 8.5.2 of the IRR:
 - a) Registration certificate from the Securities and Exchange Commission (SEC), Department of Trade and Industry (DTI) for sole proprietorship, or CDA for cooperatives;
 - b) Mayor’s/Business permit issued by the local government where the principal place of business of the Bidder is located; and
 - c) Audited Financial Statements showing, among others, the prospective Bidder’s total and current assets and liabilities stamped “received” by the Bureau of Internal Revenue or its duly accredited and authorized institutions, for the preceding calendar year which should not be earlier than two years from the date of bid submission.
- 24.7. Each partner of a joint venture agreement shall likewise submit the document required in **ITB** Clause 12.1(a)(i). Submission of documents required under **ITB** Clauses 12.1(a)(ii) to 12.1(a)(iv) by any of the joint venture partners constitutes compliance.
- 24.8. The Procuring Entity shall prepare the minutes of the proceedings of the bid opening that shall include, as a minimum: (a) names of Bidders, their bid price (per lot, if applicable, and/or including discount, if any), bid security, findings of preliminary examination, and whether there is a withdrawal or modification; and (b) attendance sheet. The BAC members shall sign the abstract of bids as read.
- 24.9. The Bidders or their duly authorized representatives may attend the opening of bids. The BAC shall ensure the integrity, security, and confidentiality of all submitted bids. The Abstract of Bids as read and the minutes of the Bid Opening shall be made available to the public upon written request and payment of a specified fee to recover cost of materials.

- 24.10. To ensure transparency and accurate representation of the bid submission, the BAC Secretariat shall notify in writing all Bidders whose bids it has received through its PhilGEPS-registered physical address or official e-mail address. The notice shall be issued within seven (7) calendar days from the date of the bid opening.

E. Evaluation and Comparison of Bids

25. Process to be Confidential

- 25.1. Members of the BAC, including its staff and personnel, as well as its Secretariat and TWG, are prohibited from making or accepting any kind of communication with any Bidder regarding the evaluation of their bids until the issuance of the Notice of Award, unless otherwise allowed in the case of ITB Clause 26.
- 25.2. Any effort by a Bidder to influence the Procuring Entity in the Procuring Entity's decision in respect of bid evaluation, bid comparison or contract award will result in the rejection of the Bidder's bid.

26. Clarification of Bids

To assist in the evaluation, comparison and post-qualification of the bids, the Procuring Entity may ask in writing any Bidder for a clarification of its bid. All responses to requests for clarification shall be in writing. Any clarification submitted by a Bidder in respect to its bid and that is not in response to a request by the Procuring Entity shall not be considered

27. Detailed Evaluation and Comparison of Bids

- 27.1. The Procuring Entity will undertake the detailed evaluation and comparison of Bids which have passed the opening and preliminary examination of Bids, pursuant to ITB Clause 24, in order to determine the Lowest Calculated Bid.
- 27.2. The Lowest Calculated Bid shall be determined in two steps:
- (a) The detailed evaluation of the financial component of the bids, to establish the correct calculated prices of the bids; and
 - (b) The ranking of the total bid prices as so calculated from the lowest to highest. The bid with the lowest price shall be identified as the Lowest Calculated Bid.
- 27.3. The Procuring Entity's BAC shall immediately conduct a detailed evaluation of all bids rated "passed," using non-discretionary "pass/fail" criterion. The BAC shall consider the following in the evaluation of bids:
- (a) Completeness of the bid. Unless the **BDS** allows partial bids, bids not addressing or providing all of the required items in the Schedule of Requirements including, where applicable, bill of quantities, shall be

considered non-responsive and, thus, automatically disqualified. In this regard, where a required item is provided, but no price is indicated, the same shall be considered as non-responsive, but specifying a zero (0) or a dash (-) for the said item would mean that it is being offered for free to the Procuring Entity, except those required by law or regulations to be provided for; and

(b) Arithmetical corrections. Consider computational errors and omissions to enable proper comparison of all eligible bids. It may also consider bid modifications. Any adjustment shall be calculated in monetary terms to determine the calculated prices.

- 27.4. Based on the detailed evaluation of bids, those that comply with the above-mentioned requirements shall be ranked in the ascending order of their total calculated bid prices, as evaluated and corrected for computational errors, discounts and other modifications, to identify the Lowest Calculated Bid. Total calculated bid prices, as evaluated and corrected for computational errors, discounts and other modifications, which exceed the ABC shall not be considered, unless otherwise indicated in the BDS.
- 27.5. The Procuring Entity's evaluation of bids shall be based on the bid price quoted in the Bid Form, which includes the Bill of Quantities.
- 27.6. Bids shall be evaluated on an equal footing to ensure fair competition. For this purpose, all Bidders shall be required to include in their bids the cost of all taxes, such as, but not limited to, value added tax (VAT), income tax, local taxes, and other fiscal levies and duties which shall be itemized in the bid form and reflected in the detailed estimates. Such bids, including said taxes, shall be the basis for bid evaluation and comparison.
- 27.7. If so indicated pursuant to **ITB** Clause 1.2. Bids are being invited for individual lots or for any combination thereof, provided that all Bids and combinations of Bids shall be received by the same deadline and opened and evaluated simultaneously so as to determine the bid or combination of bids offering the lowest calculated cost to the Procuring Entity. Bid prices quoted shall correspond to all of the requirements specified for each lot. Bid Security as required by **ITB** Clause 18 shall be submitted for each contract (lot) separately. The basis for evaluation of lots is specified in **BDS** Clause 27.3.

28. Post Qualification

- 28.1. The BAC shall determine to its satisfaction whether the Bidder that is evaluated as having submitted the Lowest Calculated Bid complies with and is responsive to all the requirements and conditions specified in ITB Clauses 5, 12, and 13.
- 28.2. Within a non-extendible period of five (5) calendar days from receipt by the Bidder of the notice from the BAC that it submitted the Lowest Calculated Bid, the Bidder shall submit its latest income and business tax returns filed and paid through the BIR Electronic Filing and Payment System (eFPS) and

other appropriate licenses and permits required by law and stated in the BDS.

Failure to submit any of the post-qualification requirements on time, or a finding against the veracity thereof, shall disqualify the Bidder for award. Provided in the event that a finding against the veracity of any of the documents submitted is made, it shall cause the forfeiture of the bid security in accordance with Section 69 of the IRR of RA 9184.

- 28.3. The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted pursuant to ITB Clauses 12 and 13, as well as other information as the Procuring Entity deems necessary and appropriate, using a non-discretionary "pass/fail" criterion, which shall be completed within a period of twelve (12) calendar days.
- 28.4. If the BAC determines that the Bidder with the Lowest Calculated Bid passes all the criteria for post-qualification, it shall declare the said bid as the LCRB, and recommend to the HoPE the award of contract to the said Bidder at its submitted price or its calculated bid price, whichever is lower, subject to ITB Clause 30.3.
- 28.5. A negative determination shall result in rejection of the Bidder's bid, in which event the Procuring Entity shall proceed to the next Lowest Calculated Bid, with a fresh period to make a similar determination of that Bidder's capabilities to perform satisfactorily. If the second Bidder, however, fails the post qualification, the procedure for post qualification shall be repeated for the Bidder with the next Lowest Calculated Bid, and so on until the LCRB is determined for recommendation of contract award.
- 28.6. Within a period not exceeding fifteen (15) calendar days from the determination by the BAC of the LCRB and the recommendation to award the contract, the HoPE or his duly authorized representative shall approve or disapprove the said recommendation.
- 28.7. In the event of disapproval, which shall be based on valid, reasonable, and justifiable grounds as provided for under Section 41 of the IRR of RA 9184, the HoPE shall notify the BAC and the Bidder in writing of such decision and the grounds for it. When applicable, the BAC shall conduct a post-qualification of the Bidder with the next Lowest Calculated Bid. A request for reconsideration may be filed by the Bidder with the HoPE in accordance with Section 37.1.3 of the IRR of RA 9184.

29. Reservation Clause

- 29.1. Notwithstanding the eligibility or post-qualification of a Bidder, the Procuring Entity concerned reserves the right to review its qualifications at any stage of the procurement process if it has reasonable grounds to believe that a misrepresentation has been made by the said Bidder, or that there has been a change in the Bidder's capability to undertake the project from the time it submitted its eligibility requirements. Should such review uncover any misrepresentation made in the eligibility and bidding requirements,

statements or documents, or any changes in the situation of the Bidder which will affect its capability to undertake the project so that it fails the preset eligibility or bid evaluation criteria, the Procuring Entity shall consider the said Bidder as ineligible and shall disqualify it from submitting a bid or from obtaining an award or contract.

29.2. Based on the following grounds, the Procuring Entity reserves the right to reject any and all Bids, declare a Failure of Bidding at any time prior to the contract award, or not to award the contract, without thereby incurring any liability, and make no assurance that a contract shall be entered into as a result of the bidding:

(a) If there is *prima facie* evidence of collusion between appropriate public officers or employees of the Procuring Entity, or between the BAC and any of the Bidders, or if the collusion is between or among the Bidders themselves, or between a Bidder and a third party, including any act which restricts, suppresses or nullifies or tends to restrict, suppress or nullify competition;

(b) If the Procuring Entity's BAC is found to have failed in following the prescribed bidding procedures; or

(c) For any justifiable and reasonable ground where the award of the contract will not redound to the benefit of the GOP as follows:

(i) If the physical and economic conditions have significantly changed so as to render the project no longer economically, financially or technically feasible as determined by the HoPE;

(ii) If the project is no longer necessary as determined by the HoPE; and

(iii) If the source of funds for the project has been withheld or reduced through no fault of the Procuring Entity.

29.3. In addition, the Procuring Entity may likewise declare a failure of bidding when:

(a) No bids are received;

(b) All prospective Bidders are declared ineligible;

(c) All bids fail to comply with all the bid requirements, fail post-qualification; or

(d) The Bidder with the LCRB refuses, without justifiable cause, to accept the award of contract, and no award is made in accordance with Section 40 of the IRR of RA 9184.

F. Award of Contract

30. Reservation Clause

- 30.1. Subject to ITB Clause 28, the HoPE or its duly authorized representative shall award the contract to the Bidder whose bid has been determined to be the LCRB.
- 30.2. Prior to the expiration of the period of bid validity, the Procuring Entity shall notify the successful Bidder in writing that its bid has been accepted, through a Notice of Award duly received by the Bidder or its representative personally or by registered mail or electronically, receipt of which must be confirmed in writing within two (2) days by the Bidder with the LCRB and submitted personally or sent by registered mail or electronically to the Procuring Entity.
- 30.3. Notwithstanding the issuance of the Notice of Award, award of contract shall be subject to the following conditions:
 - (a) Submission of the following documents within ten (10) calendar days from receipt of the Notice of Award:
 - (i) In the case of procurement by a Philippine Foreign Service Office or Post, the PhilGEPS Registration Number of the winning foreign Bidder; or
 - (ii) Valid PCAB license and registration for the type and cost of the contract to be bid for foreign bidders when the Treaty or International or Executive Agreement expressly allows submission of the PCAB license and registration for the type and cost of the contract to be bid as a pre-condition to the Award;
 - (b) Posting of the performance security in accordance with **ITB** Clause 32;
 - (c) Signing of the contract as provided in **ITB** Clause 31; and
 - (d) Approval by higher authority, if required, as provided in Section 37.3 of the IRR of RA 9184.

31. Signing of the Contract

- 31.1. At the same time as the Procuring Entity notifies the successful Bidder that its bid has been accepted, the Procuring Entity shall send the Contract Form to the Bidder, which Contract has been provided in the Bidding Documents, incorporating therein all agreements between the parties.
- 31.2. Within ten (10) calendar days from receipt of the Notice of Award, the successful Bidder shall post the required performance security, sign and date the contract and return it to the Procuring Entity.
- 31.3. The Procuring Entity shall enter into contract with the successful Bidder within the same ten (10) calendar day period provided that all the documentary requirements are complied with.

31.4. The following documents shall form part of the contract:

- (a) Contract Agreement;
- (b) Bidding Documents;
- (c) Winning Bidder's bid, including the Technical and Financial Proposals, and all other documents/statements submitted (*e.g.*, Bidder's response to request for clarifications on the bid), including corrections to the bid, if any, resulting from the Procuring Entity's bid evaluation;
- (d) Performance Security;
- (e) Notice of Award of Contract; and
- (f) Other contract documents that may be required by existing laws and/or specified in the BDS.

32. Performance Security

- 32.1. To guarantee the faithful performance by the winning Bidder of its obligations under the contract, it shall post a performance security within a maximum period of ten (10) calendar days from the receipt of the Notice of Award from the Procuring Entity and in no case later than the signing of the contract.
- 32.2. The Performance Security shall be denominated in Philippine Pesos and posted in favor of the Procuring Entity in an amount not less than the percentage of the total contract price in accordance with the following schedule:

Form of Performance Security	Amount of Performance Security (Not less than the Percentage of the Total Contract Price)
) Cash or cashier's/manager's check issued by a Universal or Commercial Bank.	Ten percent (10%)
) Bank draft/guarantee or irrevocable letter of credit issued by a Universal or Commercial Bank: Provided, however, that it shall be confirmed or authenticated by a Universal or Commercial Bank, if issued by a foreign bank.	
) Surety bond callable upon demand issued by a surety or insurance company duly certified by the Insurance Commission as authorized to issue such security.	Thirty percent (30%)

32.3. Failure of the successful Bidder to comply with the above-mentioned requirement shall constitute sufficient ground for the annulment of the award and forfeiture of the bid security, in which event the Procuring Entity shall have a fresh period to initiate and complete the post qualification of the second Lowest Calculated Bid. The procedure shall be repeated until LCRB is identified and selected for recommendation of contract award. However if no Bidder passed post-qualification, the BAC shall declare the bidding a failure and conduct a re-bidding with re-advertisement, if necessary.

33. Notice to Proceed

Within seven (7) calendar days from the date of approval of the Contract by the appropriate government approving authority, the Procuring Entity shall issue the Notice to Proceed (NTP) together with a copy or copies of the approved contract to the successful Bidder. All notices called for by the terms of the contract shall be effective only at the time of receipt thereof by the successful Bidder.

34. Protest Mechanism

Decision of the procuring entity at any stage of the procurement process may be questioned in accordance with Sections 55 of the IRR of RA 9184.

Section III. Bid Data Sheet

ITB Clause	
1.1	<p>The Procuring Entity is Provincial Government of Pangasinan</p> <p>The name of the Contract is Construction of Provincial Warehouse with Multi Purpose Drying Pavement in Bugallon</p> <p>The identification number of the Contract is PRDP-SU-IB-R001-PAN-004-000-000-2023-VCI</p>
2	<p>The Funding Source is World Bank through Loan No. 9577-PH in the amount of US\$600,000,000.00.</p> <p>The name of the Project is Philippine Rural Development Project Scale Up. Payments by the Foreign Funding Source will be made only at the request of the PROCURING ENTITY and upon approval by the Funding Source in accordance with the terms and conditions of the Loan Agreement between the PROCURING ENTITY and the Funding Source. (hereunder called the "Loan Agreement"). The Payments will be subject in all respect to the terms and conditions of the Loan Agreement and the applicable law. No party other than the PROCURING ENTITY shall derive any rights from the Loan Agreement or have any claim to the funds.</p>
3.1	<p>The World Bank's Anticorruption Guidelines requires Borrowers (including beneficiaries of Bank-financed activity), as well as Bidders, Suppliers, Contractors and their agents (whether declared or not), sub-contractors, sub-consultants, service providers or suppliers and any personnel thereof, observe the highest standard of ethics during the procurement and execution of Bank-financed contracts. Any action to influence the procurement process or contract execution for undue advantage is improper.</p> <p>In pursuance of this policy, the Bank:</p> <p>(a) defines, for the purposes of this provision, the terms set forth below as follows:</p> <p style="padding-left: 40px;">(i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party. Another party refers to a public official acting in relation to the procurement process or contract execution. Public official includes World Bank staff and employees of other organizations taking or reviewing procurement decisions;</p> <p style="padding-left: 40px;">(ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation. The term "party" refers to a public official; the terms "benefit" and "obligations" relate to the procurement process or contract execution; and the "act or omission" is intended to influence the procurement process or contract execution;</p> <p style="padding-left: 40px;">(iii) "coercive practice" means impairing or harming, or</p>

threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party. The term "party" refers to a participant in the procurement process or contract execution;

(iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party. The term "parties" refers to participants in the procurement process (including public officials) attempting either themselves, or through another person or entity not participating in the procurement or selection process, to simulate competition or establish bid prices at artificial, noncompetitive levels, or are privy to each other's bid prices or other conditions;

(v) "obstructive practice" is

(aa) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or

(bb) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph (e) below.

(b) will reject a proposal for award if it determines that the Bidder recommended for award, or any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract in question

(c) will declare mis-procurement and cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement or the implementation of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

(d) will sanction a firm or an individual, at any time, in accordance with the prevailing Bank's sanctions procedures, including by publicly declaring such firm or individual ineligible, either indefinitely or for a stated period of time: (i) to be awarded a Bank-financed contract; and (ii) to be a nominated sub-contractor, consultant, manufacturer or supplier, or service provider (different names are used depending on the particular bidding document) is one which has either been (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to

	<p>meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower. A firm or individual may be declared ineligible to be awarded a Bank financed contract upon (i) completion of the Bank's sanctions proceedings as per its sanctions procedures, including, inter alia, cross debarment as agreed with other International Financial Institutions, including Multilateral Development Banks, and through the application of the World Bank Group corporate administrative procurement sanctions procedures for fraud and corruption; and (ii) as a result of temporary suspension or early temporary suspension in connection with an ongoing sanctions proceeding. See footnote 14 and paragraph 8 of Appendix 1 of the World Bank Guidelines for Procurement of Goods, Works, and Non-Consulting Services;</p> <p>(e) will require that a clause be included in bidding documents and in contracts financed by a Bank loan or grant, requiring bidders, suppliers and contractors, and their sub-contractors, agents, personnel, consultants, service providers, or suppliers to permit Bank to inspect all accounts and records and other documents relating to the submission of bids and contract performance, and to have them audited by auditors appointed by Bank.</p>
5.1	The Financing Agreement provides that procurement shall follow the Bank's Procurement Regulations and Section 3.21 thereof permits the participation of firm from all countries except for those mentioned in Section 3.23 thereof. last
5.2	Foreign bidders may participate in this Project as provided for in the financing agreement which provides that procurement shall follow the Bank's Procurement Regulations and Section 3.21 thereof permits the participation of firm from all countries except for those mentioned in Section 3.23 thereof.
5.4	<p>To be considered eligible and qualified, a Bidder must have:</p> <ul style="list-style-type: none"> - A successful experience as prime contractor in the construction of at least one (1) work of a nature and complexity equivalent to the Works generally within the ten (10) years (to comply with this requirement, single works cited should be at least fifty percent (50%) of value of estimated contract cost of Works under bid in the amount of Twenty-One Million Forty-One Thousand pesos (Php21,041,000.00), such being verifiable from Certificate of Completion; and - An average annual turnover of Construction Income for the last three (3) years equal or greater than one hundred percent (100%) of the estimated value of the contract to be bid as evidenced by the audited financial statements for the last three (3) years stamped "received" by the BIR [with supporting Income Tax Return stamped "received" by BIR or its duly accredited and authorized institutions or eBIR Tax Return Receipt Confirmation (if submitted through eBIR), and eFPS], in the amount of Forty-Two Million Eighty-Two Thousand pesos (Php42,082,000.00).

	<p>In case of Joint Venture, either one of the partners must have:</p> <ul style="list-style-type: none"> - A successful experience as prime contractor in the construction of at least one (1) work of a nature and complexity equivalent to the Works generally within the last ten (10) years of 50% of the estimated project cost of Works under bid amounting to Twenty-One Million Forty-One Thousand pesos (Php21,041,000.00) such being verifiable from Certificate of Completion, and the rest of the partner with 25% of the estimated project cost of Works under bid amounting to Ten Million Five Hundred Twenty Thousand Five Hundred pesos (Php10,520,500.00); and - An average annual turnover of Construction Income for the last three (3) years of at least equal to one hundred (100%) of the estimated project cost of Works under bid as evidenced by the audited financial statements for the last three (3) years stamped “received” by the BIR [with supporting Income Tax Return stamped “received” by BIR or its duly accredited and authorized institutions or eBIR Tax Return Receipt Confirmation (if submitted through eBIR), and eFPS], in the amount of Forty-Two Million Eighty-Two Thousand pesos (Php42,082,000.00) and at least equal to 50% of the estimated project cost of Works under bid for the rest of the partner amounting to Twenty-One Million Forty-One Thousand pesos (Php21,041,000.00). <p>For this purpose, similar contracts shall refer to Building Construction.</p>
5.5	Not mandatory.
8.1	<p>Subcontracting is allowed.</p> <p>There is no restriction on the involvement of general sub-contractors in the areas of manual and semi-skilled labor or construction materials provided that the contractor undertakes not less than fifty percent (50%) of the contracted works with its own resources.</p>
8.2	To be considered eligible and qualified a subcontractor must have a successful experience as contractor in the construction of at least one (1) work of a nature and complexity equivalent to the scope of works to be subcontracted, generally during within the last five (5) years.
9.1	<p>The Date, Time and Venue of the Pre-Bid Conference is:</p> <p>May 17, 2024 at 10:00 AM Multi-Purpose Hall, PESO Building, East Alvear St., Lingayen, Pangasinan with invitation link: https://us02web.zoom.us/j/87353312554?pwd=MjdPU3h1a1U0SWNRUktsczVLZEhrZz09 .</p>
10.1	<p>The Procuring Entity’s address is:</p> <p>Provincial Capitol Building, Capitol Compound, Lingayen, Pangasinan</p>
10.4	No further instructions.

12.1	<p>During Bid opening, if the first bid envelope lacks any of the following requirements that are historical information, these can be clarified following Section II, ITB Clause 26. If the first bid envelope lacks the Bid Securing Declaration, the bid shall be declared non-responsive.</p> <p>The first envelope shall contain the following eligibility and technical documents:</p> <p>a. Eligibility Requirements</p> <ul style="list-style-type: none"> i. Registration Certification of the Company (from SEC or DTI or CDA); ii. Statement of the bidder’s Single Largest Completed Contract (SLCC) similar to the contract to be bid and Average Annual Turnover, as specified in ITB Clause 5.4; iii. Audited Financial Statements for the last three (3) years; iv. In case of Joint Venture, a duly notarized Joint Venture agreement and a copy of the duly accomplished application form for Special License of the Joint Venture filed with the PCAB, or a copy of the Special License of the Joint Venture if already issued. <p>b. Technical Documents</p> <ul style="list-style-type: none"> v. Project Requirements, to include: <ul style="list-style-type: none"> (v.1) List of contractor’s personnel (one (1) Project Engineer, and one (1) Materials Engineer) to be assigned to the contract to be bid, with their complete qualifications and experience data; and (v.2) List of contractor’s major equipment units which are owned and are supported by Certified True Copy from the Original of proof of ownership such as, without limitation, Deed of Sale, Official Receipt/Certificate of Registration, Sales Invoice, Charge Invoice or Delivery Receipt, which must meet the minimum requirement for the contract set in the BDS 12.1(b)(iii.3) vi. Bid Securing Declaration as required in ITB 18; <p>Foreign bidders may submit the equivalent documents, if any, issued by the country of the foreign bidder.</p>
12.1(a)(iii)	<p>Foreign bidders may submit their valid Philippine Contractors Accreditation Board (PCAB) license or special PCAB License in case of joint ventures, and registration for the type and cost of the contract for this Project as a pre-condition for award as provided in the Financing Agreement, and ITB Nos. 12.1(b)(ii.2) and 12.1(b)(iii.3).</p>

12.1(b)(ii.2)	The minimum work experience requirements for key personnel are the following:		
	<u>General Experience</u>	<u>Relevant Experience</u>	
1. Project Engineer (PE)	Minimum of five (5) years experience as Licensed Civil/Agricultural Engineer	Minimum of two (2) building construction projects handled as Project Engineer with a value of at least twenty percent (20%) of the EPC/Component and must be related to the nature of Works being procured	
2. Materials Engineer (ME)	Licensed Civil Engineer	duly accredited by DPWH as Materials Engineer I following DPWH D.O. 98, S. of 2016	
12.1(b)(iii.3)	Minimum Required Equipment		
	Particulars	Owned	Leased
1.	Bulldozer (D65A-8)		1
2.	Payloader (1.5 cu.m.)	1	
3.	Road Grader, GD705-A4		1
4.	Vibratory Roller (SD100DC)		1
5.	Truck Mounted Crane		1
	Total	1	4
13.1	No further instruction		
13.2 (a) & (b)	There is no ceiling for Financial Proposals.		
14.2	No further instructions.		
15.4	No further instruction.		
16.1	The bid prices shall be quoted in Philippine Pesos.		
16.3	No further instructions.		
17.1	Bids will be valid until ninety (90) calendar days from bid opening date.		
18.1	The bid security shall be in the form of a Bid Securing Declaration		
18.2	The bid security shall be valid until one hundred twenty (120) calendar days from the date set for Bid opening date.		
19.2	Substance over the form is considered.		
20.3	<p>Each Bidder shall submit:</p> <ul style="list-style-type: none"> - one (1) original, and - four (4) copies of the first and second components of its bid. - An electronic copy of the bid should also be submitted in PDF file format in a flash drive. <p>Should there be discrepancies, the original copy would prevail.</p>		
21	The address for Submission of Bids is at the BAC Conference Room, 2nd Floor, Malong Building, Capitol Compound, Lingayen, Pangasinan.		

	The deadline for Submission of Bids is May 30, 2024 at 10:00 AM
24.1	<p>The BAC shall open the bids in public on May 30, 2024 at 10:00 AM, at the Multi-Purpose Hall, PESO Building, East Alvear St., Lingayen, Pangasinan with invitation link: https://us02web.zoom.us/j/88549547789?pwd=S3JoRFVlMHdLMWp1T0pOY2lMSE16dz09 .</p> <p>The time for the bid opening shall be the same as the deadline for receipt of bids or promptly thereafter. Re-scheduling the date of the opening of bids shall not be considered except for force majeure, such as natural calamities. In re-scheduling the opening of bids, the BAC shall issue a Notice of Postponement to be posted at the PhilGEPS' and the Procuring Entity's websites.</p>
24.2	During Bid opening, if the first envelope lacks any of the requirements that are historical information, as listed in World Bank BDS 12.1, these can be clarified following Section II, ITB Clause 26. If the first bid envelope lacks the Bid Securing Declaration, the bid shall be declared non-responsive but the documents shall be kept by the Procuring Entity.
24.3	The financial proposals in the second envelope of all the bidders shall be read for record purposes. The first and second envelopes shall not be returned to the bidders.
27.4	No financial ceiling
28.2	None
28.4	The Financing Agreement provides that procurement shall follow the Bank's Procurement Regulations and Annex X 2.3 (i) thereof provides that the amount of the award of contract to the bidder with the Lowest Calculated Responsive Bid (LCRB) shall be at its adjusted Bid price.
31.4(f)	<p>The other document required are:</p> <ol style="list-style-type: none"> 1) Construction schedule 2) S-Curve 3) Manpower schedule 4) Construction methods 5) Equipment Utilization schedule 6) Construction Safety and Health Program approved by the Department of Labor and Employment; and 7) PERT/CPM.
32.2	<p>In times of declaration of state of emergency/calamity, to allow submission of the following (until revoke/lifted) the following documents:</p> <ol style="list-style-type: none"> 1. Performance Securing Declaration (PSD) in lieu of a performance security to guarantee the winning bidder's faithful performance of obligations under the contract, subject to the following: a. Similar to the PSD used in Framework Agreement, such declaration shall state, among others, that the winning bidder shall be blacklisted from being qualified to participate in any government procurement activity for one (1) year,

	<p>in case of first offense or two (2) years, if with prior similar offense, in the event it violates any of the conditions stated in the contract.</p> <p>a. An un-notarized PSD may be accepted, subject to submission of a notarized PSD before payment, unless the same is replaced with a performance security in the prescribed form, as stated below; and</p> <p>b. The end-user may require the winning bidder to replace the submitted PSD with a performance security in any of the prescribed forms under Section 39.2 of the 2016 revised IRR of RA No. 9184 upon lifting of the State of Calamity.</p>
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Section IV. General Conditions of Contract

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1. Definitions

For purposes of this Clause, boldface type is used to identify defined terms.

- 1.1. The **Arbiter** is the person appointed jointly by the Procuring Entity and the Contractor to resolve disputes in the first instance, as provided for in **GCC** Clause 21.
- 1.2. **Bill of Quantities** refers to a list of the specific items of the Work and their corresponding unit prices, lump sums, and/or provisional sums.
- 1.3. The **Completion Date** is the date of completion of the Works as certified by the Procuring Entity's Representative, in accordance with **GCC** Clause 49.
- 1.4. The **Contract** is the contract between the Procuring Entity and the Contractor to execute, complete, and maintain the Works.
- 1.5. The **Contract Effectivity Date** is the date of signing of the Contract. However, the contractor shall commence execution of the Works on the Start Date as defined in **GCC** Clause 1.28.
- 1.6. The **Contract Price** is the price stated in the Notice of Award and thereafter to be paid by the Procuring Entity to the Contractor for the execution of the Works in accordance with this Contract
- 1.7. **Contract Time Extension** is the allowable period for the Contractor to complete the Works in addition to the original Completion Date stated in this Contract.
- 1.8. The **Contractor** is the juridical entity whose proposal has been accepted by the Procuring Entity and to whom the Contract to execute the Work was awarded.
- 1.9. The **Contractor's Bid** is the signed offer or proposal submitted by the Contractor to the Procuring Entity in response to the Bidding Documents.
- 1.10. **Days** are calendar days; months are calendar months.
- 1.11. **Dayworks** are varied work inputs subject to payment on a time basis for the Contractor's employees and Equipment, in addition to payments for associated Materials and Plant.
- 1.12. A **Defect** is any part of the Works not completed in accordance with the Contract.
- 1.13. The **Defects Liability Certificate** is the certificate issued by Procuring Entity's Representative upon correction of defects by the Contractor.
- 1.14. The **Defects Liability Period** is the one year period between contract completion and final acceptance within which the Contractor assumes the

responsibility to undertake the repair of any damage to the Works at his own expense.

- 1.15 **Drawings** are graphical presentations of the Works. They include all supplementary details, shop drawings, calculations, and other information provided or approved for the execution of this Contract.
- 1.16 **Equipment** refers to all facilities, supplies, appliances, materials or things required for the execution and completion of the Work provided by the Contractor and which shall not form or are not intended to form part of the Permanent Works.
- 1.17 The **Intended Completion Date** refers to the date specified in the SCC when the Contractor is expected to have completed the Works. The Intended Completion Date may be revised only by the Procuring Entity's Representative by issuing an extension of time or an acceleration order.
- 1.18 **Materials** are all supplies, including consumables, used by the Contractor for incorporation in the Works.
- 1.19 The **Notice to Proceed** is a written notice issued by the Procuring Entity or the Procuring Entity's Representative to the Contractor requiring the latter to begin the commencement of the work not later than a specified or determinable date.
- 1.20 **Permanent Works** are all permanent structures and all other project features and facilities required to be constructed and completed in accordance with this Contract which shall be delivered to the Procuring Entity and which shall remain at the Site after the removal of all Temporary Works.
- 1.21 **Plant** refers to the machinery, apparatus, and the like intended to form an integral part of the Permanent Works.
- 1.22 The **Procuring Entity** is the party who employs the Contractor to carry out the Works stated in the SCC.
- 1.23 The **Procuring Entity's Representative** refers to the Head of the Procuring Entity or his duly authorized representative, identified in the SCC, who shall be responsible for supervising the execution of the Works and administering this Contract.
- 1.24 The **Site** is the place provided by the Procuring Entity where the Works shall be executed and any other place or places which may be designated in the SCC, or notified to the Contractor by the Procuring Entity's Representative as forming part of the Site.
- 1.25 **Site Investigation Reports** are those that were included in the Bidding Documents and are factual and interpretative reports about the surface and subsurface conditions at the Site.

- 1.26 **Slippage** is a delay in work execution occurring when actual accomplishment falls below the target as measured by the difference between the scheduled and actual accomplishment of the Work by the Contractor as established from the work schedule. This is actually described as a percentage of the whole Works.
- 1.27 **Specifications** means the description of Works to be done and the qualities of materials to be used, the equipment to be installed and the mode of construction.
- 1.28 The **Start Date**, as specified in the SCC, is the date when the Contractor is obliged to commence execution of the Works. It does not necessarily coincide with any of the Site Possession Dates.
- 1.29 A **Subcontractor** is any person or organization to whom a part of the Works has been subcontracted by the Contractor, as allowed by the Procuring Entity, but not any assignee of such person.
- 1.30 **Temporary Works** are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the Permanent Works.
- 1.31 **Work(s)** refer to the Permanent Works and Temporary Works to be executed by the Contractor in accordance with this Contract, including (i) the furnishing of all labor, materials, equipment and others incidental, necessary or convenient to the complete execution of the Works; (ii) the passing of any tests before acceptance by the Procuring Entity's Representative; (iii) and the carrying out of all duties and obligations of the Contractor imposed by this Contract as described in the SCC.

2. Interpretation

- 2.1. In interpreting the Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of this Contract unless specifically defined. The Procuring Entity's Representative will provide instructions clarifying queries about the Conditions of Contract.
- 2.2. If sectional completion is specified in the SCC, references in the Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).
- 2.3. The documents forming this Contract shall be interpreted in the following order of priority:
- a) Contract Agreement;
 - b) Bid Data Sheet;

- c) Instructions to Bidders;
- d) Addenda to the Bidding Documents;
- e) Special Conditions of Contract;
- f) General Conditions of Contract;
- g) Specifications;
- h) Bill of Quantities; and
- i) Drawings.

3. Governing Language and Law

- 3.1. This Contract has been executed in the English language, which shall be the binding and controlling language for all matters relating to the meaning or interpretation of this Contract. All correspondence and other documents pertaining to this Contract which are exchanged by the parties shall be written in English.
- 3.2. This Contract shall be interpreted in accordance with the laws of the Republic of the Philippines.

4. Communications

Communications between parties that are referred to in the Conditions shall be effective only when in writing. A notice shall be effective only when it is received by the concerned party.

5. Possession of Site

- 5.1. On the date specified in the SCC, the Procuring Entity shall grant the Contractor possession of so much of the Site as may be required to enable it to proceed with the execution of the Works. If the Contractor suffers delay or incurs cost from failure on the part of the Procuring Entity to give possession in accordance with the terms of this clause, the Procuring Entity's Representative shall give the Contractor a Contract Time Extension and certify such sum as fair to cover the cost incurred, which sum shall be paid by Procuring Entity.
- 5.2. If possession of a portion is not given by the date stated in the SCC Clause 5.1, the Procuring Entity will be deemed to have delayed the start of the relevant activities. The resulting adjustments in contract time to address such delay shall be in accordance with GCC Clause 47.
- 5.3. The Contractor shall bear all costs and charges for special or temporary right-of-way required by it in connection with access to the Site. The Contractor shall also provide at his own cost any additional facilities outside the Site required by it for purposes of the Works.

- 5.4. The Contractor shall allow the Procuring Entity's Representative and any person authorized by the Procuring Entity's Representative access to the Site and to any place where work in connection with this Contract is being carried out or is intended to be carried out.

6. The Contractor's Obligations

- 6.1. The Contractor shall carry out the Works properly and in accordance with this Contract. The Contractor shall provide all supervision, labor, Materials, Plant and Contractor's Equipment, which may be required. All Materials and Plant on Site shall be deemed to be the property of the Procuring Entity.
- 6.2. The Contractor shall commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Program of Work submitted by the Contractor, as updated with the approval of the Procuring Entity's Representative, and complete them by the Intended Completion Date.
- 6.3. The Contractor shall be responsible for the safety of all activities on the Site.
- 6.4. The Contractor shall carry out all instructions of the Procuring Entity's Representative that comply with the applicable laws where the Site is located.
- 6.5. The Contractor shall employ the key personnel named in the Schedule of Key Personnel, as referred to in the SCC, to carry out the supervision of the Works. The Procuring Entity will approve any proposed replacement of key personnel only if their relevant qualifications and abilities are equal to or better than those of the personnel listed in the Schedule.
- 6.6. If the Procuring Entity's Representative asks the Contractor to remove a member of the Contractor's staff or work force, for justifiable cause, the Contractor shall ensure that the person leaves the Site within seven (7) days and has no further connection with the Work in this Contract.
- 6.7. During Contract implementation, the Contractor and his subcontractors shall abide at all times by all labor laws, including child labor related enactments, and other relevant rules.
- 6.8. The Contractor shall submit to the Procuring Entity for consent the name and particulars of the person authorized to receive instructions on behalf of the Contractor.
- 6.9. The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Procuring Entity between the dates given in the schedule of other contractors particularly when they shall require access to the Site. The Contractor shall also provide facilities and services for them during this period. The Procuring Entity may modify the schedule of other contractors, and shall notify the Contractor of any such modification thereto.

- 6.10. Should anything of historical or other interest or of significant value be unexpectedly discovered on the Site, it shall be the property of the Procuring Entity. The Contractor shall notify the Procuring Entity's Representative of such discoveries and carry out the Procuring Entity's Representative's instructions in dealing with them.

7. Performance Security

- 7.1. Within ten (10) calendar days from receipt of the Notice of Award from the Procuring Entity but in no case later than the signing of the contract by both parties, the Contractor shall furnish the performance security in any of the forms prescribed in ITB Clause 32.2.
- 7.2. The performance security posted in favor of the Procuring Entity shall be forfeited in the event it is established that the Contractor is in default in any of its obligations under the Contract.
- 7.3. The performance security shall remain valid until issuance by the Procuring Entity of the Certificate of Final Acceptance.
- 7.4. The performance security may be released by the Procuring Entity and returned to the Contractor after the issuance of the Certificate of Final Acceptance subject to the following conditions:
- (a) There are no pending claims against the Contractor or the surety company filed by the Procuring Entity;
 - (b) The Contractor has no pending claims for labor and materials filed against it; and
 - (c) Other terms specified in the SCC.
- 7.5. The Contractor shall post an additional performance security following the amount and form specified in **ITB** Clause 32.2 to cover any cumulative increase of more than ten percent (10%) over the original value of the contract as a result of amendments to order or change orders, extra work orders and supplemental agreements, as the case may be. The Contractor shall cause the extension of the validity of the performance security to cover approved contract time extensions.
- 7.6. In case of a reduction in the contract value or for partially completed Works under the contract which are usable and accepted by the Procuring Entity the use of which, in the judgment of the implementing agency or the Procuring Entity, will not affect the structural integrity of the entire project, the Procuring Entity shall allow a proportional reduction in the original performance security, provided that any such reduction is more than ten percent (10%) and that the aggregate of such reductions is not more than fifty percent (50%) of the original performance security.
- 7.7. Unless otherwise indicated in the SCC, the Contractor, by entering into the Contract with the Procuring Entity, acknowledges the right of the Procuring Entity to institute action pursuant to Act 3688 against any

subcontractor be they an individual, firm, partnership, corporation, or association supplying the Contractor with labor, materials and/or equipment for the performance of this Contract.

8. Subcontracting

- 8.1. Unless otherwise indicated in the SCC, the Contractor cannot subcontract Works more than the percentage specified in BDS Clause 8.1.
- 8.2. Subcontracting of any portion of the Works does not relieve the Contractor of any liability or obligation under this Contract. The Contractor will be responsible for the acts, defaults, and negligence of any subcontractor, its agents, servants or workmen as fully as if these were the Contractor's own acts, defaults, or negligence, or those of its agents, servants or workmen.
- 8.3. If subcontracting is allowed. The contractor may identify its subcontractor during contract implementation stage. Subcontractors disclosed and identified during the bidding may be changed during the implementation of this Contract. In either case, subcontractors must submit the documentary requirements under ITB Clause 12 and comply with the eligibility criteria specified in the BDS. In the event that any subcontractor is found by any Procuring Entity to be eligible, the subcontracting of such portion of the Works shall be disallowed.

9. Liquidated Damages

- 9.1. The Contractor shall pay liquidated damages to the Procuring Entity for each day that the Completion Date is later than the Intended Completion Date. The applicable liquidated damages is at least one-tenth (1/10) of a percent of the cost of the unperformed portion for every day of delay. The total amount of liquidated damages shall not exceed ten percent (10%) of the amount of the contract. The Procuring Entity may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities. Once the cumulative amount of liquidated damages reaches ten percent (10%) of the amount of this Contract, the Procuring Entity may rescind or terminate this Contract, without prejudice to other courses of action and remedies available under the circumstances.
- 9.2. If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer of the Procuring Entity shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate.

10. Site Investigation Reports

The Contractor, in preparing the Bid, shall rely on any Site Investigation Reports referred to in the SCC supplemented by any information obtained by the Contractor.

11. The Procuring Entity, Licenses and Permits

The Procuring Entity shall, if requested by the Contractor, assist him in applying for permits, licenses or approvals, which are required for the Works.

12. Contractor's Risk and Warranty Security

- 12.1. The Contractor shall assume full responsibility for the Works from the time project construction commenced up to final acceptance by the Procuring Entity and shall be held responsible for any damage or destruction of the Works except those occasioned by *force majeure*. The Contractor shall be fully responsible for the safety, protection, security, and convenience of his personnel, third parties, and the public at large, as well as the Works, Equipment, installation, and the like to be affected by his construction work.
- 12.2. The defects liability period for infrastructure projects shall be one year from contract completion up to final acceptance by the Procuring Entity. During this period, the Contractor shall undertake the repair works, at his own expense, of any damage to the Works on account of the use of materials of inferior quality within ninety (90) days from the time the HoPE has issued an order to undertake repair. In case of failure or refusal to comply with this mandate, the Procuring Entity shall undertake such repair works and shall be entitled to full reimbursement of expenses incurred therein upon demand.
- 12.3. Unless otherwise indicated in the SCC, in case the Contractor fails to comply with the preceding paragraph, the Procuring Entity shall forfeit its performance security, subject its property(ies) to attachment or garnishment proceedings, and perpetually disqualify it from participating in any public bidding. All payables of the GoP in his favor shall be offset to recover the costs.
- 12.4. After final acceptance of the Works by the Procuring Entity, the Contractor shall be held responsible for "Structural Defects," *i.e.*, major faults/flaws/deficiencies in one or more key structural elements of the project which may lead to structural failure of the completed elements or structure, or "Structural Failures," *i.e.*, where one or more key structural elements in an infrastructure facility fails or collapses, thereby rendering the facility or part thereof incapable of withstanding the design loads, and/or endangering the safety of the users or the general public:
 - (a) Contractor – Where Structural Defects/Failures arise due to faults attributable to improper construction, use of inferior quality/substandard materials, and any violation of the contract plans and specifications, the contractor shall be held liable;
 - (b) Consultants – Where Structural Defects/Failures arise due to faulty and/or inadequate design and specifications as well as construction supervision, then the consultant who prepared the design or

undertook construction supervision for the project shall be held liable;

- (c) Procuring Entity's Representatives/Project Manager/Construction Managers and Supervisors – The project owner's representative(s), project manager, construction manager, and supervisor(s) shall be held liable in cases where the Structural Defects/Failures are due to his/their willful intervention in altering the designs and other specifications; negligence or omission in not approving or acting on proposed changes to noted defects or deficiencies in the design and/or specifications; and the use of substandard construction materials in the project;
- (d) Third Parties - Third Parties shall be held liable in cases where Structural Defects/Failures are caused by work undertaken by them such as leaking pipes, diggings or excavations, underground cables and electrical wires, underground tunnel, mining shaft and the like, in which case the applicable warranty to such structure should be levied to third parties for their construction or restoration works.
- (e) Users - In cases where Structural Defects/Failures are due to abuse/misuse by the end user of the constructed facility and/or non-compliance by a user with the technical design limits and/or intended purpose of the same, then the user concerned shall be held liable.

12.5. The warranty against Structural Defects/Failures, except those occasioned on force majeure, shall cover the period specified in the SCC reckoned from the date of issuance of the Certificate of Final Acceptance by the Procuring Entity.

12.6. The Contractor shall be required to put up a warranty security in the form of cash, bank guarantee, letter of credit, GSIS or surety bond callable on demand, in accordance with the following schedule:

Form of Warranty	Amount of Warranty Security Not less than the Percentage (%) of Total Contract Price
) Cash or letter of credit issued by Universal or Commercial bank: provided, however, that the letter of credit shall be confirmed or authenticated by a Universal or Commercial bank, if issued by a foreign bank	Five Percent (5%)
) Bank guarantee confirmed by Universal or Commercial bank: provided, however, that the letter of credit shall be confirmed or authenticated by a Universal or Commercial bank, if issued by a foreign bank	Ten Percent (10%)
) Surety bond callable upon demand issued by GSIS or any surety or insurance company duly certified by the Insurance Commission	Thirty Percent (30%)

12.7. The warranty security shall be stated in Philippine Pesos and shall remain effective for one year from the date of issuance of the Certificate of Final Acceptance by the Procuring Entity, and returned only after the lapse of said one year period.

12.8. In case of structural defects/failure occurring during the applicable warranty period provided in **GCC** Clause 12.5, the Procuring Entity shall undertake the necessary restoration or reconstruction works and shall be entitled to full reimbursement by the parties found to be liable for expenses incurred therein upon demand, without prejudice to the filing of appropriate administrative, civil, and/or criminal charges against the responsible persons as well as the forfeiture of the warranty security posted in favor of the Procuring Entity.

13. Liability of the Contractor

Subject to additional provisions, if any, set forth in the SCC, the Contractor's liability under this Contract shall be as provided by the laws of the Republic of the Philippines.

14. Procuring Entity's Risk

14.1. From the Start Date until the Certificate of Final Acceptance has been issued, the following are risks of the Procuring Entity:

- (a) The risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to:
 - (i) any type of use or occupation of the Site authorized by the Procuring Entity after the official acceptance of the works; or
 - (ii) negligence, breach of statutory duty, or interference with any legal right by the Procuring Entity or by any person employed by or contracted to him except the Contractor.
- (b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Procuring Entity or in the Procuring Entity's design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed.

15. Insurance

- 15.1. The Contractor shall, under his name and at his own expense, obtain and maintain, for the duration of this Contract, the following insurance coverage:
- (a) Contractor's All Risk Insurance;
 - (b) Transportation to the project Site of Equipment, Machinery, and Supplies owned by the Contractor;
 - (c) Personal injury or death of Contractor's employees; and
 - (d) Comprehensive insurance for third party liability to Contractor's direct or indirect act or omission causing damage to third persons.
- 15.2. The Contractor shall provide evidence to the Procuring Entity's Representative that the insurances required under this Contract have been effected and shall, within a reasonable time, provide copies of the insurance policies to the Procuring Entity's Representative. Such evidence and such policies shall be provided to the Procuring Entity's through the Procuring Entity's Representative.
- 15.3. The Contractor shall notify the insurers of changes in the nature, extent, or program for the execution of the Works and ensure the adequacy of the insurances at all times in accordance with the terms of this Contract and shall produce to the Procuring Entity's Representative the insurance policies in force including the receipts for payment of the current premiums.

The above insurance policies shall be obtained from any reputable insurance company approved by the Procuring Entity's Representative.

- 15.4. If the Contractor fails to obtain and keep in force the insurances referred to herein or any other insurance which he may be required to obtain under the terms of this Contract, the Procuring Entity may obtain and keep in force any such insurances and pay such premiums as may be necessary for the purpose. From time to time, the Procuring Entity may deduct the amount it shall pay for said premiums including twenty five percent (25%) therein from any monies due, or which may become due, to the Contractor, without prejudice to the Procuring Entity exercising its right to impose other sanctions against the Contractor pursuant to the provisions of this Contract.
- 15.5. In the event the Contractor fails to observe the above safeguards, the Procuring Entity may, at the Contractor's expense, take whatever measure is deemed necessary for its protection and that of the Contractor's personnel and third parties, and/or order the interruption of dangerous Works. In addition, the Procuring Entity may refuse to make the payments under **GCC Clause 40** until the Contractor complies with this Clause.
- 15.6. The Contractor shall immediately replace the insurance policy obtained as required in this Contract, without need of the Procuring Entity's demand, with a new policy issued by a new insurance company acceptable to the Procuring Entity for any of the following grounds:
- (a) The issuer of the insurance policy to be replaced has:
 - (i) become bankrupt;
 - (ii) been placed under receivership or under a management committee;
 - (iii) been sued for suspension of payment; or
 - (iv) been suspended by the Insurance Commission and its license to engage in business or its authority to issue insurance policies cancelled; or
 - (v) Where reasonable grounds exist that the insurer may not be able, fully and promptly, to fulfill its obligation under the insurance policy.

16. Termination for Default of Contractor

- 16.1. The Procuring Entity shall terminate this Contract for default when any of the following conditions attend its implementation:
- (i) Due to the Contractor's fault and while the project is on-going, it has incurred negative slippage of fifteen percent (15%) or more in accordance with Presidential Decree 1870, regardless of whether or not previous warnings and notices have been issued for the Contractor to improve his performance;

- (ii) Due to its own fault and after this Contract time has expired, the Contractor incurs delay in the completion of the Work after this Contract has expired; or
- (iii) The Contractor:
 - (i) abandons the contract Works, refuses or fails to comply with a valid instruction of the Procuring Entity or fails to proceed expeditiously and without delay despite a written notice by the Procuring Entity;
 - (ii) does not actually have on the project Site the minimum essential equipment listed on the bid necessary to prosecute the Works in accordance with the approved Program of Work and equipment deployment schedule as required for the project;
 - (iii) does not execute the Works in accordance with this Contract or persistently or flagrantly neglects to carry out its obligations under this Contract;
 - (iv) neglects or refuses to remove materials or to perform a new Work that has been rejected as defective or unsuitable; or
 - (v) sub-lets any part of this Contract without approval by the Procuring Entity.

16.2. All materials on the Site, Plant, Works, including Equipment purchased and funded under the Contract shall be deemed to be the property of the Procuring Entity if this Contract is rescinded because of the Contractor's default.

17. Termination for Default of Procuring Entity

The Contractor may terminate this Contract with the Procuring Entity if the works are completely stopped for a continuous period of at least sixty (60) calendar days through no fault of its own, due to any of the following reasons:

- (d) Failure of the Procuring Entity to deliver, within a reasonable time, supplies, materials, right-of-way, or other items it is obligated to furnish under the terms of this Contract; or
- (e) The prosecution of the Work is disrupted by the adverse peace and order situation, as certified by the Armed Forces of the Philippines Provincial Commander and approved by the Secretary of National Defense.

18. Termination for Other Causes

18.1. The Procuring Entity may terminate this Contract, in whole or in part, at any time for its convenience. The HoPE may terminate this Contract for the convenience of the Procuring Entity if he has determined the existence of

conditions that make Project Implementation economically, financially or technically impractical and/or unnecessary, such as, but not limited to, fortuitous event(s) or changes in law and National Government policies.

- 18.2. The Procuring Entity or the Contractor may terminate this Contract if the other party causes a fundamental breach of this Contract.
- 18.3. Fundamental breaches of Contract shall include, but shall not be limited to, the following:
 - (a) The Contractor stops work for twenty eight (28) days when no stoppage of work is shown on the current Program of Work and the stoppage has not been authorized by the Procuring Entity's Representative;
 - (b) The Procuring Entity's Representative instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within twenty eight (28) days;
 - (c) The Procuring Entity shall terminate this Contract if the Contractor is declared bankrupt or insolvent as determined with finality by a court of competent jurisdiction. In this event, termination will be without compensation to the Contractor, provided that such termination will not prejudice or affect any right of action or remedy which has accrued or will accrue thereafter to the Procuring Entity and/or the Contractor. In the case of the Contractor's insolvency, any Contractor's Equipment which the Procuring Entity instructs in the notice is to be used until the completion of the Works;
 - (d) A payment certified by the Procuring Entity's Representative is not paid by the Procuring Entity to the Contractor within eighty four (84) days from the date of the Procuring Entity's Representative's certificate;
 - (e) The Procuring Entity's Representative gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Procuring Entity's Representative;
 - (f) The Contractor does not maintain a Security, which is required;
 - (g) The Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as defined in the **GCC** Clause 9; and
 - (h) In case it is determined prima facie by the Procuring Entity that the Contractor has engaged, before or during the implementation of the contract, in unlawful deeds and behaviors relative to contract

acquisition and implementation, such as, but not limited to, the following:

- (i) corrupt, fraudulent, collusive, coercive, and obstructive practices as defined in **ITB** Clause 3.1(a), unless otherwise specified in the SCC;
- (ii) drawing up or using forged documents;
- (iii) using adulterated materials, means or methods, or engaging in production contrary to rules of science or the trade; and
- (iv) any other act analogous to the foregoing.

18.4. The Funding Source or the Procuring Entity, as appropriate, will seek to impose the maximum civil, administrative and/or criminal penalties available under the applicable law on individuals and organizations deemed to be involved with corrupt, fraudulent, or coercive practices.

18.5. When persons from either party to this Contract gives notice of a fundamental breach to the Procuring Entity's Representative in order to terminate the existing contract for a cause other than those listed under **GCC** Clause 18.3, the Procuring Entity's Representative shall decide whether the breach is fundamental or not.

18.6. If this Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible.

19. Procedures for Termination of Contracts

19.1. The following provisions shall govern the procedures for the termination of this Contract:

(a) Upon receipt of a written report of acts or causes which may constitute ground(s) for termination as aforementioned, or upon its own initiative, the Procuring Entity shall, within a period of seven (7) calendar days, verify the existence of such ground(s) and cause the execution of a Verified Report, with all relevant evidence attached;

(b) Upon recommendation by the Procuring Entity, the HoPE shall terminate this Contract only by a written notice to the Contractor conveying the termination of this Contract. The notice shall state:

- (i) that this Contract is being terminated for any of the ground(s) afore-mentioned, and a statement of the acts that constitute the ground(s) constituting the same;
- (ii) the extent of termination, whether in whole or in part;

- (iii) an instruction to the Contractor to show cause as to why this Contract should not be terminated; and
- (iv) special instructions of the Procuring Entity, if any.

The Notice to Terminate shall be accompanied by a copy of the Verified Report;

- (c) Within a period of seven (7) calendar days from receipt of the Notice of Termination, the Contractor shall submit to the HoPE a verified position paper stating why the contract should not be terminated. If the Contractor fails to show cause after the lapse of the seven (7) day period, either by inaction or by default, the HoPE shall issue an order terminating the contract;
- (d) The Procuring Entity may, at any time before receipt of the Contractor's verified position paper described in item (c) above withdraw the Notice to Terminate if it is determined that certain items or works subject of the notice had been completed, delivered, or performed before the Contractor's receipt of the notice;
- (e) Within a non-extendible period of ten (10) calendar days from receipt of the verified position paper, the HoPE shall decide whether or not to terminate this Contract. It shall serve a written notice to the Contractor of its decision and, unless otherwise provided in the said notice, this Contract is deemed terminated from receipt of the Contractor of the notice of decision. The termination shall only be based on the ground(s) stated in the Notice to Terminate; and
- (f) The HoPE may create a Contract Termination Review Committee (CTRC) to assist him in the discharge of this function. All decisions recommended by the CTRC shall be subject to the approval of the HoPE.

19.2. Pursuant to Section 69(f) of RA 9184 and without prejudice to the imposition of additional administrative sanctions as the internal rules of the agency may provide and/or further criminal prosecution as provided by applicable laws, the procuring entity shall impose on contractors after the termination of the contract the penalty of suspension for one (1) year for the first offense, suspension for two (2) years for the second offense from participating in the public bidding process, for violations committed during the contract implementation stage, which include but not limited to the following:

- (a) Failure of the contractor, due solely to his fault or negligence, to mobilize and start work or performance within the specified period in the Notice to Proceed ("NTP");
- (b) Failure by the contractor to fully and faithfully comply with its contractual obligations without valid cause, or failure by the contractor to comply with any written lawful instruction of the

procuring entity or its representative(s) pursuant to the implementation of the contract. For the procurement of infrastructure projects or consultancy contracts, lawful instructions include but are not limited to the following:

- (i) Employment of competent technical personnel, competent engineers and/or work supervisors;
 - (ii) Provision of warning signs and barricades in accordance with approved plans and specifications and contract provisions;
 - (iii) Stockpiling in proper places of all materials and removal from the project site of waste and excess materials, including broken pavement and excavated debris in accordance with approved plans and specifications and contract provisions;
 - (iv) Deployment of committed equipment, facilities, support staff and manpower; and
 - (v) Renewal of the effectivity dates of the performance security after its expiration during the course of contract implementation.
- (c) Assignment and subcontracting of the contract or any part thereof or substitution of key personnel named in the proposal without prior written approval by the procuring entity.
- (d) Poor performance by the contractor or unsatisfactory quality and/or progress of work arising from his fault or negligence as reflected in the Constructor's Performance Evaluation System ("CPES") rating sheet. In the absence of the CPES rating sheet, the existing performance monitoring system of the procuring entity shall be applied. Any of the following acts by the Contractor shall be construed as poor performance:
- (i) Negative slippage of 15% and above within the critical path of the project due entirely to the fault or negligence of the contractor; and
 - (ii) Quality of materials and workmanship not complying with the approved specifications arising from the contractor's fault or negligence.
- (e) Willful or deliberate abandonment or non-performance of the project or contract by the contractor resulting to substantial breach thereof without lawful and/or just cause.

In addition to the penalty of suspension, the performance security posted by the contractor shall also be forfeited.

20. Force Majeure, Release From Performance

- 20.1. For purposes of this Contract the terms “*force majeure*” and “fortuitous event” may be used interchangeably. In this regard, a fortuitous event or *force majeure* shall be interpreted to mean an event which the Contractor could not have foreseen, or which though foreseen, was inevitable. It shall not include ordinary unfavorable weather conditions; and any other cause the effects of which could have been avoided with the exercise of reasonable diligence by the Contractor.
- 20.2. If this Contract is discontinued by an outbreak of war or by any other event entirely outside the control of either the Procuring Entity or the Contractor, the Procuring Entity’s Representative shall certify that this Contract has been discontinued. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all works carried out before receiving it and for any Work carried out afterwards to which a commitment was made.
- 20.3. If the event continues for a period of eighty-four (84) days, either party may then give notice of termination, which shall take effect twenty eight (28) days after the giving of the notice.
- 20.4. After termination, the Contractor shall be entitled to payment of the unpaid balance of the value of the Works executed and of the materials and Plant reasonably delivered to the Site, adjusted by the following:
- (a) any sum to which the Contractor is entitled under **GCC** Clause 28;
 - (b) the cost of his suspension and demobilization;
 - (c) any sum to which the Procuring Entity is entitled.
- 20.5. The net balance due shall be paid or repaid within a reasonable time period from the time of the notice of termination.

21. Resolution of Disputes

- 21.1. If any dispute or difference of any kind whatsoever shall arise between the parties in connection with the implementation of the contract covered by the Act and this IRR, the parties shall make every effort to resolve amicably such dispute or difference by mutual consultation.
- 21.2. If the Contractor believes that a decision taken by the Procuring Entity’s Representative was either outside the authority given to the Procuring Entity’s Representative by this Contract or that the decision was wrongly taken, the decision shall be referred to the Arbiter indicated in the SCC within fourteen (14) days of the notification of the Procuring Entity’s Representative’s decision.
- 21.3. Any and all disputes arising from the implementation of this Contract covered by the R.A. 9184 and its IRR shall be submitted to arbitration in

the Philippines according to the provisions of Republic Act No. 876, otherwise known as the “ Arbitration Law” and Republic Act 9285, otherwise known as the “Alternative Dispute Resolution Act of 2004”: *Provided, however,* That, disputes that are within the competence of the Construction Industry Arbitration Commission to resolve shall be referred thereto. The process of arbitration shall be incorporated as a provision in this Contract that will be executed pursuant to the provisions of the Act and its IRR: *Provided, further,*

That, by mutual agreement, the parties may agree in writing to resort to other alternative modes of dispute resolution.

22. Suspension of Loan, Credit, Grant, or Appropriation

In the event that the Funding Source suspends the Loan, Credit, Grant, or Appropriation to the Procuring Entity, from which part of the payments to the Contractor are being made:

- (f) The Procuring Entity is obligated to notify the Contractor of such suspension within seven (7) days of having received the suspension notice.
- (g) If the Contractor has not received sums due for work already done within forty five (45) days from the time the Contractor’s claim for payment has been certified by the Procuring Entity’s Representative, the Contractor may immediately issue a suspension of work notice in accordance with **GCC** Clause 45.2.

23. Procuring Entity’s Representative’s Decisions

- 23.1. Except where otherwise specifically stated, the Procuring Entity’s Representative will decide contractual matters between the Procuring Entity and the Contractor in the role representing the Procuring Entity.
- 23.2. The Procuring Entity’s Representative may delegate any of his duties and responsibilities to other people, except to the Arbiter, after notifying the Contractor, and may cancel any delegation after notifying the Contractor.

24. Approval of Drawings and Temporary Works by the Procuring Entity’s Representative

- 24.1. All Drawings prepared by the Contractor for the execution of the Temporary Works, are subject to prior approval by the Procuring Entity’s Representative before its use.
- 24.2. The Contractor shall be responsible for design of Temporary Works.
- 24.3. The Procuring Entity’s Representative’s approval shall not alter the Contractor’s responsibility for design of the Temporary Works.
- 24.4. The Contractor shall obtain approval of third parties to the design of the Temporary Works, when required by the Procuring Entity.

25. Acceleration and Delays Ordered by the Procuring Entity's Representative

- 25.1. When the Procuring Entity wants the Contractor to finish before the Intended Completion Date, the Procuring Entity's Representative will obtain priced proposals for achieving the necessary acceleration from the Contractor. If the Procuring Entity accepts these proposals, the Intended Completion Date will be adjusted accordingly and confirmed by both the Procuring Entity and the Contractor.
- 25.2. If the Contractor's Financial Proposals for an acceleration are accepted by the Procuring Entity, they are incorporated in the Contract Price and treated as a Variation.

26. Extension of the Intended Completion Date

- 26.1. The Procuring Entity's Representative shall extend the Intended Completion Date if a Variation is issued which makes it impossible for the Intended Completion Date to be achieved by the Contractor without taking steps to accelerate the remaining work, which would cause the Contractor to incur additional costs. No payment shall be made for any event which may warrant the extension of the Intended Completion Date.
- 26.2. The Procuring Entity's Representative shall decide whether and by how much to extend the Intended Completion Date within twenty one (21) days of the Contractor asking the Procuring Entity's Representative for a decision thereto after fully submitting all supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

27. Right to Vary

- 27.1. The Procuring Entity's Representative with the prior approval of the Procuring Entity may instruct Variations, up to a maximum cumulative amount of ten percent (10%) of the original contract cost.
- 27.2. Variations shall be valued as follows:
- (a) At a lump sum price agreed between the parties;
 - (b) where appropriate, at rates in this Contract;
 - (c) in the absence of appropriate rates, the rates in this Contract shall be used as the basis for valuation; or failing which
 - (d) at appropriate new rates, equal to or lower than current industry rates and to be agreed upon by both parties and approved by the HoPE.

28. Contractor's Right to Claim

If the Contractor incurs cost as a result of any of the events under GCC Clause 13, the Contractor shall be entitled to the amount of such cost. If as a result of any of

the said events, it is necessary to change the Works, this shall be dealt with as a Variation.

29. Dayworks

- 29.1. Subject to GCC Clause 43 on Variation Order, and if applicable as indicated in the SCC, the Dayworks rates in the Contractor's bid shall be used for small additional amounts of work only when the Procuring Entity's Representative has given written instructions in advance for additional work to be paid for in that way.
- 29.2. All work to be paid for as Dayworks shall be recorded by the Contractor on forms approved by the Procuring Entity's Representative. Each completed form shall be verified and signed by the Procuring Entity's Representative within two days of the work being done.
- 29.3. The Contractor shall be paid for Dayworks subject to obtaining signed Dayworks forms.

30. Early Warning

- 30.1. The Contractor shall warn the Procuring Entity's Representative at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works. The Procuring Entity's Representative may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.
- 30.2. The Contractor shall cooperate with the Procuring Entity's Representative in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Procuring Entity's Representative.

31. Program of Work

- 31.1. Within the time stated in the SCC, the Contractor shall submit to the Procuring Entity's Representative for approval a Program of Work showing the general methods, arrangements, order, and timing for all the activities in the Works.
- 31.2. An update of the Program of Work shall show the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.
- 31.3. The Contractor shall submit to the Procuring Entity's Representative for approval an updated Program of Work at intervals no longer than the period stated in the SCC. If the Contractor does not submit an updated Program of Work within this period, the Procuring Entity's Representative may withhold the amount stated in the SCC from the next payment

certificate and continue to withhold this amount until the next payment after the date on which the overdue Program of Work has been submitted.

- 31.4. The Procuring Entity's Representative's approval of the Program of Work shall not alter the Contractor's obligations. The Contractor may revise the Program of Work and submit it to the Procuring Entity's Representative again at any time. A revised Program of Work shall show the effect of any approved Variations.
- 31.5. When the Program of Work is updated, the Contractor shall provide the Procuring Entity's Representative with an updated cash flow forecast. The cash flow forecast shall include different currencies, as defined in the Contract, converted as necessary using the Contract exchange rates.
- 31.6. All Variations shall be included in the updated Program of Work produced by the Contractor.

32. Management Conferences

- 32.1. Either the Procuring Entity's Representative or the Contractor may require the other to attend a Management Conference. The Management Conference shall review the plans for remaining work and deal with matters raised in accordance with the early warning procedure.
- 32.2. The Procuring Entity's Representative shall record the business of Management Conferences and provide copies of the record to those attending the Conference and to the Procuring Entity. The responsibility of the parties for actions to be taken shall be decided by the Procuring Entity's Representative either at the Management Conference or after the Management Conference and stated in writing to all who attended the Conference.

33. Bill of Quantities

- 33.1. The Bill of Quantities shall contain items of work for the construction, installation, testing, and commissioning of work to be done by the Contractor.
- 33.2. The Bill of Quantities is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.
- 33.3. If the final quantity of any work done differs from the quantity in the Bill of Quantities for the particular item and is not more than twenty five percent (25%) of the original quantity, provided the aggregate changes for all items do not exceed ten percent (10%) of the Contract price, the Procuring Entity's Representative shall make the necessary adjustments to allow for the changes subject to applicable laws, rules, and regulations.
- 33.4. If requested by the Procuring Entity's Representative, the Contractor shall provide the Procuring Entity's Representative with a detailed cost breakdown of any rate in the Bill of Quantities.

34. Instructions, Inspections and Audits

- 34.1. The Procuring Entity's personnel shall at all reasonable times during construction of the Work be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of the construction.
- 34.2. If the Procuring Entity's Representative instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no defect, the test shall be a Compensation Event.
- 34.3. The Contractor shall permit the Funding Source named in the SCC to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by the Funding Source, if so required by the Funding Source.

35. Identifying Defects

The Procuring Entity's Representative shall check the Contractor's work and notify the Contractor of any defects that are found. Such checking shall not affect the Contractor's responsibilities. The Procuring Entity's Representative may instruct the Contractor to search uncover defects and test any work that the Procuring Entity's Representative considers below standards and defective.

36. Cost of Repairs

Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Liability Periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

37. Correction of Defects

- 37.1. The Procuring Entity's Representative shall give notice to the Contractor of any defects before the end of the Defects Liability Period, which is One (1) year from project completion up to final acceptance by the Procuring Entity's Representative.
- 37.2. Every time notice of a defect is given, the Contractor shall correct the notified defect within the length of time specified in the Procuring Entity's Representative's notice.
- 37.3. The Contractor shall correct the defects which he notices himself before the end of the Defects Liability Period.
- 37.4. The Procuring Entity shall certify that all defects have been corrected. If the Procuring Entity considers that correction of a defect is not essential, he can request the Contractor to submit a quotation for the corresponding reduction in the Contract Price. If the Procuring Entity accepts the quotation, the corresponding change in the SCC is a Variation.

38. Uncorrected Defects

- 38.1. The Procuring Entity shall give the Contractor at least fourteen (14) days notice of his intention to use a third party to correct a Defect. If the Contractor does not correct the Defect himself within the period, the Procuring Entity may have the Defect corrected by the third party. The cost of the correction will be deducted from the Contract Price.
- 38.2. The use of a third party to correct defects that are uncorrected by the Contractor will in no way relieve the Contractor of its liabilities and warranties under the Contract.

39. Advance Payment

- 39.1. The Procuring Entity shall, upon a written request of the contractor which shall be submitted as a contract document, make an advance payment to the contractor in an amount not exceeding fifteen percent (15%) of the total contract price, to be made in lump sum or, at the most two, installments according to a schedule specified in the SCC.
- 39.2. The advance payment shall be made only upon the submission to and acceptance by the Procuring Entity of an irrevocable standby letter of credit of equivalent value from a commercial bank, a bank guarantee or a surety bond callable upon demand, issued by a surety or insurance company duly licensed by the Insurance Commission and confirmed by the Procuring Entity.
- 39.3. The advance payment shall be repaid by the Contractor by an amount equal to the percentage of the total contract price used for the advance payment.
- 39.4. The contractor may reduce his standby letter of credit or guarantee instrument by the amounts refunded by the Monthly Certificates in the advance payment.
- 39.5. The Procuring Entity will provide an Advance Payment on the Contract Price as stipulated in the Conditions of Contract, subject to the maximum amount stated in SCC Clause 1).

40. Progress Payments

- 40.1. The Contractor may submit a request for payment for Work accomplished. Such request for payment shall be verified and certified by the Procuring Entity's Representative/Project Engineer. Except as otherwise stipulated in the SCC, materials and equipment delivered on the site but not completely put in place shall not be included for payment.
- 40.2. The Procuring Entity shall deduct the following from the certified gross amounts to be paid to the contractor as progress payment:
 - (a) Cumulative value of the work previously certified and paid for.
 - (b) Portion of the advance payment to be recouped for the month.

- (c) Retention money in accordance with the condition of contract.
- (d) Amount to cover third party liabilities.
- (e) Amount to cover uncorrected discovered defects in the works.

- 40.3. Payments shall be adjusted by deducting there from the amounts for advance payments and retention. The Procuring Entity shall pay the Contractor the amounts certified by the Procuring Entity's Representative within twenty-eight (28) days from the date each certificate was issued. No payment of interest for delayed payments and adjustments shall be made by the Procuring Entity.
- 40.4. The first progress payment may be paid by the Procuring Entity to the Contractor provided that at least five percent (5%) of the work has been accomplished as certified by the Procuring Entity's Representative.
- 40.5. Items of the Works for which a price of "0" (zero) has been entered will not be paid for by the Procuring Entity and shall be deemed covered by other rates and prices in the Contract.

41. Payment Certificates

- 41.1. The Contractor shall submit to the Procuring Entity's Representative monthly statements of the estimated value of the work executed less the cumulative amount certified previously.
- 41.2. The Procuring Entity's Representative shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor.
- 41.3. The value of Work executed shall:
 - (a) be determined by the Procuring Entity's Representative;
 - (b) comprise the value of the quantities of the items in the Bill of Quantities completed; and
 - (c) include the valuations of approved variations.
- 41.4. The Procuring Entity's Representative may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

42. Retention

- 42.1. The Procuring Entity shall retain from each payment due to the Contractor an amount equal to a percentage thereof using the rate as specified in GCC Sub-Clause 42.2.
- 42.2. Progress payments are subject to retention of ten percent (10%), referred to as the "retention money." Such retention shall be based on the total amount due to the Contractor prior to any deduction and shall be retained

from every progress payment until fifty percent (50%) of the value of Works, as determined by the Procuring Entity, are completed. If, after fifty percent (50%) completion, the Work is satisfactorily done and on schedule, no additional retention shall be made; otherwise, the ten percent (10%) retention shall again be imposed using the rate specified therefor.

- 42.3. The total “retention money” shall be due for release upon final acceptance of the Works. The Contractor may, however, request the substitution of the retention money for each progress billing with irrevocable standby letters of credit from a commercial bank, bank guarantees or surety bonds callable on demand, of amounts equivalent to the retention money substituted for and acceptable to the Procuring Entity, provided that the project is on schedule and is satisfactorily undertaken. Otherwise, the ten (10%) percent retention shall be made. Said irrevocable standby letters of credit, bank guarantees and/or surety bonds, to be posted in favor of the Government shall be valid for a duration to be determined by the concerned implementing office/agency or Procuring Entity and will answer for the purpose for which the ten (10%) percent retention is intended, *i.e.*, to cover uncorrected discovered defects and third party liabilities.
- 42.4. On completion of the whole Works, the Contractor may substitute retention money with an “on demand” Bank guarantee in a form acceptable to the Procuring Entity.

43. Variation Orders

- 43.1. Variation Orders may be issued by the Procuring Entity to cover any increase/decrease in quantities, including the introduction of new work items that are not included in the original contract or reclassification of work items that are either due to change of plans, design or alignment to suit actual field conditions resulting in disparity between the preconstruction plans used for purposes of bidding and the “as staked plans” or construction drawings prepared after a joint survey by the Contractor and the Procuring Entity after award of the contract, provided that the cumulative amount of the Variation Order does not exceed ten percent (10%) of the original project cost. The addition/deletion of Works should be within the general scope of the project as bid and awarded. The scope of works shall not be reduced so as to accommodate a positive Variation Order. A Variation Order may either be in the form of a Change Order or Extra Work Order.
- 43.2. A Change Order may be issued by the Procuring Entity to cover any increase/decrease in quantities of original Work items in the contract.
- 43.3. An Extra Work Order may be issued by the Procuring Entity to cover the introduction of new work necessary for the completion, improvement or protection of the project which were not included as items of Work in the original contract, such as, where there are subsurface or latent physical conditions at the site differing materially from those indicated in the contract, or where there are duly unknown physical conditions at the site

of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in the Work or character provided for in the contract.

- 43.4. Any cumulative Variation Order beyond ten percent (10%) shall be subject of another contract to be bid out if the works are separable from the original contract. In exceptional cases where it is urgently necessary to complete the original scope of work, the HoPE may authorize a positive Variation Order go beyond ten percent (10%) but not more than twenty percent (20%) of the original contract price, subject to the guidelines to be determined by the GPPB: *Provided, however,* That appropriate sanctions shall be imposed on the designer, consultant or official responsible for the original detailed engineering design which failed to consider the Variation Order beyond ten percent (10%).
- 43.5. In claiming for any Variation Order, the Contractor shall, within seven (7) calendar days after such work has been commenced or after the circumstances leading to such condition(s) leading to the extra cost, and within twenty-eight (28) calendar days deliver a written communication giving full and detailed particulars of any extra cost in order that it may be investigated at that time. Failure to provide either of such notices in the time stipulated shall constitute a waiver by the contractor for any claim. The preparation and submission of Variation Orders are as follows:
- (a) If the Procuring Entity's representative/Project Engineer believes that a Change Order or Extra Work Order should be issued, he shall prepare the proposed Order accompanied with the notices submitted by the Contractor, the plans therefore, his computations as to the quantities of the additional works involved per item indicating the specific stations where such works are needed, the date of his inspections and investigations thereon, and the log book thereof, and a detailed estimate of the unit cost of such items of work, together with his justifications for the need of such Change Order or Extra Work Order, and shall submit the same to the HoPE for approval.
 - (b) The HoPE or his duly authorized representative, upon receipt of the proposed Change Order or Extra Work Order shall immediately instruct the appropriate technical staff or office of the Procuring Entity to conduct an on-the-spot investigation to verify the need for the Work to be prosecuted and to review the proposed plan, and prices of the work involved.
 - (c) The technical staff or appropriate office of the Procuring Entity shall submit a report of their findings and recommendations, together with the supporting documents, to the Head of Procuring Entity or his duly authorized representative for consideration.
 - (d) The HoPE or his duly authorized representative, acting upon the recommendation of the technical staff or appropriate office, shall

approve the Change Order or Extra Work Order after being satisfied that the same is justified, necessary, and in order.

- (e) The timeframe for the processing of Variation Orders from the preparation up to the approval by the Procuring Entity concerned shall not exceed thirty (30) calendar days.

44. Contract Completion

Once the project reaches an accomplishment of ninety-five (95%) of the total contract amount, the Procuring Entity may create an inspectorate team to make preliminary inspection and submit a punch-list to the Contractor in preparation for the final turnover of the project. Said punch-list will contain, among others, the remaining Works, Work deficiencies for necessary corrections, and the specific duration/time to fully complete the project considering the approved remaining contract time. This, however, shall not preclude the claim of the Procuring Entity for liquidated damages.

45. Suspension of Work

- 45.1. The Procuring Entity shall have the authority to suspend the work wholly or partly by written order for such period as may be deemed necessary, due to *force majeure* or any fortuitous events or for failure on the part of the Contractor to correct bad conditions which are unsafe for workers or for the general public, to carry out valid orders given by the Procuring Entity or to perform any provisions of the contract, or due to adjustment of plans to suit field conditions as found necessary during construction. The Contractor shall immediately comply with such order to suspend the work wholly or partly.
- 45.2. The Contractor or its duly authorized representative shall have the right to suspend work operation on any or all projects/activities along the critical path of activities after fifteen (15) calendar days from date of receipt of written notice from the Contractor to the district engineer/regional director/consultant or equivalent official, as the case may be, due to the following:
 - (a) There exist right-of-way problems which prohibit the Contractor from performing work in accordance with the approved construction schedule.
 - (b) Requisite construction plans which must be owner-furnished are not issued to the contractor precluding any work called for by such plans.
 - (c) Peace and order conditions make it extremely dangerous, if not possible, to work. However, this condition must be certified in writing by the Philippine National Police (PNP) station which has responsibility over the affected area and confirmed by the Department of Interior and Local Government (DILG) Regional Director.

(d) There is failure on the part of the Procuring Entity to deliver government-furnished materials and equipment as stipulated in the contract.

(e) Delay in the payment of Contractor's claim for progress billing beyond forty-five (45) calendar days from the time the Contractor's claim has been certified to by the procuring entity's authorized representative that the documents are complete unless there are justifiable reasons thereof which shall be communicated in writing to the Contractor.

45.3. In case of total suspension, or suspension of activities along the critical path, which is not due to any fault of the Contractor, the elapsed time between the effectivity of the order suspending operation and the order to resume work shall be allowed the Contractor by adjusting the contract time accordingly.

46. Payment on Termination

46.1. If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Procuring Entity's Representative shall issue a certificate for the value of the work done and Materials ordered less advance payments received up to the date of the issue of the certificate and less the percentage to apply to the value of the work not completed, as indicated in the SCC. Additional Liquidated Damages shall not apply. If the total amount due to the Procuring Entity exceeds any payment due to the Contractor, the difference shall be a debt payable to the Procuring Entity.

46.2. If the Contract is terminated for the Procuring Entity's convenience or because of a fundamental breach of Contract by the Procuring Entity, the Procuring Entity's Representative shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.

46.3. The net balance due shall be paid or repaid within twenty-eight (28) days from the notice of termination.

46.4. If the Contractor has terminated the Contract under GCC Clauses 17 or 18, the Procuring Entity shall promptly return the Performance Security to the Contractor.

47. Extension of Contract Time

47.1. Should the amount of additional work of any kind or other special circumstances of any kind whatsoever occur such as to fairly entitle the contractor to an extension of contract time, the Procuring Entity shall determine the amount of such extension; provided that the Procuring Entity is not bound to take into account any claim for an extension of time unless the Contractor has, prior to the expiration of the contract time and within thirty (30) calendar days after such work has been commenced or

after the circumstances leading to such claim have arisen, delivered to the Procuring Entity notices in order that it could have investigated them at that time. Failure to provide such notice shall constitute a waiver by the Contractor of any claim. Upon receipt of full and detailed particulars, the Procuring Entity shall examine the facts and extent of the delay and shall extend the contract time completing the contract work when, in the Procuring Entity's opinion, the findings of facts justify an extension.

- 47.2. No extension of contract time shall be granted the Contractor due to (a) ordinary unfavorable weather conditions and (b) inexcusable failure or negligence of Contractor to provide the required equipment, supplies or materials.
- 47.3. Extension of contract time may be granted only when the affected activities fall within the critical path of the PERT/CPM network.
- 47.4. No extension of contract time shall be granted when the reason given to support the request for extension was already considered in the determination of the original contract time during the conduct of detailed engineering and in the preparation of the contract documents as agreed upon by the parties before contract perfection.
- 47.5. Extension of contract time shall be granted for rainy/unworkable days considered unfavorable for the prosecution of the works at the site, based on the actual conditions obtained at the site, in excess of the number of rainy/unworkable days pre-determined by the Procuring Entity in relation to the original contract time during the conduct of detailed engineering and in the preparation of the contract documents as agreed upon by the parties before contract perfection, and/or for equivalent period of delay due to major calamities such as exceptionally destructive typhoons, floods and earthquakes, and epidemics, and for causes such as non-delivery on time of materials, working drawings, or written information to be furnished by the Procuring Entity, non-acquisition of permit to enter private properties or non-execution of deed of sale or donation within the right-of-way resulting in complete paralyzation of construction activities, and other meritorious causes as determined by the Procuring Entity's Representative and approved by the HoPE. Shortage of construction materials, general labor strikes, and peace and order problems that disrupt construction operations through no fault of the Contractor may be considered as additional grounds for extension of contract time provided they are publicly felt and certified by appropriate government agencies such as DTI, DOLE, DILG, and DND, among others. The written consent of bondsmen must be attached to any request of the Contractor for extension of contract time and submitted to the Procuring Entity for consideration and the validity of the Performance Security shall be correspondingly extended.

48. Price Adjustment

Except for extraordinary circumstances as determined by NEDA and approved by the GPPB, no price escalation shall be allowed. Nevertheless, in cases where the cost of the awarded contract is affected by any applicable new laws, ordinances,

regulations, or other acts of the GoP, promulgated after the date of bid opening, a contract price adjustment shall be made or appropriate relief shall be applied on a no loss-no gain basis.

49. Completion

The Contractor shall request the Procuring Entity's Representative to issue a certificate of Completion of the Works, and the Procuring Entity's Representative will do so upon deciding that the work is completed.

50. Taking Over

The Procuring Entity shall take over the Site and the Works within seven (7) days from the date the Procuring Entity's Representative issues a certificate of Completion.

51. Operating and Maintenance Manuals

- 51.1. If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the SCC.
- 51.2. If the Contractor does not supply the Drawings and/or manuals by the dates stated in the SCC, or they do not receive the Procuring Entity's Representative's approval, the Procuring Entity's Representative shall withhold the amount stated in the SCC from payments due to the Contractor.

Section V. Special Conditions of Contract

GCC Clause	
1.17	The Intended Completion Date is 395 calendar days from start date. Inclusive of 73 Holidays and Sundays .
1.22	The Procuring Entity is Provincial Government of Pangasinan
1.23	The Procuring Entity's Representative is: HON. RAMON V. GUICO III Governor Provincial Government of Pangasinan
1.24	The Site is located at Barangay Poblacion, Bugallon, Pangasinan
1.28	The Start Date is ten (10) calendar days upon receipt of the Notice to Proceed (NTP).
1.31	The Work consist of: For the Construction of Provincial Warehouse - Provision of Field Office for the Engineer (Rental Basis); Provision of Furnitures/Fixtures, Equipment & Appliances; Project Billboard / Signboard; Occupational Safety and Health; Mobilization / Demobilization; Recognition Plate / Project Marker; Clearing and Grubbing; Structure Excavation (Common Soil); Embankment from Structure Excavation (Common Soil); Embankment from Borrow (Common Soil); Gravel Fill; Structural Concrete, Class A, 3000psi, 28 days; Reinforcing Steel (Deformed) Grade 40; Formworks and Falseworks; Dampproofing, Polyethylene Sheet; Soil Poisoning; Catch Basin, CHB; Sewer Line Works; Storm Drainage and Downspouts; Septic Tank, CHB; Plumbing Fixtures; Cold Water Lines; Carpentry and Joinery Works; Finishing Hardware; Steel Window; Aluminum Framed Glass Door, Swing Type; Aluminum Glass Windows, Sliding Type; Wooden Doors; Roll Up Door, Steel; Fabricated Metal Roofing Accessories; Pre Painted Metal Sheets, 0.60mm, Rib Type, Long Span; Glazed Tiles and Trims; Unglazed Tiles; Cement Plaster Finish; Painting Works, Masonry/Concrete; Painting Works, Wood; Painting Works, Steel; Aluminum Cladding; CHB Non-Load Bearing (Including Reinforcing Steel), 100mm; CHB Non-Load Bearing (Including Reinforcing Steel), 150mm; Structural Steel, Roof Framing; Metal Structure Accessories; Stainless Steel Railing; Conduits, Boxes and Fittings (Conduit Works/ Conduit Rough-In); Wires and Wiring Devices; Panel Board with Main &

	<p>Branch Breakers; Lighting Fixtures; Fire Extinguisher (4.54kg) (CO2/HCF123 with bracket);</p> <p>For the Construction of Multi-Purpose Drying Pavement -</p> <p>Surplus Common Excavation; Embankment from Borrow; Aggregate Subbase Course; Portland Cement Concrete Pavement (200mm thick); Reinforcing Steel; Structural Concrete; CHB Non-Load Bearing (Including Reinforcing Steel), 100mm; Cement Plaster Finish; Catch Basin, CHB; Storm Drainage and Downspouts;</p>
36.2	Sectional completion is not allowed.
39.1	The Procuring Entity shall give possession of all parts of the Site to the Contractor upon issuance of NTP
40.5	<p>The Contractor shall employ the following Key Personnel: as per BDS 12.1(b)(ii.2)</p> <p>Project Engineer – Licensed Civil/Agricultural Engineer with minimum of five (5) years' experience as a Licensed Civil/Agricultural Engineer and has at least two (2) building construction project handled as Project Engineer with a value of at least twenty percent (20%) of the EPC/ Component and must be related to the nature of Works being procured</p> <p>Materials Engineer – Licensed Civil Engineer duly accredited by DPWH as Materials Engineer I following DPWH D.O. 98, S. of 2016</p>
41.4(c)	No further instructions.
41.7	No further instructions.
42.1	No further instructions.
44	None.
3)	No further instructions.
46.5	Five (5) years.
47	“No additional provision” or if the contractor is a joint venture, “All partners to the joint venture shall be jointly and severally liable to the Procuring Entity”.
18.3(h)(i)	The World Bank’s Anticorruption Guidelines requires Borrowers (including beneficiaries of Bank-financed activity), as well as Bidders, Suppliers, Contractors and their agents (whether declared or not), sub-contractors, sub-consultants, service providers or suppliers and any personnel thereof, observe the highest standard of ethics during the procurement and execution of Bank-financed contracts. Any action to influence the procurement process or contract execution for

undue advantage is improper.

In pursuance of this policy, the Bank:

(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party. Another party refers to a public official acting in relation to the procurement process or contract execution. Public official includes World Bank staff and employees of other organizations taking or reviewing procurement decisions;

(ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation. The term "party" refers to a public official; the terms "benefit" and "obligations" relate to the procurement process or contract execution; and the "act or omission" is intended to influence the procurement process or contract execution;

(iii) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party. The term "party" refers to a participant in the procurement process or contract execution;

(iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party. The term "parties" refers to participants in the procurement process (including public officials) attempting either themselves, or through another person or entity not participating in the procurement or selection process, to simulate competition or establish bid prices at artificial, noncompetitive levels, or are privy to each other's bid prices or other conditions;

(v) "obstructive practice" is

(aa) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing

or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or

(bb) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph (e) below.

(b) will reject a proposal for award if it determines that the Bidder recommended for award, or any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract in question

(c) will declare mis-procurement and cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement or the implementation of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

(d) will sanction a firm or an individual, at any time, in accordance with the prevailing Bank's sanctions procedures, including by publicly declaring such firm or individual ineligible, either indefinitely or for a stated period of time: (i) to be awarded a Bank-financed contract; and (ii) to be a nominated sub-contractor, consultant, manufacturer or supplier, or service provider (different names are used depending on the particular bidding document) is one which has either been (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower. A firm or individual may be declared ineligible to be awarded a Bank financed contract upon (i) completion of the Bank's sanctions proceedings as per its sanctions procedures, including, inter alia, cross debarment as agreed with other International Financial Institutions, including Multilateral Development Banks, and through the application of the World Bank Group corporate administrative procurement sanctions procedures for fraud and corruption; and (ii) as a result of temporary suspension or early temporary suspension in connection with an ongoing sanctions proceeding. See footnote 14 and paragraph 8 of Appendix 1 of the World Bank Guidelines for Procurement of Goods, Works, and Non-

	<p>Consulting Services;</p> <p>(e) will require that a clause be included in bidding documents and in contracts financed by a Bank loan or grant, requiring bidders, suppliers and contractors, and their sub-contractors, agents, personnel, consultants, service providers, or suppliers to permit Bank to inspect all accounts and records and other documents relating to the submission of bids and contract performance, and to have them audited by auditors appointed by Bank.</p>
0	<p>The Arbiter is:</p> <p>Construction Industry Arbitration Commission, Manila</p>
63.1	No dayworks are applicable to the contract.
65.1	The Contractor shall submit the Program of Work to the Procuring Entity's Representative within five (5) calendar days of delivery of the Notice of Award.
65.3	<p>The period between Program of Work updates is 30 days.</p> <p>The amount to be withheld for late submission of an updated Program of Work is 1% of the progress billing.</p>
34.1(a)	<p>Upon instruction by the Procuring Entity, the contractor will arrange and shall shoulder cost for the materials and field testing.</p> <p>The materials and field test shall be conducted by DPWH or its accredited testing laboratories.</p> <p>For field density test (FDT), it shall be carried out through the following options:</p> <ol style="list-style-type: none"> 1. By DPWH or its accredited testing laboratories as default; 2. By independent accredited Materials Engineer located within the province; 3. By an accredited Materials Engineer of the Provincial Government; 4. By colleges and universities with testing laboratories; <p>The conditions to effect the other options (2, 3 & 4) mentioned above are described below. Whoever conducts the test must prepare and attest to the veracity of the test report. The contracting parties are the signatory witnesses in the conduct of the FDTs. The FDTs shall be closely witnessed by the contractor, and PPMIU and Regional Project Coordination Office (RPCO) or Project Support Office (PSO).</p> <p>Options 2, 3 and 4 maybe availed of by the contracting parties in the conduct of FDTs if DPWH facilities will not be available on a timely basis.</p>

	<p>1. The options to be adopted by the contracting parties must be communicated properly to the DPWH regional office where the LGU is covered. The response of the DPWH would trigger the application of the three options. The concurrence of the Project will be based on the evidence of impending or actual delays in the conduct of FDTs through Option 1;</p> <p>2. The engagement of accredited Materials Engineers for Options 2 and 3 will follow the limits of authority for ME1 and ME 2 by the Bureau of Research and Standards (BRS) of the Department of Public Works and Highways. The nomination of which will come from the LGU and to be concurred by the Regional Project Coordination Office. However, the test apparatuses to be utilized by the accredited Materials Engineer may either come from the LGU or the contractor. The test apparatuses shall be re-calibrated and tested in the presence of the RPCO or PSO engineers prior to actual use.</p> <p>The selection of colleges and universities to conduct the FDT must be supported with proof that indeed the laboratory technicians have conducted the same test within the last three years. Records of FDT reports taken from similar projects filed by the laboratory administrator will suffice as proof of capacity to engage the said college or university.</p>
34.3	The Funding Source is the World Bank.
39.1	The amount of the advance payment is 15% of the Contract Price and to be recouped every progress billing.
39.2	Except for surety bond
40.1	No further instructions.
40.4	Progress payment shall be made monthly as per work accomplished.
41.5	The Contractor is obliged to submit to the Procuring Entity's Representatives the geotagged photos taken before, during and after construction of each item of work especially the embedded items, at the time that the claim for payment is made and the Statement of Work Accomplished (SWA) is executed.
51.1	The date by which "as built" drawings are required is 15-30 of days from Completion Date as defined under GCC 1.1.3.
51.2	The amount to be withheld for failing to produce "as built" drawings and/or operating and maintenance manuals by the date required is 1% of the final contract amount.

Section VI. Specifications

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I. CONSTRUCTION OF PROVINCIAL WAREHOUSE

PART A - FACILITIES FOR THE ENGINEER

A.1 Requirements

A.1.1 Field Office [and Laboratory Building] for the Engineer

- (1) The Contractor shall, for the entire period during which the construction work is being undertaken, provide an equipped and furnished Field Office for the Engineer of at least 63.00 square meters of useable floor area (7mx9m) with conference room and separate comfort room for male and female. The minimum roofing is of galvanized iron sheets and plywood ceiling and walling. A list of the equipment, furniture, instruments, apparatus, fixtures, fittings and other items to be provided by the Contractor for the Field Office is shown in 'Attachment A' to these Technical Specifications.
- (2) The Contractor shall also, for the entire period during which testing of materials and workmanship is required, provide an equipped and furnished Laboratory Field Office of at least 20.00 square meters of useable floor area, and which shall be complete with its own sanitary facilities if not attached to the Field Office. The minimum roofing is of galvanized iron sheets and plywood ceiling and walling. A list of the equipment, furniture, instruments, apparatus, fixtures, fittings and other items to be provided by the Contractor for the Laboratory Field Office is shown in 'Attachment B' to these Technical Specifications.
- (3) The Field Office and Laboratory Field Office shall be located within close proximity to the Site and usually within the batching plant compound. In a location approved of by the Engineer and shall be made available for the Engineer's occupation before any construction work commences. Such facilities may, entirely at the discretion of the Contractor, be in rented accommodation or be purpose built, provided always that the facility is of a standard acceptable to the Engineer. Shaded areas shall be provided at all such facilities for the Engineer's car parking, with a suitable self-draining gravel base. When the Engineer decides that temporary facilities built on the Site or Government-provided land are no longer required, the Contractor shall remove all evidence of the temporary work and reinstate the ground to its original state, unless the Engineer directs otherwise.
- (4) It is the Contractor's responsibility to make all necessary arrangements to provide the Field Office and Laboratory Field Office and to provide all necessary equipment, furniture, utilities and security staff to attend thereto, including payment thereof at his own cost. The Employer and the Engineer shall be free from any liability in connection with the use of such facilities.
- (5) The Contractor shall provide an adequate supply of all necessary stationery, printing papers, laboratory materials, testing materials and any other

consumable items for the Engineer's Field Office and Laboratory Field Office as required by and to the satisfaction of the Engineer.

- (6) All equipment, furniture, instruments, apparatus, fixtures, fittings and other items to be provided for the use of the Engineer shall be new and shall conform to the specifications as to kinds, grades, types and sizes, all to the satisfaction of the Engineer. When the Engineer decides that such items are no longer required, they shall be handed back to the Contractor, who shall then remove them from the Site.
- (7) Electrical power for the Field Office and Laboratory Field Office shall be continuously available and adequate for all the equipment, apparatus and lighting needs. Similarly, a continuous water supply and other provisions necessary for the efficient operation of all the facilities shall be made available, including the provision of potable water where the facilities are manned on a regular or continuous basis.
- (8) The Contractor shall provide an adequate complement of qualified and competent laboratory staff or technicians to carry out all the materials quality control and all the tests required by the Engineer. The persons so appointed shall work full time and shall be responsible to the Engineer for all the laboratory work required to be carried out.
- (9) The Contractor shall make available, for the exclusive use of the Engineer and staff, a single direct telephone line service and a two-way radio communication service for the entire period during which construction activities take place. If the Laboratory Field Office is adjacent to the Field Office, then an extension telephone line between the Laboratory Field Office and the Field Office shall be provided, but otherwise an additional telephone service to the Laboratory Field Office shall be provided or a cellphone."

A.1.2 Transportation for the Engineer

The Contractor shall provide, not later than ten (10) calendar days after the issuance of the notice to proceed, one (1) 4 x 4 Crew cab Diesel Pick-up, such vehicle shall be mechanically and electrically sound, with no visible defects in the bodywork, and shall be in good running condition for the exclusive use of the Engineers.

The Contractor shall provide substitute transportation acceptable to the Engineer if there is a delay in providing the transportation specified in the Contract and during any period when the specified transportation is taken out for service, maintenance, repair or any other reason.

A.1.3 Assistance to the Engineer

The Contractor shall provide such equipment, instruments and apparatus as determined by the Engineer from time to time, based on the specific activities to be undertaken."

A.2 Measurement and Payment

A.2.1 Measurement

- (1) The provision of the Field Office and the Laboratory Field Office (which shall be deemed to be inclusive of all necessary equipment, furniture, appliances and survey equipment for the Engineer) shall be stated in an item and measured in months.

The payment for the Field Office and Laboratory Field Office shall be deemed to include all rental fees or supply, erection and subsequent removal of temporary buildings (as appropriate), and for the provision of all utilities, including electricity, telephone and water bills, and all equipment, furniture, instruments, apparatus, fixtures, fittings and other items to be provided for the use of the Engineer. Maintenance of the Engineer’s Field Office and the Laboratory Building (including all furniture, equipment, etc.) shall also be considered incidental to and covered within the pay item for the provision of the facilities. No separate payment shall be made in respect of consumables.

- (1) The provision of fixtures/ furniture and appliances for the Engineer’s use shall be measured in lumpsum.

The quantities for this provision shall be for the time the Engineer is supplied with such prior to their finally becoming the property of the Government or until the end of the contract.

A.2.2 Payment

Payment for the Engineer’s Field Office and Laboratory Field Office shall be due and payable for the entire period for which the Engineer occupies the facilities.

Payment for the provision of furniture/ fixtures, equipment and appliances for the Engineer’s use shall be due and payable for the entire period for which the Engineer makes use of such provision.

Payment for part of a month shall be made on a proportional basis, calculated by dividing the monthly rate by 30 days and multiplying by the number of calendar days for which use of the facility was provided.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
A.1.1 (8)	Provision of Field Office for the Engineer (Rental Basis)	Months
A.1.1 (11)	Provision of Furniture/Fixtures, Equipment & Appliances	Lump Sum

ATTACHMENT A

List of Items to be provided by the Contractor for the Field Office

- | | | | |
|----|------|------|--|
| 1. | 1.00 | Set | - Desktop Computer with Monitor and Complete Accessories |
| | | | Specifications:
Graphics Card: Nvidia GeForce RTX 2070
Graphics Card Memory: at least 4Gb
System Memory (RAM): at least 16Gb or more
Hard drive: SATA3 SSD |
| | | | Monitor Specifications:
24" Monitor; 144Hz Full HD (1920 x 1080) |
| 2. | 2.00 | Sets | - Geotagging device |
| 3. | 1.00 | pc. | - Outdoor Projector with accessories |
| 4. | 2.00 | Sets | - Lockable 3 layers Steel Cabinet |
| 5. | 30.0 | Pcs | - Monoblock Chairs |
| 6. | 5.00 | Pc | - Monoblock Tables |
| 7. | 2.00 | pcs. | - White Board with stand (4'x8') |
| 8. | 2.00 | Pcs | - White Board (2"x3") |
| 9. | 1.00 | Set | - A3 Colored Printer w/ Scanner |
| 10 | 1.00 | Set | - Hot & Cold Water Dispenser with Tank |
| . | | | |
| 11 | 1 | unit | - Air Condition Unit 2hp, Split Type, Wall Mounted
(Standard Inverter: Digital Inverter Boost, Fast Cooling Mode, Triple Protector Plus, Durafin™, Quiet Mode, Single User Mode, R32 Refrigerant) |
| . | | | |
| 12 | 1 | l.s. | - Office Supplies and Consumables (ballpens, eraser, pentel pen, 1-rim bond paper A4, Letter, Long, and A3 to be supplied monthly up to entire duration of the project) |
| . | | | |

ATTACHMENT B

List of Items to be Provided by the Contractor for the Laboratory

1. 3 sets of 3- Unit cylindrical concrete mold (DPWH Standard)
2. 3 sets of 3- Unit concrete mold for Flexure Test (DPWH Standard)
3. 2 m x 1.5m x 0.50m Concrete Water Basin
4. Slump Test Mold
5. FDT Apparatus
6. Survey Instrument

PART B. OTHER GENERAL REQUIREMENTS

B.5 - PROJECT BILLBOARD / SIGNBOARD

Description

This Item shall consist of furnishing and installing project billboard in accordance with this Specification and details shown on the Plans, or as required by the Engineer.

The project billboard shall comply in all respects with the "COA Circular No. 2013-004" dated January 30, 2013. The information and publicity on projects of Government Agencies including Foreign Funded Projects are being guided by this Circular.

The project billboard will be erected as soon as the award has been made. It will be located at the beginning and at the end of the subproject throughout the project duration.

The size, materials and design to be used for the project signboard will specifically adhere to the General Guidelines No. 2.2.3 of the Circular while the content of the information shall conform to the General Guidelines No. 2.2.6 and the sample format shown in "Annex A" of the Circular.

Material Requirements

Tarpaulin

The design and format of the tarpaulin shall have the following specifications:

White	Color	:	
ft. x 8 ft.	Size	:	8
dpi	Resolution	:	70
Helvetica	Font	:	
	Font Size of Main Information	:	3 inches
	Font Size of Sub-Information	:	1 inch
Black	Font Color	:	
Rigid wood frame with post; and	Suitable Frame	:	

Posting: Outside display at the project location after award has been made.

**ANNEX 14
PROJECT BILLBOARD**

Name of Agency Business Address		PLGU LOGO					
Project: _____	Cost: _____						
Location: _____	Fund Source(s): LP, GOP, LGU						
Implementing Agency(ies): _____							
Development Partner(s): _____							
Contractor/Supplier: _____							
Brief Description of Project: _____							
Project Details:							
	Project Date		Project Status		Remarks		
Duration	Started	Target Date of Completion	Percentage of Completion	As of (Date)	Cost Incurred to Date	Date Completed	
For particulars or complaints about this project, please contact the Regional Office or Cluster which has audit jurisdiction on this project.							
COA Regional Office No./Cluster: _____							
Address: _____							
Contact No: _____ or Text COA Citizen's Desk at 0915-5391957							
World Bank Anti-Corruption Hotline: 105-11-1-800-831-0463							

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.) subproject's title, location, cost and description, v.) project details to include duration, date started, target date of completion and project status, and vi.) COA and WB 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 marine plywood where the tarpaulin will be attached.

Concrete Foundation Blocks

The concrete for the foundation blocks shall be Class A in accordance with Item 405, Structural Concrete and shall be of the size shown on the Plans.

Construction Requirements

Excavation and Backfilling

Holes shall be excavated to the required depth to the bottom of the concrete foundation as shown on the Plans.

The space around the post shall be backfilled to the ground line with approved material in layers not exceeding 100 mm and each layer shall be moistened and thoroughly compacted. Surplus excavated material shall be disposed of by the Contractor as directed by the Engineer.

Erection of Posts

The posts shall be erected vertically in position inside the formwork of the foundation block prior to the placing of the concrete and shall be adequately supported by bracing to prevent movement of the post during the placing and setting of concrete. The posts shall be located at the positions shown on the Plans.

Tarpaulin Installation

Tarpaulin shall be installed in accordance with the details shown on the Plans. The frame should be covered with the marine plywood before the tarpaulin is 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, for excavation, backfilling and construction of foundation blocks, and all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
B.5	Project Billboard/Signboard	Each

B.7 - OCCUPATIONAL SAFETY AND HEALTH

The following shall be the minimum requirements for the approval of a Construction Safety and Health Program (CSHP) under the Department of Labor and Employment (DOLE) Department Order No. 13, Series 1998.

1.1 Company Safety and Health Policy. The following shall apply:

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:

- a. Registration (Rule 1020 and DO 18---02)
- b. Report of Safety Committee Organization (Rule 1040)
- c. Notification of Accidents and Occupational Illnesses (Rule 1050)
- d. Annual Work Accident/Illness Exposure Data Report (Rule 1050)
- e. Application for installation of mechanical/electrical equipment for construction of structure for industrial use (Rule 1070 and 1160)
- f. Annual Medical Report (Rule 1960)

1.2 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.

1.3 Composition of Construction Safety and Health Committee.

A structure and membership of the construction safety and health committee which shall be consistent with the minimum requirements of Section 11 of D.O. 13, series of 1998.

1.4 Safety and Health Personnel. The following shall apply:

- a. All appointed first---aiders shall be duly trained and certified by the Philippine National Red Cross and shall possess a Certificate of Basic First Aid Training Course (Standard) with a valid PNRC ID Card.
- b. All appointed Safety Officers shall have completed the 40---hour BWC prescribed safety and health course as required by Rule 1030 of the OSHS, as amended by D.O. 16. All full---time safety personnel shall be accredited by the BWC pursuant to D.O. 16.
- c. All physicians and nurses assigned at the project site shall have completed the Bureau prescribed course on occupational safety and health course, pursuant to Rule 1960 of the OSHS.

1.5 Specific duties and responsibilities of the Safety Officer. The following shall apply:

- a. Specific duties and responsibilities shall comply with the outlined duties and responsibilities in Rule 1047 of the OSHS; and
- b. Procedure on the required performance of the assigned duties and responsibilities of safety officers in the construction site.

1.6 Applicable In---plant Safety and Health Promotion and Continuing Information Dissemination. The following shall apply:

- a. Detailed information dissemination or advisories to the new employees prior to on---site assignment, e.g. conduct of safety orientation, company's health and safety policies, hazards related to the job safety measures, safe work procedures.

- b. Detailed programs on continuing education such as trainings and seminars, if any, that shall be given to employees, e.g. BOSH, refresher course, first aid training, refresher course toolbox meeting, construction safety training for site safety officers, 80---hour advance safety course prescribe.
- c. Arrangements for conveying information on safety and health IEC materials e.g. Posters/komiks/flyers, safety signages, handbooks/manuals, bulletin boards
- d. Arrangements for setting up sub---committees on safety and health, where necessary.
- e. Schedule of safety related activities, e.g. toolbox meeting, health and safety committee meeting

1.7 Accident and incident investigation, recording, and reporting. The following shall apply:

- a. All accidents or incidences shall be investigated and recorded.
- b. All work-related accidents resulting to disabling injuries and dangerous occurrences as defined in OSH Standards (Rule 1050) shall be reported.
- c. Responsible or duly authorized officer for accident or incident investigation recording and reporting who are either the employer/owner/project manager/safety officer
- d. Accident Report shall contain the minimum information as required in DOLE/BWC/OHSD/IP---6.
- e. Shall notify the appropriate DOLE Regional within 24 hours in case of fatal accidents. An accident investigation shall be conducted by the Regional Office within forty eight (48) hours after receipt of initial report of the employer.

1.8 Provisions for the protection of the general public within the vicinity of the company premises during construction and demolition. The following shall apply:

- a. Measures in order to ensure the safety of the general public shall be pursuant to Rule 11 of the National Building Code---Implementing Rules and Regulations: Protection of Pedestrians During Construction or Demolition
- b. Appropriate provisions and rules of OSHS
 - Rule 1412.09: Protection of the Public
 - Rule 1412.12: Protection against collapse of Structure
 - Rule 1412.16: Traffic Control
 - Rule 1413: Excavation
 - Rule 1417: Demolition
 - Rule 1060: Premises of Establishments
 - D.O. 13, Section 9: Construction Safety Signs
 - Other relevant provisions of OSHS.

1.9 General safety within construction premises. The following shall apply:

The provisions for danger signs, barricades, and safety instructions for workers, employees, public, and visitors such as, housekeeping; walkway surfaces; means of access i.e. stairs, ramps, floor openings, elevated walkways, runways and platforms; and, light.

1.10 Environmental Control (Rule 1070 of the Standards). The following shall apply:

- a. Monitoring and control of hazardous noise, vibration and air---borne contaminants such as gases, fumes, mists and vapors.
- b. Provisions to comply with minimum requirements for lighting, ventilation and air movement.

1.11 Guarding of hazardous machinery (Rule 1200 of the Standards). The following shall apply:

- a. Provisions for installation/design of built---in machine guards.
- b. Provisions for built---in safety in case of machine failure.
- c. Provisions for guarding of exposed walkways, access---ways, working platforms.

1.12 Provisions for and use of Personal Protective Equipment (PPE) --- (Rule 1080 of the Standards). The following shall apply:

- a. Appropriate types and duly tested PPEs to be issued to workers after the required training on their use.
- b. Provisions for maintenance, inspection and replacement of PPEs.
- c. In all cases the basic PPE commonly required for all types of construction projects are hard hats, safety shoes and working gloves. Other PPEs shall be required depending on the type of work and hazards.

1.13 Handling of Hazardous Substances - (Rule 1090 of the Standards). The following shall apply:

Provision for identification, safe handling, storage, transport and disposal of hazardous substances and emergency procedure in accordance with Material Safety Data Sheet (MSDS) in cases of accidents.

1.14 General materials handling and storage procedures. - (Rule 1150 of the Standards). The following shall apply:

- Safe use of mechanical materials handling equipment
- Secured and safe storage facilities
- Regular housekeeping as necessary so as not to constitute and/orresent hazards
- Clearly marked clearance limits
- Proper area guarding of storage facilities

1.15 Installation, use and dismantling of hoist and elevators.---Rule 1415.10 Testing and Examination of Lifting Appliance, Rule 1220 Elevators and Related Equipment. The following shall apply:

- a. Provisions to ensure safe installation, use and dismantling of hoist and elevator;
- b. Periodic inspection of hoists and elevators.

1.16 Testing and inspection of electrical and mechanical facilities and equipment. The following Rules of the Occupational Safety and Health Standards shall apply: **Rule Coverage**

- a. Rule 1160 --- Boiler
- b. Rule 1170 --- Unfired Pressure Vessels

- c. Rule 1210 --- Electrical Safety
- d. Rule 1220 --- Elevators and Related Equipment
- e. Rule 1410 --- Construction Safety
- f. Rule 1415.10 – Training and Examination of Lifting Appliance

1.17 Workers skills and certification. The following shall apply:

- a. Provisions to ensure that workers are qualified to perform the work safely.
- b. Provisions to ensure that only qualified operators are authorized to use and operate electrical and mechanical equipment.

1.18 Provisions for emergency transportation facilities for workers. The following shall apply:

Rule 1963.02 of the Occupational Safety and Health Standards – Emergency Medical and Dental Services

1.19 Fire Protection Facilities and Equipment. The following rule shall apply:

- a. Fire protection facilities and equipment as required under Rule 1940 of the OSHS
- b. Proposed structure and membership of fire brigade
- c. Provision for training on emergency preparedness

1.20 First aid and health care medicines, equipment and facilities.

- a. Identification of the proposed first aid and health care facilities that the employer shall provide satisfying the minimum requirements of OSHS.
- b. Identification of the medical and health supplies, such as medicines and equipment to be provided.
- c. In all cases, the provision of first aid medicines and emergency treatment shall be mandatory.
- d. In the absence of the required on site health care facilities, the employer shall attach a copy of a written contract with a recognized emergency health provider as required under the OSHS.

1.21 Workers Welfare Facilities. The following shall apply:

- a. Provisions for toilet and sanitary facilities
- b. Proposed bathing, washing, facilities
- c. Proposed facilities for supplying food and eating meals
- d. Proposed facilities for supplying potable water for drinking and for washing
- e. Proposed facilities for locker rooms, storing and changing of clothes for workers.

1.22 Proposed Hours of Work and Rest and Rest Breaks. The following shall apply:

- a. Work schedules, working hours, shifting schedules
- b. Frequency and length of meals and breaks
- c. Schedule of rest periods

1.23 Waste Disposal. The following shall apply:

- a. Proposed method of clearing and disposal of waste.

- b. Provisions for permits and clearance where require in disposal of hazardous wastes.

1.24 Disaster and Emergency Preparedness Contingency

1.25 Safety Program . The Safety Programs shall contain the following:

- a. Standard work procedures.
- b. Job hazard analysis for the following activities as applicable to the project.
- c. Other hazardous work, not outline herein but will be performed during project execution must also be included.

The activities may consist of any number of the following, depending on the nature of the project, vis---à---vis exposure to hazards:

- a. Site Clearing
- b. Excavations
- c. Erection and dismantling of scaffolds and other temporary working platforms
- d. Temporary electrical connections/installations
- e. Use of scaffolds and other temporary working platforms
- f. Working at unprotected elevated working platforms or surfaces
- g. Work over water
- h. Use of power tools and equipment
- i. Gas and electric welding and cutting operations
- j. Working in confined spaces
- k. Use of internal combustion engines
- l. Handling hazardous and/or toxic chemical substances
- m. Use of hand tools
- n. Working with pressurized equipment
- o. Working in hot or cold environments
- p. Handling, storage, usage and disposal of explosives
- q. Use of mechanized lifting appliances for movement of materials
- r. Use of construction heavy equipment
- s. Demolition

The hazard analysis shall contain the following:

- a. Identification of possible hazards for a particular activity.
- b. Identification of any company permits or clearances needed prior to the performance of the activity together with the name of person/s who is authorized to issue such permit or clearance.
- c. Identification of the proposed improvement in work standard procedures that shall be followed during implementation of a particular activity.
- d. Company inspection procedures to ensure safety during the execution of a particular activity.

- e. Identification of emergency procedures in case of accidents or any untoward incident while performing a particular activity.

1.26 Company Penalties/Sanctions for Violation/s of the Provision/s of Safety and Health Program – The appropriate penalties or sanctions for violation of company rules and regulations or those stipulated in the CHSP and the observance of due process.

2. Personal Protective Equipment by Type of Project

2.1 General Building Construction Project (GBC). The following classifications shall apply:

Classification: Air Navigation Facilities, Power Transmission & Distribution, Building and Housing, Communication facilities, Sewerage, water treatment plants and Site/Land development.

2.2 General Engineering Construction Project. The following classifications shall apply:

Classifications: Roads and Airports (Horizontal structure), bridges, irrigation system, flood control and drainages, dams, tunneling, ports and harbor, water supply

2.3 Specialty Construction Project. The following classifications shall apply:

Classifications: Electrical work, mechanical work, plumbing and sanitary work, air conditioning or refrigeration, water proofing work, painting work, communication facilities, foundation or piling work, structural steel work, concrete pre---cast, elevator or escalator, well drilling work, navigational equipment and instrument installation, electromechanical work, metal roofing and siding installation, structural demolition and landscaping.

3. Safety Personnel and Skilled Worker. The following shall apply: **3.1 Minimum Required Safety Personnel.** The following shall apply:

- a. The General Constructor shall provide for a full-time officer, who shall be assigned as the general construction safety and health officer to oversee full time the overall management of the Construction Safety and Health Program.
- b. The General Constructor shall provide for additional Construction Safety and Health Officer/s in accordance with the requirements for Safety Officer of D.O. 16, s. 2001, depending of the total number of personnel assigned to the construction project site.
- c. The General Constructor shall provide for one (1) Construction Safety and Health Officer for every ten (10) units of heavy equipment assigned to the project site.
- d. Each construction contractors/subcontractors shall provide for the required number of safety officers in accordance with the requirements of D.O. 16 series 2001.

3.2 Qualification and Training of Safety and Health Personnel and Skilled Workers.

The following shall apply:

- a. Training of OSH Personnel shall be pursuant to D.O. 16 series of 2001 and its Procedural Guidelines.
- b. Worker Skills Certification for the critical operations/occupations shall be pursuant to D.O. 13 and D.O. 19 as well as the TESDA requirements on worker competency.

4. Construction Heavy Equipment. The following shall apply:

4.1 Accreditation of Organization for Testing of Construction Heavy Equipment shall be pursuant to D.O. No. 16 and its Implementing Guidelines and Procedural Guidelines on Accreditation and Performance Audit of Testing Organization for Construction Heavy Equipment.

4.2 Conduct of Inspection and Test of Construction Heavy Equipment shall be pursuant to Sec. 10 of D.O. No. 13 and its Procedural Guidelines. The following shall apply:

- a. Procedural Guidelines on Accreditation and Performance Audit of Testing Organization for Construction Heavy Equipment
- b. Standard Checklist for Testing and Inspection of Construction Heavy Equipment.
- c. Inspection Procedures for DOLE Inspectors

4.3 TESDA Certification Requirements for Operators. Certification for Operators shall be in accordance with the requirements of TESDA on worker competency.

4.4 Monitoring and Evaluation of CHE Test/Inspection conducted shall be pursuant to the Procedural Guidelines on Accreditation and Performance Audit of Testing Organization for Construction Heavy Equipment.

5. Signages and Barricades. The following shall apply:

Construction Safety Signages shall be provided as a precaution and to advise the workers and the general public of the hazards existing in the worksite.

5.1 Signage Procedures: The signages shall be:

- a. Posted in prominent positions and at strategic locations.
- b. As far as practicable, be in the language understandable to most of the workers employed in the site.
- c. For non-raised floor areas, the attached yellow CAUTION sign shall be used when using yellow CAUTION tape.
- d. For non-raised floor areas, the attached red DANGER sign shall be used when using the red DANGER tape.
- e. Placed in designated areas at four (4) feet from ground level, if there are no other more practicable height placement.
- f. Regularly inspected and maintained in good condition to achieve its purpose. Signages that are damaged; illegible or that no longer apply as to purpose, site or language, shall be removed or be replaced by the safety officer when needed.
- g. Removed after the hazard is completely eliminated. If upon work completion the hazard is still present, the signage shall remain in place.
- h. Designed and constructed following the Overall Dimensions of Safety Signs Formula as required by the OSHS
- i. Specific with the type of hazard and should indicate the name of the contaminant/ substance involved (for chemical hazards), and the type of PPE or respiratory equipment to be worn.

5.2 Posting of Signages shall include, but not limited to the following places:

- a. Areas where there are risks of falling objects.

- b. Areas where there are risks of falling, slipping, tripping among workers and the public
- c. Prior to entry in project sites, locations and its perimeter.
- d. Where there is mandatory requirement on the usage of PPEs.
- e. Areas where explosives and flammable substances are used or stored
- f. Approaches to working areas where danger from toxic or irritant airborne contaminants/ substances may exist,
- g. All places where contact with or proximity to electrical facility/equipment can cause danger
- h. All places where workers may come in contact with dangerous moving parts of machinery or equipment
- i. Locations of fire alarms and fire---fighting equipment
- j. Locations for instructions on the proper usage of specific construction equipment, tools.

5.3 Barricading Procedures: The following shall apply:

- a. The contractor shall provide all necessary barricades, safety tapes, safety cones or safety lines as required in isolating or protecting an unsafe work area from other workers, pedestrians or vehicular traffic.
- b. Barricades shall completely enclose the hazardous area and effectively limit unintentional or casual entry.
- c. Barricades shall be three (3) feet vertical height from the ground, when no other more practical height specification is available.
- d. Barricades shall be maintained in good condition to achieve its purpose.
- e. Barricades that are damaged; faded or that no longer apply as to purpose, site or meaning, shall be removed or shall be replaced by the safety officer.
- f. Barricade tape shall not be used on the floor as this presents a slipping hazard of its own.
- g. In addition to using the proper warning tape, the contractor shall use the appropriate safety signage when barricading an area.
- h. All barricades shall be removed after the hazard is completely eliminated.

I. Upon work completion, if the hazard is still present, the barricade shall remain in place.

5.4 Installation of barricades shall include, but not limited to the following worksites conditions:

- a. hazardous areas
- b. trip hazard
- c. robotic movement
- d. energized electrical works
- e. overhead suspended load test
- f. critical high pressure test

- g. chemical introduction
- h. fall exposure
- i. Emergency Response Zone
- j. Unsafe condition zone
- k. Danger zone
- l. Confined and enclosed space

6. Construction Safety and Health Committee. The following shall apply:

6.1 Composition

- a. Project Manager or his representative as chairperson ex---officio
- b. General Construction Safety and Health Officer
- c. Construction Safety and Health Officers
- d. Safety representatives (SAFETY OFFICER) from each subcontractor.

If DOLE's minimum requirements based on the number of workers of the contractor requires only a part time safety officer, the safety officer need not be an accredited safety practitioner or consultant.

- e. Doctors, nurses and other health personnel pursuant to the requirements stated in Rule 1042 of the OSHS
- f. Workers' representatives

If there are no contractor's sub---contractors or the constructor is a subcontractor, the safety and health committee shall be in accordance with the requirements of Rule 1040 of the Occupational Safety and Health Standards.

6.2 Duties and responsibilities

- a. The Project Manager or his representative shall act as the Chairperson of the committee.
- b. The committee shall conduct safety meetings at least once a month.
- c. The persons constituting the Safety and Health Committee shall, as far as practicable, be at the construction site whenever construction work is being undertaken.
- d. The committee shall continually plan and develop accident prevention programs.
- e. The committee shall review reports of inspection, accident investigation and monitor implementation of the safety program.
- f. The committee shall provide necessary assistance to government authorities authorized to conduct inspection in the proper conduct of their activities
- g. The committee shall initiate and supervise safety trainings for its employees
- h. The committee shall conduct safety inspection at least once a month, and shall conduct investigation of work accidents and shall submit a regular report to DOLE.
- i. The committee shall initiate and supervise the conduct of daily brief safety meetings or toolbox meetings.

- j. The committee shall prepare and submit to DOLE, reports on said committee meetings.
- k. The committee shall develop a disaster contingency plan and organize such emergency service units as may be necessary to handle disaster situations.

7. Construction Safety and Health Reports. The following shall apply:

7.1 The Construction Safety and Health Report shall include:

- a. Monthly summary of all safety and health committee meetings
- b. Summary of all accident investigations /reports
- c. Corrective/Preventive measures/action for each hazard
- d. Periodic hazards assessment with corresponding remedial measures for new hazards
- e. Safety promotions and trainings conducted/attended

7.2 Submission of Reports. The following shall apply:

- a. All general constructors shall be required to submit a monthly construction safety and health report to the BWC copy furnished the DOLE Regional Office concerned.
- b. In case of any dangerous occurrence or major accident resulting in death or permanent total disability, the concerned employer shall notify the appropriate DOLE Regional Office within twenty---four (24) hours from occurrence.
- c. After the conduct of investigation by the concerned construction safety and health officer, the employer shall report all disabling injuries to the DOLE Regional Office on or before the 20th of the month following the date of occurrence of accident using the DOLE/BWC/HSD---IP---6 form.

8. Cost of Construction Safety and Health Program. The following shall apply:

8.1 The total cost of implementing a Construction Safety and Health Program shall be mandatory and shall be made an integral part of the project's construction cost as a separate pay item, duly quantified and reflected in the Project's Tender Documents and likewise reflected in the Project's Construction Contract Documents.

8.2 The cost of the following PPEs: helmet, eye goggles, safety shoes, working gloves, rain coats, dust mask, ear muffs, rubber boots, and other similar PPE's shall be indicated/enumerated per cost, per worker, foreman, leadman, jackhammer operator, carpenter, electrician, mason, steelman, painter, mechanic, welder, plumber, heavy equipment operator, physician/inspector, and other such personnel.

8.3 The PPEs shall be sufficient in number for all workers particularly where simultaneous construction activities/operations in different areas are being undertaken.

8.4 The cost of the minimum required inventory of medicines, supplies and equipment as indicated in "Attachment C" of the OHS Standards shall be included.

8.5 The safety personnel manpower cost salaries/wages, benefits shall be included.

8.6 Cost of safety promotions/activities, training conducted and salaries of safety and health personnel, medical personnel employed or engaged by constructor.

9. Safety and Health Information. The following shall apply:

9.1 Workers shall be adequately and suitably:

- a. Informed of potential safety and health hazards to which they may be exposed at their workplace.
- b. Instructed and trained on the measures available for the prevention, control and protection against those hazards.

9.2 Every worker shall receive instruction and training regarding general safety and health common to construction sites which shall include, but not limited to the following:

- a. The basic rights and duties of the workers at the construction site.
- b. The means of access and egress, both during normal work and in emergency situations.
- c. The measures for good housekeeping.
- d. The location and proper use of welfare and first---aid facilities.
- e. The proper care and use of the items or personal protective equipment and protective clothing provided the workers.
- f. The general measures for personal hygiene and health protection.
- g. The fire precautions to be taken.
- h. The action to be taken in case of any emergency.
- i. The requirements of relevant health and safety rules and regulations.

9.3 The instruction, training and information materials provided shall be given in a language or dialect understood by the worker.

Written, oral, visual and participative approaches shall be used to ensure that the worker has understood and assimilated the information.

9.4 Each supervisor or any person e.g. foreman, lead man, gangboss, and other similar personnel shall conduct daily tool box or similar meetings prior to the start of the operations for the day to discuss with the workers and to anticipate safety and health problems related.

9.5 No person shall be deployed in a construction site unless he has undergone a safety and health awareness seminar conducted by safety professionals or accredited organizations or other institutions recognized by DOLE.

9.6 Specialized instruction and training shall be provided to the following:

- a. Drivers and operators of lifting appliances, transport, earth---moving and materials--- handling equipment and machinery; or any equipment of specialized or dangerous nature.
- b. Workers engaged in the erection or dismantling of scaffolds.
- c. Workers engaged in excavations at least one (1) meter deep or deep enough to cause danger, shafts, earthworks, underground works or tunnels.
- d. Workers handling explosives or engaged in blasting operations.
- e. Workers engaged in pile---driving.
- f. Workers in compressed air cofferdams and caissons.

- g. Workers engaged in the erection of prefabricated parts of steel structural frames and tall chimneys, and in concrete work, form work and other such type of work.
- h. Workers handling hazardous substances and materials.
- i. Workers as signalers and riggers.
- j. Other types of workers as may be categorized by TESDA

10. Welfare Facilities. The following shall apply:

The employer shall provide the following welfare facilities in order to ensure humane working conditions:

10.1 Adequate supply of safe drinking water:

- a. If the water is used in common drinking areas, it shall be stored in closed containers from which the water is dispensed through taps or cocks. Such containers shall be cleaned and disinfected at regular intervals but not exceeding fifteen (15) days.
- b. Notices shall be posted conspicuously in locations where there is water supply that is not for drinking purposes

10.2 Adequate sanitary and washing facilities:

- a. Adequate facilities for changing and for the storage and drying of work clothes.
- b. Adequate accommodation facilities for taking meals and for shelter.
- c. Adequate washing facilities regardless of sex for every 25 employees up to the first 100 and an additional of one (1) facility for every 40 additional workers.
- d. Suitable living accommodation for workers and as may be applicable for their families, such as separate sanitary, washing and sleeping facilities for men and women workers.

10.3 Adequate and suitable toilet and bath facilities for both male and female workers at the following ratio:

- a. Where the number of female workers exceeds 100, one (1) and bath facilities for every 20 female workers up to the first 100 and one (1) toilet and bath facilities for every 30 additional female workers.
- b. Where the number of male workers exceeds 100 and sufficient urinals have been provided, one (1) toilet and bath facilities for every 25 sales up to the first 100 and one (1) more for every 40 additional male workers.
- c. Every toilet shall be provided with enclosure, partitioned off so as to provide/ensure privacy. If feasible, shall have a proper door and fastenings, so doors shall be tight fitting and self---closing.
- d. Urinals shall be placed or screened so as not to be visible from other parts of the site, or other workers.
- e. Rest rooms shall be so arranged so as to be conveniently accessible to the workers and shall be kept clean and orderly at all times.
- f. Adequate hand---washing facilities shall be so provided within or adjacent to the toilet facilities

- g. In cases where persons of both sexes are employed, toilet and bath facilities for each sex shall be situated or partitioned so that the interior will not be visible even when the door of any facility is opened from any place where persons of the other sex have to work or pass.
- h. If toilet and bath facilities for one sex adjoin those for the other sex, the approaches shall be separate, and toilet and bath facilities for each sex shall be properly indicated.

11. DPWH DO No. 136 series of 2022 Revised Construction Safety Guidelines for the Implementation of Infrastructure Projects During the COVID-19 Public Health Crisis, Superseding Department Order Nos. 39 Series of 2020 and 30, Series of 2021

To ensure safety and health of the public, communities, workers and personnel amidst COVID-19, the PRDP prepared a set of guidelines and tools adhering to the Safeguards Policies of the World Bank as well as the new policy issuances, protocols and standards of the Philippine Government.

Provisions of DPWH DO No. 136 series of 2022 should be incorporated at the preparation and implementation of subprojects.

Mode of Measurement

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 the provision of Personal Protective Equipment (PPE) and Devices, Medicines, Medical Supplies and other incidentals necessary to complete the item.

Basis of Payment

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.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
B.7	Occupational Safety and Health	Lump Sum

ATTACHMENT C

Estimates of Medicines, Supplies and Facilities for Non-Hazardous Workplaces

1. Medicines	Number of Workers					
	1-50	51-99	100-199	200-600	601-2,000	2,001 up
1. Topical Antiseptic, cc.	60	60	60	120	240	240

2. Antiseptic eyewash, cc.	-	-	-	-	-	-
3. 70% Isopropyl Alcohol, cc.	240	240	240	240	500	500
4. Aromatic Spirit of Ammonia, cc	30	30	30	30	30	30
5. Toothache drops, cc	15	15	30	30	30	30
6. Hydrogen peroxide soln, cc.	120	120	120	240	240	240
7. Burn ointment, tube	-	-	1	1	1	1
8. Analgesic/ Antipyretic, tablets	10	10	10	20	30	40
9. Anti-histaminic tablets	-	-	10	20	30	40
10. Antacid tablets	10	10	10	20	30	40
11. Anti-diarrhea tablets	10	10	10	20	30	40
II. Medical Supplies & Equipment						
	Number of Workers					
	1-50	51-99	100-199	200-600	601-2,000	2,001 up
1. First Aid pamphlet	1	1	1	1	1	1
2. First Aid box	1	1	1	1	1	1
3. Thermometer	1	1	1	1	2	2
4. Stethoscope	-	-	1	1	1	1
5. Sphygmomanometer	-	-	1	1	1	1
6. Sterile gauze pads	5	5	5	10	20	20
7. Gauze, bandage, roll	1	1	1	1	2	2
8. Adhesive tape, roll	1	1	1	1	1	1
9. Absorbent cotton	*	*	*	*	*	*
10. Bandage scissors	1	1	1	1	1	1
11. Triangular bandage	-	1	1	1	2	2
12. Safety pins	-	*	*	*	*	*
13. Tongue depressors, wooden	-	-	100	100	100	100
14. Hot water bag	1	1	1	1	1	1
15. Ice bag	1	1	1	1	1	1
16. Disposable hypodermic syringes w/needles, 2.5cc	-	-	10	10	10	20
17. Rubber tourniquet	1	1	1	1	1	1

18.Venoclysis set (IV tubing butterfly)	-	1	1	2	2	2
19. Minor Surgical Instruments	-	-	*	*	*	*
20.Forceps	-	*	*	*	*	*
21. Sterilizer	-	-	-	-	1	1
22.Waste pail	1	1	1	1	1	1
23.Soap cake	*	*	*	*	*	*
24.Examining table	-	-	-	1	1	1
25.Linens	-	-	-	*	*	*
26.Bed	-	-	-	1	1	1
27.Stretchter	-	-	-	1	1	1
28.Cabinet for medicine &supplies	-	-	1	1	1	1
III. Medical Facilities						
	Number of Workers					
	1-50	51-99	100-199	200-600	601-2,000	2,001 up
1. Treatment Room		X	X	X		
2. Emergency Clinics					X	X
3. Emergency Hospital/Infirmary						
4. Dental Clinic						X

B.9 - MOBILIZATION/DEMOBILIZATION

General

Work under this Contract shall be in accordance with the terms and conditions stipulated in the Bid Documents.

Scope of Work

This Section includes mobilization, demobilization, assembly, and disassembly of all proposed minimum equipment including incidentals necessary to complete the work. It shall be computed based on the equipment requirements of the project stipulated in the proposal and contract booklet. In no case shall mobilization and demobilization exceed 1% of the Estimated Direct Cost (EDC) of the civil works items

Mobilization

- a) The Contractor shall mobilize and put into operation all equipment required to undertake the Bid Documents, which is the Bill of Quantities and all associated work items.
- b) Mobilization shall include the transferring to the job-sites of all equipment necessary for the execution and completion of the work subject to the confirmation of the LGU.

- c) Equipment encountering breakdowns must be repaired at the most expeditious method possible at no cost to the LGU. In the event that the equipment call for major repair works that cannot be undertaken at the site, the Contractor shall replace such equipment with equal or better performance capacity at no additional mobilization costs to the LGU, and the Contractor shall not be entitled to any time extension.
- d) The Contractor will be held responsible for any damage to existing structures, works, materials, or equipment because of his operations. The Contractor shall repair or replace any damaged structures, works, materials, or equipment to the satisfaction of the LGU, and at no additional cost to the Procuring Entity.
- e) The Contractor shall be responsible for all damage to streets, roads, railroads, curbs, sidewalks, highways, shoulders, ditches, embankment, culverts, bridges, or other public or private property, which may be caused by the transport of equipment to or from the Works.
- f) All construction equipment provided by the Contractor shall, when brought on to the Site, be deemed to be exclusively intended for the construction and completion of the Works and the Contractor shall not remove the same or any part thereof without the approval of the LGU.
- g) The LGU shall not at any time be liable for the loss or damage to any of the said construction plant and equipment provided by the Contractor.

Demobilization

Demobilization upon request of the Contractor and approval by the LGU shall include the following:

- a) The dismantling, preparation and loading for removal and shipment of all Contractor's equipment at the site after completion of the works.
- b) Transportation of all the above equipment from the site to the Contractor's home station or somewhere else outside the sites.
- c) Removal of all supplementary markers furnished and installed by the Contractor, provided that the LGU has not taken the option to retain the markers.
- d) The clean-up of the Site and the removal of materials, debris, waste, etc., and making good damages or temporary alterations, to the satisfaction of the LGU.
- e) The restoration, up to a degree acceptable to the LGU, of damage to the surrounding area (including vegetation, minor structures etc.) resulting from the construction or construction-related activities

Method of Measurement

The Lump sum price shall provide for the mobilization and demobilization of all Contractor's equipment to cover all costs for mobilization and demobilization, transportation, insurance during transportation, port fees, taxes, utilities, operators and all other incidentals.

The payment shall cover the dismantling of the work site by the Contractor, with removal of all the alterations, construction equipment, so that the site is restored to the state it was in before the installations and equipment were placed there.

Basis of Payment

All costs associated with and necessary for compliance with this Specification shall be included in the Lump Sum price. No additional or separate payment will be made in this regard.

The LGU may at any time withhold payment if in the opinion of the Engineer, the requirements of this Specification section are not provided.

The Lump Sum payments will be paid following the schedule below:

- 50 % of the lump sum cost will be paid for mobilization and 50% for demobilization.
- The progress billing for mobilization is computed by dividing the number of equipment mobilized at the site over the total minimum number of equipment required in the bidding documents multiplied by 50% of the lump sum cost. Likewise, payment for demobilization will follow the computation process for mobilization but only after the completion of the works assigned to the equipment and site restored in good condition.

Pay Item No.	Description	Unit of Measurement
B.9	Mobilization/Demobilization	Lump Sum

B.16 RECOGNITION PLATE/ PROJECT MARKER

B.16.1 General Requirements

In order to have a uniform and consistent design in all recognition plate/project markers and for the guidance and information of the citizenry about the completed infrastructure projects being undertaken by the Department, recognition plate/project markers shall be installed in all applicable project sites by the concerned implementing offices of the Department, respectively.

Henceforth, the following shall be observed in the preparation and installation of the recognition plate/project markers.

1. The marker to be installed in all completed projects shall be made of 2.4 mm thick brass plate, 450 mm x 600 mm in size with black sunk lettering. It shall include the name of project, location, personages and source of funds.
2. For building and similar projects, it shall be strategically located at the front wall of the structure.

B.16.2 Method of Measurement

Recognition plate/project marker shall be measured by each unit placed and installed at the proper locations.

B.16.3 Basis of Payment

The accepted quantities, measured as provided in Section B.16.2, Method of Measurement shall be paid for at the Contract Unit Price of the Pay Item listed below that is included in the Bill of Quantities. The unit price shall cover full compensation for all related services necessary to complete the Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
B.16	Recognition Plate/Project Marker	Lump Sum

PART C - EARTHWORKS

ITEM 800-CLEARING AND GRUBBING

800.1 Description

This Item shall consist of clearing, grubbing, removing, earth balling 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.

800.2 Construction Requirements

800.2.1 General

The Engineer will establish the limits of work and designate all trees, shrubs, objects designated to remain in-place. The Contractor shall preserve all objects designated to remain in-place. 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. Earthfill, stockpiling of materials, vehicular parking, and excessive foot or vehicular traffic shall not be allowed within the drip line of vegetation designated to remain in-place. Vegetation damaged by any of these or similar actions shall be replaced with viable vegetation of the same species, similar condition, and like size unless otherwise approved by the Engineer.

Clearing shall extend 1 m 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).

All other objects designated to be remained shall be preserved and protect from injury or defacement.

800.2.2 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 mowed as required, except as provided below:

1. Removal of undisturbed stumps and roots and nonperishable solid objects with a minimum depth of 1 m 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 above the ground line or low water level.
3. Grubbing of pits, channel changes and ditches will be required only to the depth necessitated by the proposed excavation within such areas.

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.

In areas where Hand Clearing as directed by the Engineer, no requirement of wheels or trucks shall be used. Care shall be taken to ensure that the grass, moss cover, or the natural ground is not disturbed.

The materials shall be properly disposed in accordance with the Environmental Compliance Certificate (ECC) requirements.

Materials and debris may be disposed of 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 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 of 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 and faces not exceeding 3,900 mm² 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 loose thickness. Diseased trees shall be buried or disposed of 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.

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

800.2.2.1 Temporary Erosion Control

Prior to the beginning of clearing and grubbing activities, the Contractor shall inspect the area to determine if these activities are likely to cause damage or require access to adjacent private property. Typical damage that may occur to adjacent properties includes cutting through tree roots, pushing excavated material onto adjacent lands, and damaging septic systems or public utilities. Erosion may become a problem after ground cover is disturbed. The Contractor shall install erosion control devices or procedures to protect the project limits, the environment, and private property. These operations shall be in accordance with the Plans or as directed by the Engineer. Temporary Seeding and Silt Fences are some of the temporary erosion control methods that can be used prior to the clearing and grubbing activities.

800.3 Method of Measurement

Measurement will be by the following alternate method:

Area Basis. The work to be paid for shall be the number of square meters and fractions thereof acceptably cleared and grubbed within the limits indicated on the Plans. 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.

800.4 Basis of Payment

The accepted quantities, measured as prescribed in Section 800.3, Method of Measurement 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.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
800(1)	Clearing and Grubbing	Square Meter

ITEM 803 - STRUCTURE EXCAVATION

803.1 Description

This item shall consist of the necessary excavation for foundation of buildings, culverts,

underdrains, and other structures not otherwise provided for in the Specifications. Except as otherwise provided for pipe culverts, the backfilling of completed structures and the disposal of all excavated surplus materials, shall be in accordance with the Plans and this Specification.

This Item shall include necessary diversion of live streams, dewatering, pumping, draining, sheeting, bracing, and the necessary construction of cribs and cofferdams, and furnishing the materials therefore, and the subsequent removal of cribs and cofferdams and the placing of all necessary backfill.

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 shall be made for classification of different types of material encountered.

803.2 Construction Requirements

803.2.1 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 800, Clearing and Grubbing.

803.2.2 Excavation

1. General, All Structures

The Contractor shall notify the Engineer sufficiently in advance at 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. 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.

Boulders, logs, and other objectionable materials encountered in excavation shall be removed.

After each excavation is completed, the Contractor shall notify the Engineer to that effect and no footing, bedding material or pipe culvert shall be placed until the Engineer has approved the depth of excavation and the character of the foundation material.

803.2.3 Utilization of Excavated Materials

All excavated materials, so far as suitable, shall be utilized as backfill, or embankment.

The surplus material shall be disposed of in such a 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.

803.3 Method of Measurement

803.3.1 Structure Excavation

The volume of excavation to be paid for shall be the number of cubic meters measured in original position of material acceptably excavated as shown on the plans or as directed by the Engineer, but in no case, except as noted, shall any of the following volumes be included in the measurement for payment:

1. The volume outside of vertical planes 450 mm outside of and parallel to the neat lines of footings and the inside walls of pipe and pipe-arch culverts at their widest horizontal dimensions.
2. The volume of excavation for culvert and sections outside the vertical plane for culverts stipulated in (1) above.
3. The volume outside of neat lines of underdrains as shown on the plans, and the outside the limits of foundation fill as ordered by the engineer.
4. The volume included within the stake limits of the excavation, contiguous channel changes, ditches, and the like, for which payment is otherwise provided in the specification.
5. Volume of water or other liquid resulting from construction operations and which can be pumped or drained away.
6. The volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed ground.
7. The volume of any material rehandled, except that where the plans indicate or the engineer directs the excavation after embankment has been placed and except that when installation of pipe culverts by the imperfect trench method specified in Subsection 1718.3.7, Imperfect trench of Item 1718, Pipe Culverts and Storm Drains is required, the volume of material re excavated as directed will be included.
8. The volume of excavation for footings ordered at a depth more than 1.5 m below the lowest elevation for such footings shown on the original contract plans, unless the Bill of Quantities contains a pay item for excavation ordered below the elevations shown on the plans for the individual footings.

803.4 Basis of Payment

The accepted quantities, measured as prescribed in Section 803.3, Method of Measurement shall be paid at the Contract Unit Price for each of the particular pay items listed below that is included in the Bill of Quantities. The payment shall constitute full compensation for the removal and disposal of excavated materials including all labor,

equipment, tools and incidentals necessary to complete the work prescribed in this Item, except as follows:

1. Any excavation for footings ordered at a depth more than 1.5 m below the lowest elevation shown on the original contract plans shall be paid for as provided in the Part K of Volume I requirements and conditions of contract, unless a pay item for excavation ordered below plan elevation appears in the bill of quantities.
2. Concrete will be measured and paid for as provided under Item 900, Structural Concrete. The quantity of structural concrete to be paid for shall be the final quantity placed and accepted in the completed structure. No deduction shall be made for the volume occupied by pipe less than 100 mm in diameter or by reinforcing steel, anchors, conduits, weep holes or expansion joint materials.
3. An excavation or borrow excavation required in excess of the quantity excavated for structures shall be measured and paid for as provided under Item 802, Excavation.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
803 (1)a	Structure Excavation (Common Soil)	Cubic Meter

ITEM 804 - EMBANKMENT

804.1 Description

This Item shall consist of the construction embankment using suitable materials of various composition and compacted in accordance with this Specification and in conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer.

804.2 Material Requirements

804.2.1 Suitable Material

Embankments shall be constructed of suitable materials and materials meeting with the following requirements:

1. Selected Borrow - soil of such gradation that all particles will pass a sieve with 75 mm square openings and not more than 15 mass percent will pass the 0.075 mm (No. 200) sieve, as determined by AASHTO T 11, Standard Method of Test for Materials Finer Than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing. The material shall have a plasticity index of not more than six (6) as determined by AASHTO T 90, Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils and a liquid limit of not more than 30 as determined by AASHTO T 89, Standard Method of

Test for Determining the Liquid Limit of Soils.

2. Gravel fill shall consist of crushed, partially crushed, or naturally occurring granular material. The abrasion loss as determined by AASHTO T 96, Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine shall not exceed 40 mass percent.

The gravel fill material grading requirements shall conform to Table 804.1.

Table 804.1 Grading Requirements

Sieve Designation		Mass Percent Passing
Standard, mm	Alternate US Standard	Grading A
63.5	2 ½"	100
50	2"	65-100
25	1"	50-85
4.75	No. 4	26-44
0.425	No. 40	16 max
0.075	No. 200	9 max

804.2.2. Unsuitable Material

Materials that are not acceptable for use are the following:

1. Organic soils such as peat and muck.
2. Soils with liquid limit exceeding 80 and/or plasticity index exceeding 55.
3. Soils with a natural water content exceeding 100%.
4. Soils with very low natural density, 800 kg/m³ or lower.
5. Materials containing detrimental quantities of organic materials, such as grass, roots, sewerage, and other materials that cannot be properly compacted as determined by the Engineer.

804.3 Construction Requirements

804.3.1 General

Prior to placing of embankment materials, all necessary clearing and grubbing in that area shall have been performed in conformity with Item 800, Clearing and Grubbing.

Embankment construction shall consist of constructing embankments, including

preparation of the areas upon which they are to be placed; the construction of dikes within or adjacent to any structures; the placing and compacting of approved material within areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits, and other depressions within the area.

Embankments and backfills shall contain no muck, peat, sod, roots or other deleterious matter. Rocks, broken concrete or other solid, bulky materials shall not be placed in embankment areas where piling is to be placed or driven.

Where shown on the Plans or directed by the Engineer, the surface of the existing ground shall be compacted to a depth of 150 mm and to the specified requirements of this Item.

Where provided on the Plans and Bill of Quantities the top portions of the roadbed in both cuts and embankments, as indicated, shall consist of selected borrow for topping from excavations.

804.3.2 Methods of Construction

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

When embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is built 1/2 of the width at a time, the existing slopes that are steeper than 3:1 when measured at right angles to the roadway shall be continuously benched over those areas as the work is brought up in layers. Benching will be subject to the Engineer's approval and shall be of sufficient width to permit operation of placement and compaction equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Material thus excavated shall be placed and compacted along with the embankment material in accordance with the procedure described in this Section.

Unless shown otherwise on the Plans or Special Provisions, where an embankment of less than 1.2 m below subgrade is to be made, all sod and vegetable matter shall be removed from the surface upon which the embankment is to be placed, and the cleared surfaced shall be completely broken up by plowing, scarifying, or steeping to a minimum depth of 150 mm except as provided in Subsection 802.2.2, Conservation of Topsoil. This area shall then be compacted as provided in Subsection 804.3.3, Compaction. Sod not required to be removed shall be thoroughly disc harrowed or scarified before construction of embankment. Wherever a compacted embankment containing granular materials lies within 900 mm of the subgrade, such old embankment shall be scarified to a depth of at least 150 mm whenever directed by the Engineer. This scarified material shall then be compacted as provided in Subsection 804.3.3, Compaction.

Embankment of earth material shall be placed in horizontal layers not exceeding 200 mm, loose measurement, and shall be compacted as specified before the next layer is placed. However, a thicker layer may be placed if a vibratory roller with high compacting 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.

Where embankment is to be constructed across low swampy ground that will not support the mass of trucks or other hauling equipment, the lower part of the fill may be constructed by dumping successive loads in a uniformly distributed layer of a thickness not greater than necessary to support the hauling equipment while placing subsequent layers. Fill material shall be placed in a way it effectively displaces unsuitable material from within an unstable area of the proposed embankment.

When excavated material contains more than 25 mass percent of rock larger than 150 mm in greatest diameter and cannot be placed in layers of the thickness prescribed without crushing, pulverizing or further breaking down the pieces resulting from excavation methods, such materials may be placed on the embankment in layers not exceeding in thickness the approximate average size of the larger rocks, but not greater than 600 mm.

Even though the thickness of layers is limited as provided above, the placing of individual rocks and boulders greater than 600 mm in diameter shall be permitted provided that when placed, they do not exceed 1,200 mm in height and provided they are carefully distributed, with the interstices filled with finer material to form a dense and compact mass.

Each layer shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments of earth. Lifts of material containing more than 25 mass percent of rock larger than 150 mm in greatest dimensions shall not be constructed above an elevation 300 mm below the finished subgrade. The balance of the embankment shall be composed of suitable material smoothed and placed in layers not exceeding 200 mm in loose thickness and compacted as specified for embankments.

Dumping and rolling areas shall be kept separate, and no lift shall be covered by another until compaction complies with the requirements of Subsection 804.3.3, Compaction.

Hauling and leveling equipment shall be routed and distributed over each layer of the fill in such a manner as to make use of compaction effort afforded thereby and to minimize rutting and uneven compaction.

804.3.3 Compaction

1. Compaction Trials

Before commencing the formation of embankments, the Contractor shall submit in writing to the Engineer for approval his proposals for the compaction of each type of fill material to be used in the works. The proposals shall include the relationship between the types of compaction equipment, the number of passes required and the method of

adjusting moisture content. The Contractor shall carry out full scale compaction trials on areas not less than 10 m wide and 50 m long as required by the Engineer and using his proposed procedures or such amendments thereto as may be found necessary to satisfy the Engineer that all the specified requirements regarding compaction can be consistently achieved. The compaction equipment shall be equivalent or higher than the required capacity prescribed in the Contract. Compaction trials with the main types of fill material to be used in the works shall be completed before work with the corresponding materials shall be allowed to commence. When embankment dimension is less than 10 m wide and 50 m long, the Engineer may waive the construction of compaction trials.

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.

2. Earth

The Contractor shall compact the material placed in all embankment layers and the material scarified to the designated depth below subgrade in cut sections, until a uniform density of not less than 95 mass percent of the maximum dry density determined by AASHTO T 99, Standard Method of Test for Moisture Density Relations of Soils Using a 2.5 kg Rammer and a 305 mm Drop - Method C, is attained, at a moisture content determined by Engineer to be suitable for such density.

The Engineer shall, during progress of the Work, make density tests of compacted material in accordance with AASHTO T 191, Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method, AASHTO T 205, Soil - Field density test sets: Balloon density apparatus or other approved field density tests, including the use of properly calibrated nuclear testing devices. If, by such tests, the Engineer determines that the specified density and moisture conditions have not been attained, the Contractor shall perform additional work as may be necessary to attain the specified conditions.

At least one group of three (3) in-situ density tests shall be carried out for each 500 m² of each layer of compacted fill.

3. Gravel Fill

Gravel fill shall be constructed below the original ground elevation. The maximum compacted thickness of any layer shall not exceed 150 mm. All subsequent layers shall be spread and compacted in a similar manner. Gravel fill shall be in accordance with the approved Plan and conform to the applicable requirements of earth embankment.

4. Broken Concrete

Pieces of concrete not exceeding 20 cm in diameter can be mixed if approved by the Engineer. Any exposed rebar on broken concrete pieces shall be cut and disposed of properly.

804.3.4 Protection of Embankment During Construction

During the construction, the in-placed embankments shall be maintained in such condition that it will be well drained at all times. Side ditches or gutters emptying from cuts to embankments or otherwise shall be so constructed as to avoid damage to embankments by erosion.

804.3.5 Protection of Structure

If embankment can be deposited on one (1) side of adjoining structure, care shall be taken that the area adjacent to the structure shall not be compacted to the extent that it will cause damages against the structure.

When embankment is to be placed on both sides of a concrete structure, operations shall be conducted so that the embankment is always at approximately the same elevation on both sides of the structure unless otherwise specified in the Plans.

Embankments shall not be placed in areas where the materials will be submerged in water. The area shall be pumped dry and any mud or loose material shall be removed.

804.3.6 Rounding and Warping Slopes

Rounding except in solid rock, the tops and bottoms of all slopes, including the slopes of drainage ditches, shall be rounded as indicated on the Plans. A layer of earth overlaying rock shall be rounded above the rock as done in earth slopes.

Warping adjustments in slopes shall be made to avoid injury in standing trees or marring of weathered rock, or to harmonize with existing landscape features, and the transition to such adjusted slopes shall be gradual. At intersections of cuts and fills, slopes shall be adjusted and warped to flow into each other or into the natural ground surfaces without noticeable break.

804.3.7 Finishing Roadbed and Slopes

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

All earth slopes shall be left with roughened surfaces but shall be reasonably uniform, without any noticeable break, and in reasonably close conformity with the Plans or other surfaces indicated on the Plans or as staked by the Engineer, with no variations there from readily discernible as viewed from the road.

804.3.8 Serrated Slopes

Cut slopes in rippable material (soft rock) having slope ratios between 0.75:1 and 2:1 shall be constructed so that the final slope line shall consist of a series of small horizontal steps. The step rise and tread dimensions shall be shown on the Plans. No scaling shall be

performed on the stepped slopes except for removal of large rocks which will obviously be a safety hazard if they fall into the ditch line or roadway.

804.3.10 Visual Inspection

Prior to final acceptance, the inspector shall visually inspect the entire section of the compacted embankment. If visual inspection shows that the course is not uniform or that the test values may not be representative of the entire section additional tests may be performed and deficiencies shall be corrected by the Contractor. Deficiencies identified by visual inspection, such as laminations, dimensional deficiencies, soft areas, etc. shall be corrected before the section will be accepted. The section must be accepted prior to the placement of the next lift.

804.3.11 Dust Control

Adequate dust control must be maintained by the Contractor at all times during the earth-moving operations. Dust shall be controlled exclusively through the use of water unless otherwise indicated in the Contract documents or authorized by the Engineer.

804.3.12 Stockpiling

The Contractor shall not place stockpiles at locations where they are subject to erosion. The Contractor shall maintain erosion and drainage control near all stockpiles to the satisfaction of the Engineer and shall ensure that surface drainage does not adversely affect adjacent lands, watercourses or future reclamation sites.

Stockpiles shall not be situated at locations or by methods that will interfere or cause damage to any utilities such as power lines, telephone lines, pipelines, and underground utilities, among others.

Sites shall be cleared to the required dimensions. Topsoil and subsoil shall be separately excavated to the full depth or 300 mm, whichever is greater, and stockpiled separately.

Stockpiles shall not be situated within 30 m of a watercourse or permanent structure or within 4 m of adjacent property boundary unless otherwise permitted in writing by the property owner.

804.4 Method of Measurement

The quantity of embankment to be paid for shall be the volume of material compacted in place, accepted by the Engineer and formed with material obtained from an approved source.

The volume of embankment materials can be calculated using cross-sectional end area method or by the prismatic formula method with the assistance of computer aided design program.

Material from excavation per Item 802, Excavation which is used in embankment and accepted by the Engineer will be paid under Embankment and such payment will be deemed to include the cost of excavating, hauling, stockpiling and all other costs

incidental to the work.

Material for Selected Borrow topping will be measured and paid for under the same conditions specified in the preceding paragraph.

804.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 804.4, Method of Measurement shall be paid at the Contract Unit Price for each of the Pay Items listed below that is included in the Bill of Quantities. The payment shall continue full compensation for placing and compacting all materials including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment shall be made under:

Pay Item Number	Description	Unit Of Measurement
804(1)a	Embankment from Structure Excavation (Common Soil)	Cubic Meter
804(2)a	Embankment from Borrow (Common Soil)	Cubic Meter
804(7)	Gravel Fill	Cubic Meter

PART D – PLAIN AND REINFORCED CONCRETE WORKS

ITEM 900 - STRUCTURAL CONCRETE

900.1 Description

900.1.1 Scope

This Item shall consist of furnishing, placing and finishing concrete in buildings and related structures, flood control and drainage, ports, and water supply structures in accordance with this Specification and conforming to the lines, grades, and dimensions shown on the Plans.

900.1.2 Classes and Uses of Concrete

Five classes of concrete are provided for in this Item, namely: A, B, C, P and Seal. Each class shall be used in that part of the structure as called for on the Plans.

The classes of concrete will generally be used as follows:

Class A - All superstructures and substructures which include the important parts such as slabs, beams, girders, columns, arch ribs, box culverts, abutments, retaining walls, shear walls, pedestal and footings.

Class B - Pier shafts, pipe bedding, slab on fill, gravity walls (unreinforced or with only a

small amount of reinforcement), and other miscellaneous concrete structures.

Class C - Thin reinforced sections, railings, precast R.C. piles and cribbing and for filler in steel grid floors.

Class P- Prestressed concrete structures and members.

Seal - Concrete deposited in water

900.2 Material Requirement

900.2.1 Portland Cement

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

Table 900.1 Types of Cement

Type	Specification
Portland Cement	AASHTO M 85, Standard Specification for Portland Cement (ASTM C150, Standard Specification for Portland Cement)
Blended Hydraulic Cements	AASHTO M 240, Standard Specification for Portland Cement (ASTM C595, Standard Specification for Blended Hydraulic Cement)
Masonry Cement	ASTM C91, Standard Specification for Masonry Cement

900.2.2 Concrete Aggregates

Concrete aggregates shall conform to ASTM C33M, Standard Specification for Concrete Aggregates, and lightweight concrete aggregates shall conform to ASTM C330M, Standard Specification for Lightweight Aggregates except that aggregates failing to meet these specifications, but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used under Method 2 of Subsection 900.3.2, Methods of Determining the Proportions of Concrete, when authorized by the Engineer in writing.

Except as permitted elsewhere in this Subsection, the maximum size of the aggregate shall be or not larger than 1/5 of the narrowest dimensions between sides of forms of the member for which the concrete is to be used nor larger than 3/4 of the minimum clear spacing between individual reinforcing bars or bundles of bars or pre-tensioning strands.

900.2.2.1 Fine Aggregates

Fine aggregates shall consist of natural and crushed sand, stone screenings or other inert materials with similar characteristics, or combinations thereof, having hard, strong and

durable particles. Fine aggregates from different sources of supply shall not be mixed or stored in the same pile nor used alternately in the same class of concrete without the written approval of the Engineer.

It shall not contain more than three (3) mass percent of material passing the 0.075 mm (No. 200 sieve) by washing nor more than one (1) mass percent each of clay lumps or shale. The use of beach sand will not be allowed without the written approval of the Engineer.

If the fine aggregate is subjected to five (5) cycles of the sodium sulfate soundness test in accordance with AASHTO T 104, Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate and ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate, the weighted loss shall not exceed ten (10) mass percent.

Fine aggregates shall be free from injurious amounts of organic impurities. If subjected to the colorimetric test for organic impurities and a color darker than the standard is produced, it shall be rejected. However, when tested for the effect of organic impurities on strength of mortar by AASHTO T 71, Standard Method of Test for Organic Impurities in Fine Aggregate on Strength of Mortar (ASTM C87, Standard Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar) the fine aggregate may be used if the relative strength at 7 and 28 days is not less than 95%.

The fine aggregate shall be well-graded and shall conform to Table 900.2.

Table 900.2 Grading Requirements for Fine Aggregate

Sieve Designation (mm)	Mass Percent Passing
9.50	100
4.75	95-100
2.36	-
1.18	45-80
0.60	-
0.30	5-30
0.15	0-10

900.2.2.2 Coarse Aggregates

Coarse Aggregates shall consist of crushed stone, gravel, blast furnace slag, or other

approved inert materials of similar characteristics, or combinations thereof, having hard, strong, durable pieces and free from any adherent coatings.

It shall contain no more than one (1) mass percent of material passing the 0.075 mm comment sieve, not more than 0.25 mass percent of clay lumps, nor more than 3.5 mass percent of soft fragments.

If the coarse aggregate is subjected to five (5) cycles of the sodium sulfate soundness test in accordance with AASHTO T 104, Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate and ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate, the weighted loss shall not exceed 12 mass percent.

Coarse Aggregates shall have a mass percent of wear not exceeding 40 when tested by AASHTO T 96, Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine (ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine).

If the slag is used, its density shall not be less than 1,120 kg/m³.

Gradation shall conform to Table 900.3.

Table 900.3 Grading Requirements for Coarse Aggregate

Sieve Designation (mm)	Mass Percent Passing				
	Class A	Class B	Class C	Class P	Class Seal
63.00					
50.00	100	100			
37.50	95-100	-			100
25.00	-	35-70		100	95-100
19.00	35-70	-	100	-	-
12.50	-	10-30	90-100	-	25-60
9.50	10-30	-	40-70	20-55	-
4.75	0-5	0-5	0-15*	0-10*	0-10*

*Note: *The measured cement content shall be within plus (+) or minus (-) 2 mass percent of the design cement content.*

900.2.2.3 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 shall begin. It shall be the

responsibility of the Contractor to designate the source or sources of aggregates to give the Engineer sufficient time to obtain the necessary samples and submit them for testing.

No aggregates shall be used unless official advice has been received that it has satisfactorily passed all tests, at which time written authority by the Engineer shall be given for its use.

900.2.3 Water

Water used in mixing, curing or other designated application shall be reasonably clean and free of oil, salt, acid, alkali, grass or other substances injurious to the finished product. Water which is drinkable may be used without test. Where the source of water is shallow, the intake shall be so enclosed as to exclude silt, mud, grass or other foreign materials.

If it contains quantities of substance that discolor it or make it smell or taste unusual or objectionable, or cause suspicion, it shall not be used unless service records of concrete made with it (or other information) indicated that it is not deleterious to the quality, shall be subject to the acceptance criteria as shown in Table 900.4 and Table 900.5 or as designated by the Engineer.

Table 900.4 Acceptance Criteria for Water Supply

Physical Property	Limit
Compressive strength, min. % control at 7 days	90
Time of Setting deviation from control, h:min ^A	From 1:100 earlier to 1:30 later

Note: ^AComparisons shall be based on fixed proportions for concrete or mortar mixtures. The control mixture shall be made with 100% potable or distilled water. The test mixture shall be made with the mixing water that is being evaluated.

Table 900.5 Chemical Limitation for Water

Chemical Property	Limits (parts per million, ppm), max	Test Method
A. Chloride as Cl ⁽⁻¹⁾		
1. Prestressed concrete	500	ASTM C114
2. Other reinforced concrete in moist environment or containing aluminum embedments or dissimilar metals or with stay in	1000	ASTM C114

place		
B. Sulfate as SO ₄	3000	ASTM C114
C. Alkalies as (NA ₂ O + 0.658 K ₂ O)	600	ASTM C114
D. Total Solids by Mass	50000	ASTM C1603

Non-potable water will be tested in accordance with, and shall meet the suggested requirements of ASTM C1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

900.2.4 Metal Reinforcement

Reinforcing steel bars shall conform to the requirements of Subsection 902.2, Material Requirements of Item 902, Reinforcing Steel.

900.2.5 Admixtures

Air-entraining admixtures, if used, shall conform to ASTM C260M, Standard Specification for Air Entraining Admixtures for Concrete. Air-entraining admixture shall conform to the requirements of AASHTO M 154, Standard Method of Test for Time of Setting of Hydraulic Cement Paste by Gillmore Needles.

Chemical Admixtures, if used, shall conform to the requirements of ASTM C494M, Standard Specification for Chemical Admixtures for Concrete or AASHTO M 194, Standard Specification for Chemical Admixtures for Concrete.

Fly Ash, if specified or permitted as a mineral admixture and not exceeding 20% partial replacement of Portland Cement in concrete mix shall conform to the requirements of ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

Chemical Admixture/s may be added to the concrete mix to produce some desired modifications to the properties of concrete if necessary, but not as partial replacement of cement. If specified, monofilament polypropylene synthetic fibrin fibers, which are used as admixture to prevent the formation of temperature/shrinkage cracks and increase impact resistance of concrete slabs shall be applied in the dosage rate recommended by its manufacturer.

900.2.6 Storage of Cement and Aggregates

All cement shall be stored immediately upon delivery at the site in a weatherproof building which will protect the cement from dampness. The floor shall be raised from the ground. The buildings shall be placed in locations approved by the Engineer. Provisions for storage shall be ample, and the shipments of cement as received shall be separately stored in such a manner as to allow the earliest deliveries to be used first and to provide easy access for identification and inspection of each shipment. Storage buildings shall

have capacity for storage of a sufficient quantity of cement to allow sampling at least 12 days before the cement is to be used. For a storage period of less than 60 days, stack the bags no higher than 14 layers, and for longer periods, no higher than seven (7) layers. As an additional precaution the oldest cement shall be used first. Bulk cement, if used, shall be transferred to elevated air tight and weatherproof bins. Stored cement shall meet the test requirements at any time after storage when retest is ordered by the Engineer. At the time of use, all cement shall be free flowing and free of lumps.

The handling and storing of concrete aggregates shall be such as to prevent segregation or the inclusion of foreign materials. The Engineer may require that aggregates be stored on separate platforms at satisfactory locations.

In order to secure greater uniformity of concrete mix, the Engineer may require that the coarse aggregate be separated into two (2) or more sizes. Different sizes of aggregate shall be stored in separate bins or in separate stockpiles sufficiently removed from each other to prevent the material at the edges of the piles from becoming intermixed.

900.2.7 Curing Materials

Curing materials shall conform to the following requirements as specified;

1. Burlap cloth - AASHTO M 182, Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats
2. Liquid membrane forming compounds - ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
3. Sheeting (film) materials - AASHTO M 171, Standard Specification for Sheet Materials for Curing Concrete

900.2.8 Expansion Joint Materials

Expansion joint materials shall be:

1. Preformed Sponge Rubber and Cork, conforming to AASHTO M 153, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction (ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction)
2. Hot-Poured Elastic Type, conforming to ASTM D6690, Standard Specification for Joint and Crack Sealants, Hot-Applied, for Concrete and Asphalt Pavement.
3. Preformed Fillers, conforming to AASHTO M 213, Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types), ASTM D994M, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)

900.3 Construction Requirements

The notation used in these regulations is defined as follows:

f_c' = compressive strength of concrete

900.3.1 Concrete Quality

All Plans submitted for approval or used for any project shall clearly show the specified strength, f_c' , 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 (AC 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:

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 900.6. When strengths in excess of 27.58 MPa are required or when lightweight aggregates or admixtures (other than those exclusively for the purpose of air entraining) 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 900.6 may be used provided that the relationship between strength and water-cement ratio for the materials to be used has been previously established by reliable test data and the resulting concrete satisfies the requirements of concrete quality.

Where previous data are not available. Concrete trial mixtures having proportions and consistency suitable for the work shall be made using at least three (3) different water cement ratios (or cement content in 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 (3) specimens for each age to be tested shall be made, cured and tested for strength in accordance with ASTM C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimen and ASTM C192, Standard Practice for Making & Curing Concrete Test Specimens in the Laboratory.

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 graph 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.

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

Table 900.6 Maximum Permissible Water-Cement Ratios for Concrete (Method No. 1)

Specified compressive strength at 28 days, MPa	Maximum Permissible water-cement ratio			
	Non-air-entrained		Air-entrained concrete	
	Liters per 40 kg bag of cement	Absolute ratio by weight	Liters per 40 kg bag of cement	Absolute ratio by weight
17.24	25.77	0.642	22.22	0.554
20.70	23.11	0.576	18.66	0.465
24.13	20.44	0.510	15.99	0.399
27.58	17.77	0.443	14.22	0.354

900.3.3 Concrete Proportions and Consistency

The proportions of aggregates 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 progresses, at least one (1) sample consisting of three (3) concrete cylinder test specimens, 150 mm x 300 mm, shall be taken from each 75 m³ of each class of concrete or fraction thereof placed each day.

Samples from which compression test specimens are molded shall be secured in accordance with ASTM C172M, Standard Practice for Sampling Freshly Mixed Concrete. 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 C31M, Standard Practice for Making and Curing Concrete Test Specimen in the

Field. Additional test specimens cured entirely under field conditions may be required by the Engineer to check the adequacy of curing and protection of the concrete. Strength tests shall be made in accordance with ASTM C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimen.

Compliance with the requirements of this Subsection shall be determined in accordance with the following standard methods of AASHTO:

Sampling of fresh concrete	: AASHTO R 60, Standard Practice for Sampling Freshly Mixed Concrete
Weight per cubic meter and air content (gravimetric) of concrete	: AASHTO T 121M, Standard Method of Test for Density (unit weight), Yield, and Air Content (Gravimetric) of Concrete
Slump of Portland Cement Concrete	: AASHTO T 119M, Standard Method of Test For Slump of Hydraulic Cement Concrete

Test for strength shall be made in accordance with the Following:

Making and curing of concrete compressive specimen in the field	: AASHTO T 23, Standard Method of test for Making and Curing Concrete Test Specimens in the Field (ASTM C31, Standard Practice for Making and Curing Concrete Test Specimens in The Field)
Compressive strength of molded concrete cylinders	: AASHTO T 22, Standard Method of test for Test Method for Compressive Strength of Cylindrical Concrete Specimens (ASTM C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens)

900.3.5 Proportioning and Strength of Structural Concrete

The concrete materials shall be proportioned in accordance with the requirements for each class of concrete as specified in Table 900.7, using the absolute volume method as outlined in the American Concrete Institute (ACI) Standard 211.1, Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete. Other methods of proportioning may be employed in the mix design with prior approval of the Engineer. A change in the source of materials during the progress of work shall necessitate a new mix design.

The strength requirements for each class of concrete shall be as specified in Table 900.7.

Table 900.7 Composition and Strength of Concrete for Use in Structures

Class of	Minimum	Maximum	Consistenc	Designated	Minimum
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Concrete	Cement Content per m ³ 40kg/ (bag ^{**})	Water/ Cement Ratio (Kg/kg)	y Range in Slump (mm)	Size of Coarse Aggregate Square opening Std. mm	Compressive Strength of 150mm x 300mm Concrete Cylinder Specimen at 28 days, MN/m ²
A	364 (9.1 bags)	0.53	50-100	37.50-4.75	20.7
B	320 (8 bags)	0.58	50-100	50.00-4.75	16.5
C	380 (9.5 bags)	0.55	50-100	12.50-4.75	20.7
P	440 (11 bags)	0.49	100 max.	19.00-4.75	37.7
Seal	380 (9.5 bags)	0.58	100-200	25.00-4.75	20.7

Note: * The measured cement content shall be within plus cement content 2 mass percent of the design cement content.

**Based on 40 kg/bag

900.3.6 Consistency

Concrete shall have a consistency such that it will be workable in the required position and will flow around the reinforcing steel but individual particles of the coarse aggregates, when isolated, shall show a coating of 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 in mixing and transporting concrete mix. The quantity of mixing water, which shall be determined by the Engineer and shall not be varied without his consent. Concrete as dry as it is practical to place with the equipment specified shall be used.

900.3.7 Strength Test of Concrete

As a basis of acceptance, strength test shall generally be made with the frequency of not less than one (1) test [three (3) specimens] for each 75 m³. Each test shall be made from a separate batch. One each day concrete is delivered, at least one (1) strength test shall be made for each class of concrete.

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

For structures designed in accordance with the ultimate strength design method, and for prestressed structures the average of any three (3) consecutive strength test of the laboratory cured specimens representing each class of concrete shall be equal to or greater than the specified compressive strength, f_c' and not more than 10% of the strength tests shall have values less than the specified strength.

When the laboratory-cured specimens failed to conform to the requirements for strength, the Engineer shall have the right to order changes in the concrete sufficient to requirements. If the cured specimen had attained the intended minimum strength requirement, the removal of forms and falseworks may take place and shall conform to the requirements of Item 903, Formworks and Falseworks. When in the opinion of the Engineer, the strengths of the job-cured specimens may not likely be achieved, the Contractor may be required to improve the procedures for protecting and curing the concrete specimen, or when test of field-cured cylinders indicate deficiencies in protection and curing, the Engineer may require test in accordance with ASTM C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete 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.

900.3.8 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 (-) one (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%.

3. Aggregates

Stockpiling of aggregates shall be in accordance with Subsection 900.2.6, Storage of Cement and Aggregate. 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. Shipment requiring more than 12 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 h may be required by the Engineer.

Batching shall be conducted as to result in a two (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 0.5% 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 one and 1.5 h 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 (1) batch is carried on the truck, without spilling of material from one (1) 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 3%.

The use of Calcium Chloride (CaCl_2) as an admixture will not be permitted.

900.3.9 Mixing and Delivery

Concrete may be mixed at the construction site, 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, Standard Specification for Ready-Mixed Concrete except as modified in the following paragraphs of this Subsection, 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 deliveries 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 min.

Volumetric measurement shall be used only if by weight batching plant is located more than 1 h travel from the project site.

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

For batch mixing at the construction site 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% 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 s 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 s for mixers having a capacity of 1.5 m³ or less. For mixers having a capacity greater than 1.5 m³, the mixing time shall not be less than 90 s. If timing starts, the instant skip reaches its maximum raised position, 4 s 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 of by the Contractor at his own expense.

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 h, 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.

Mixing Concrete: General

All concrete batching plants prior to use shall be accredited by the DPWH-Bureau of Research and Standards.

1. 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 20 mm 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 0.5 m³ or more, the scale and weigh hopper for Portland cement shall be separated 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 three (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 90 s 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 1 hour or more, the mixer shall be thoroughly cleaned.

2. Mixing Concrete at Central Plant

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

3. Mixing Concrete in Truck

Truck mixers, unless otherwise authorized by the Engineer, shall be of the 3) 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 otherwise 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 min 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 32 °C, this limit shall be reduced to 15 min. 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 herein at a stationary mixer may be reduced to 30 s and the mixing completed in a truck mixer. The mixing time in the truck mixer shall be as specified for truck mixing.

4. Transporting and Delivery of 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 1 h, 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 30°C, or above, a time less than 1 h will be required.

The maximum temperature of concrete produced with heated aggregates, heated water, or both, shall at no time during its production or transportation exceed 32°C.

The Contractor shall have sufficient plant capacity and transportation apparatus to insure 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 min. The methods of delivering and handling the concrete shall be such as that will facilitate placing of the minimum handling.

900.3.10 Handling and Placing Concrete: General

Concrete shall not be placed until forms and reinforcing steel have been checked and approved by the Engineer.

If lean concrete is required in the Plan or as directed by the Engineer prior to placing of reinforcing steel bar, the lean concrete should have a minimum compressive strength of 13.8 MPa.

In preparation for the placing of concrete, all sawdust, chips and other construction debris and extraneous matter shall be removed from inside the formwork. Struts, stays and braces, serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. These temporary members shall be entirely removed from the forms and not buried in the concrete.

No concrete shall be used which does not reach its final position in the forms within the time stipulated under "Time of Hauling and Placing Mixed Concrete".

Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. The use of long troughs, chutes, and pipes for conveying concrete to the forms shall be permitted only on written authorization of the Engineer. The Engineer shall reject the use of the equipment for concrete transportation that will allow segregation, loss of fine materials, or in any other way will have a deteriorating effect on the concrete quality.

Open troughs and chutes shall be of metal lined; where steep slopes are required, the chutes shall be equipped with baffles or be in short lengths that reverse the direction of movement to avoid segregation.

All chutes, troughs and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run. Water used for flushing shall be discharged clear of the structure.

When placing operations would involve dropping the concrete more than 1.5 m, concrete shall be conveyed through sheet metal or approved pipes. As far as practicable, the pipes shall be kept full of concrete during placing and their lower end shall be kept buried in the newly placed concrete. After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of projecting reinforcement bars.

The concrete shall be placed as nearly as possible to its final position and the use of vibrators for moving of the mass of fresh concrete shall not be permitted.

900.3.10.1 Placing Concrete by Pneumatic Means

The equipment shall be so arranged that vibration will not damage freshly placed concrete. The capacity of equipment shall be 0.30 to 1.00 m³.

Where concrete is conveyed and placed by pneumatic means, the equipment shall be suitable in kind and adequate in capacity for the work. The machine shall be located as close as practicable to the work. The discharge lines shall be horizontal or inclined upwards from the machine. The discharge end of the line shall not be more than 3 m from the point of deposit.

At the conclusion of placing the concrete, the entire equipment shall be thoroughly cleaned.

900.3.10.2 Placing of Concrete by Pumping

The equipment shall be so arranged that vibration will not damage freshly placed concrete. The discharge capacity of the equipment shall be 1.5 to 10.0 m³/h. The minimum pressure capacity of the equipment shall be 0.60 MPa.

Where concrete is conveyed and placed by mechanically applied pressure the equipment shall be suitable in kind and adequate in capacity for the work. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients. After this operation, the entire equipment shall be thoroughly cleaned.

900.3.10.3 Placing Concrete in Water

Concrete deposited in water shall be Class Seal concrete with a minimum cement content of 380 kg/m³ of concrete. The slump of the concrete shall be maintained between 4 and 8 cm, whichever is called for in the Bill of Quantities. To prevent segregation, concrete shall be carefully placed in a compact mass, in its final position, by means of a tremie, a bottom-dump bucket, or other approved means, and shall not be disturbed after being placed.

A tremie shall consist of a tube having a diameter of not less than 250 mm constructed in sections having flanged couplings fitted with gaskets with a hopper at the top. The tremie shall be supported so as to permit free movement of the discharge and over the entire top surface of the work and so as to permit rapid lowering when necessary to retard or stop the flow of concrete. The discharge end shall be closed at the start of work so as to prevent water entering the tube and shall be completely submerged in concrete at all times. The tremie tube shall be kept full to the bottom of the hopper. When a batch is dumped into the hopper, the flow of concrete shall be induced by lightly raising the discharge end, but always keeping it in the placed concrete. The flow shall be continuous until the work is completed.

When the concrete is placed with a bottom-dump bucket, the top of the bucket shall be open. The bottom doors shall open freely downward and outward when tripped. The buckets shall be completely filled and slowly lowered to avoid backwash. It shall not be dumped until it rests on the surface upon which the concrete is to be deposited and when discharged shall be withdrawn slowly until well above the concrete.

900.3.11 Consolidation of Concrete

The consolidation method should be compatible with the concrete mixture, placing conditions, and degree of air removal desired. When concrete comes down the chute and flows into forms it carries entrapped air. The entrapped air shall be removed to prevent voids in concrete. Poorly consolidated concrete will be weak, porous and poorly bonded to the reinforcement.

Poured concrete shall be immediately and thoroughly consolidated. The concrete in walls, beams, columns and the like shall be placed in horizontal layers not more than 30 cm thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and consolidated before the Each layer's preceding layer has taken the initial set to prevent injury to the green concrete and avoid surfaces of separation between the layers. consolidated so as to avoid the formation of a construction joint with a preceding layer.

The consolidation shall be done by mechanical vibration. The concrete shall be vibrated internally unless special authorization of other methods is given or is provided herein. The intensity of vibration shall be such as to visibly affect a mass of concrete with a 3 cm slump over a radius of at least 50 cm. A sufficient number of vibrator shall be provided to properly consolidate each batch immediately after it is placed in the forms. Vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcement and embedded fixtures and into the corners and angles of the forms and shall be applied at the point of placing and in the area of freely placed concrete. The vibrators shall be inserted into and withdrawn from the concrete slowly. The diameter of the steel tube called poker depends on the spacing between the reinforcing bars in the form-work. In no case shall the vibrator be operated longer than 15 s in any one location. The vibration shall be of sufficient duration and intensity to consolidate the concrete thoroughly but shall not be continued so as to cause segregation and at any one point to the extent that localized areas of grout are formed. Application of vibrators shall be at points uniformly spaced, and not farther apart than twice the radius over which the vibration is visibly effective. Vibration shall not be applied directly or thru the reinforcement to sections or layers of concrete that have hardened to the degree that the concrete ceases to be plastic under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms of troughs or chutes.

900.3.12 Concrete Surface Finishing: General

900.3.12.1 Float Finish

Surface shall be consolidated with power-driven floats or by hand floating. Surfaces shall be left uniform, smooth and granular texture.

Float finish shall be applied to the surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

900.3.12.2 Trowel Finish

After applying float finish, trowel shall be applied first then concrete shall be consolidated by hand or power-driven trowel. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coating or floor coverings.

900.3.12.3 Concrete Rubbed Finish

After removal of forms, the rubbing of concrete shall be started as soon as its condition will permit. Allow the concrete to cure before the final rubbing with a fine carborundum stone and water. The concrete shall be kept damp while rubbing. This rubbing shall be continued until the entire surface is of smooth texture and uniform color.

After the final rubbing is completed and the surface has dried, it should be rubbed with burlap to remove loose powder and shall be left free from all unsound patches, paste, powder and objectionable marks. Surface coating of cementitious material which adds thickness to the original surface is not acceptable.

900.3.13 Curing Concrete

900.3.12.1

All newly placed concrete shall be cured in accordance with this Specification, unless otherwise directed by the Engineer. The curing method shall be one or more of the following:

1. Water Method

The concrete shall be kept continuously wet by the application of water for a minimum period of 7 days after the concrete has been placed.

The entire surface of the concrete shall be kept damp by applying water with an atomizing nozzle. Cotton mats, rugs, carpets, or earth or sand blankets may be used to retain the moisture. At the expiration of the curing period the concrete surface shall be cleared of the curing medium.

2. Curing Compound

Surfaces exposed to the air may be cured by the application of an impervious membrane if approved by the Engineer.

The membrane forming compound used shall be practically colorless liquid. The use of any membrane-forming compound that will alter the natural color of the concrete or impart a slippery surface to any wearing surface shall be prohibited. The compound shall be applied with a pressure spray in such a manner as to cover the entire concrete surface with a uniform film and shall be of such character that it will harden within 30 min after application. The amount of compound applied shall be ample to seal the surface of the concrete thoroughly. Power-operated spraying equipment shall be equipped with an operational pressure gauge and means of controlling the pressure.

The curing compound shall be applied to the concrete following the surface finishing

operation immediately after the moisture sheen begins to disappear from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any delay, in the application of the curing compound, which results in any drying or cracking of the surface, application of water with an atomizing nozzle as specified under "Water Method", shall be started immediately and shall be continued until the application of the compound is resumed or started, however, the compound shall not be applied over any resulting free-standing water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures, the damaged portion shall be repaired immediately with additional compound.

Curing compound shall not be diluted or altered in any manner after manufacture. At the time of use, the compound shall be in a thoroughly mixed condition. If the compound has not been used within 120 days after the date of manufacture, the Engineer may require additional testing before the use to determine compliance to requirements.

An anti-setting agent or a combination of anti-setting agents shall be incorporated in the curing compound to prevent caking.

The curing compound shall be packaged in clean barrels or steel containers or shall be supplied from a suitable storage tank located on the site. Storage tank shall have a permanent system designed to completely redisperse any settled material without introducing air or any other foreign substance. Containers shall be well-sealed with ring seals and lug type crimp lids. The linings of the containers shall be of a character that will resist the solvent of the curing compound. Each container shall be labeled with a manufacturer's name, specification number, batch number, capacity and date of manufacture, and shall have label warning concerning flammability. The label shall also warn that the curing compound shall be well-stirred before use. When the curing compound is shipped in tanks or tank trunks, a shipping invoice and Material Safety Data Sheet (MSDS) shall accompany each load. The invoice and MSDS shall contain the same information as that required herein for container labels.

Curing compound may be sampled by the Engineer at the source of supply and/or on the site.

3. Waterproof Membrane Method

The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed until the concrete has set, after which a curing membrane of waterproof paper or plastic sheeting shall be placed. The curing membrane shall remain in place for a period of not less than 72 h.

Waterproof paper and plastic sheeting shall conform to the specification of AASHTO M 171, Standard Specification for Sheet Materials for Curing Concrete.

The waterproof paper or plastic sheeting shall be formed into sheets of such width as to cover completely the entire concrete surface.

All joints in the sheets shall be securely fastened together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 100 mm.

The sheets shall be securely weighed down by placing a bank of earth materials on the edges of the sheets or by other means satisfactory to the Engineer.

Should any portion of the sheets be broken or damaged within 72 h after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly fastened in place.

Sections of membrane which have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used

4. Forms-in-Place Method

Formed surfaces of concrete may be cured by retaining the form-in-place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 50 cm in least dimensions, the forms shall remain in place for a minimum period of 5 days. Wooden forms shall be kept wet by watering during the curing period.

900.3.13.2

The application for curing method shall be one or more of the following:

1. Curing Cast-In-Situ Concrete

All newly placed concrete for cast-in-situ structures, shall either be cured by the water method, the forms-in-place method, or as permitted herein, by the curing compound method, all in accordance with the requirements of Subsection 900.3.13, Curing Concrete.

The curing compound method may be used on concrete surfaces which are to be buried under ground and surfaces where only Ordinary Surface Finish is to be applied and on which a uniform color is not required, and which will not be visible from public view.

When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surface being cured by the curing compound method or by the forms-in-place method until the Engineer determine that a cooling effect is no longer required.

900.3.14 Acceptance of Concrete

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

Concrete deemed to be not acceptable using the above criteria may be rejected unless the 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 T 24, Standard Method of Test for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete (ASTM C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete. Concrete in the area represented by the cores will be deemed acceptable if the average of cores is equal to or at least 85% and no sample core is less

than 75% of the specified strength otherwise it shall be rejected.

900.4 Method of Measurement

The quantity of concrete to be paid shall be the number of cubic meters placed and accepted in the completed structure. No deduction will be made for the volume occupied by the pipe less than 101 mm outside diameter nor for reinforcing steel, anchors, weephole(s) or expansion materials.

900.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 900.4, Method of Measurement shall be paid for at the Contract Unit Price for each of pay item listed below that is included in the Bill of Quantities of structural concrete and/or reinforced concrete completed in place will be paid for at the contract unit price for cubic meter as indicated on the Bid Schedule

Payment shall be made under:

Pay Item Number	Description	Unit of Measurements
900 (1)c	Structural Concrete, Class A, 3000 psi, 28 days	Cubic Meter

ITEM 902 - REINFORCING STEEL

902.1 Description

This Item shall consist of furnishing, cutting, bending, fabricating, welding, and placing of steel reinforcement with or without epoxy coating of the type, size, shape and grade required in accordance with this Specification and in conformity with the requirements shown on the Plans.

902.2 Material Requirements

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

Table 902.1 Reinforcing Steel Bars Requirements

Type of Reinforcing Steel	Specification
Deformed Billet Steel Bars for Concrete Reinforcement	AASHTO M 31M, Standard Specification for Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement

	ASTM A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
	PNS 49, Philippine National Standard, Steel Bars for Concrete Reinforcement - Specification
Deformed Steel Wire for Concrete Reinforcement	AASHTO M 336M, Standard Specification for Steel wire and Welded Wire, Plain and Deformed, for Concrete Reinforcement (ASTM A1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete)
Welded Steel Wire Fabric for Concrete Reinforcement	ASTM A1064M Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
Cold-Drawn Steel Wire for Concrete Reinforcement	AASHTO M 336M, Standard Specification for Steel Wire and Welded Wire, Plain and Deformed, for Concrete Reinforcement (ASTM A1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete)
Fabricated Steel Bar or Rod Mats for Concrete Reinforcement	AASHTO M 54M, Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement (ASTM A184M, Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement)
Welded Deformed Steel Wire Fabric or Concrete Reinforcement	AASHTO M 336M, Standard Specification for Steel Wire and Welded Wire, Plain and Deformed, for Concrete Reinforcement (ASTM 1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete)
Low Alloy Steel Deformed Bars for Concrete Reinforcement	ASTM A706M, Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement

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

Dowel and tie bars shall conform to the requirements of AASHTO M 31 (ASTM A615)/PNS 49 except that rail steel shall not be used for tie bars that are to be bent and re-straightened during construction. Tie bars shall be deformed bars. Dowel Bars shall be plain round bars. They shall be free from burning or other deformation restricting slippage in the concrete. Before delivery to the site of the work, a minimum of 1/2 the length of each dowel bar shall be painted with one coat of approved lead or tar paint.

The sleeves for dowel bars shall be metal of an approved design to cover 50 mm, plus or minus 6.3 mm of the dowel, with a closed end, and with a suitable stop to hold the end of

the sleeve at least 25 mm from the end of the dowel bar. Sleeves shall be of such design that they do not collapse during construction.

902.2.1 Wire Rope or Wire Cable

The wire rope or wire cable shall conform to the requirements of AASHTO M30, Standard Specification for Zinc-Coated Steel Wire Rope and Fittings for Highway Guardrail for the specified diameter and strength class.

902.2.2 Prestressing Reinforcing Steel

Prestressing reinforcing steel shall conform to the requirements of the following specifications:

High-tensile wire: AASHTO M 204M, Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete ASTM A241M, Standard Specification for Stress-Relieved Steel Wire for Prestressed Concrete

High Tensile Wire strand or rope: AASHTO M 203 M, Standard Specification for Steel Strand, Uncoated Seven-Wire for Concrete Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete.

High-tensile-strength alloy bars shall be cold stretched to a minimum of 895.7 MPa. The resultant physical properties shall be as follows:

Physical Property	Requirement
Minimum Ultimate Tensile Strength	1000 MPa followed by stress relieving
Minimum Yield Strength, measured by the 0.7% extension under load method	895.7 MPa
Minimum Modulus of Elasticity	25,000,000
Minimum Elongation in 20 bar diameters after rupture	4%
Diameter Tolerance	0.254 mm to 0.762 mm

If shown on the Plans, Type 270 K strand shall be used, conforming to AASHTO M 203M.

Where strands are to be used for post-tensioning, the same 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 bars for post-tensioning shall be proofstressed to 90% of the granted tensile strength. After proofstressing, the bars shall conform to the following minimum properties:

Table 902.3 Minimum Requirements for High Strength Alloy Steel Bar for Post-

Tensioning

Property	Requirement
Tensile Strength, fs'	1000 MPa
Yield Strength (0.2 offset)	0.90 fs'
Elongation at Rupture in 20 diameter	4%
Reduction of Area at Rupture	25%

902.3 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

1. Steel Reinforcement

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. Bars shall be bent around a circular pin having the following diameters (D) in relation to the nominal diameter of the bar (d) as shown in Table 902.5.

Table 902.5 Pin Diameter for Bending Bars

Nominal Diameter (d), mm	Pin Diameter (D)
10 to 20	6d
25 to 28	8d

32 and greater	10d
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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 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 300 mm in each direction, 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 6 mm. 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 as required by the Engineer, the minimum distance between bars shall be 40 mm. Reinforcement in any member shall be placed and then inspected and approved by the Engineer before the placing of concrete begins. Concrete reinforcement placed in violation of this provision shall be rejected and removal shall be required unless otherwise structural integrity of the structure was proved adequate by the contractor in writing and approved by the engineer. If fabric reinforcement is shipped in rolls, it shall be straightened before being placed. Bundled Bars shall be tied together at not more than 1.80 m 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 not be staggered as far as possible and with a minimum separation of not less than 40 bar diameters.

Bars shall be lapped in accordance to Table 902.6.

Table 902.6 Bars Minimum Lap Distance

Splice Type	Grade 280 (40)	Grade 420 (60)	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 $1 \frac{1}{3}$ 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. Spiral reinforcement shall be spliced by lapping at least 1 ½ turns or by butt welding unless otherwise shown on the plans.

Splicing shall conform to the following requirements unless otherwise shown on the Plans.

1. Lap splices shall not be permitted for bars larger than 36 mm Ø.
2. For contact lap splices, minimum clear spacing between the contact lap splice and adjacent splices or bars shall be in accordance with the requirements below.
 - a. For parallel non-prestressed reinforcement in a horizontal layer, clear spacing shall be at least the greatest of 50 mm, nominal diameter of bar (d_b) and $(4/3)$ nominal maximum size of coarse aggregates (d_{agg}).
3. For non-contact splices in flexural members, the transverse center-to-center spacing of spliced bars shall not exceed the lesser of one-fifth the required lap splice length and 150 mm.
4. Lap splices of bundled bars shall be in accordance with the requirements below.
 - a. Lap splices of bars in the bundle shall be based on the lap splice length required for the individual bars within the bundle.
 - b. Individual bar splices within a bundle shall not overlap.
 - c. Entire bundles shall not be lap spliced.

902.3.7 Welding

Welding of reinforcing steel bars shall conform to American Welding Society, AWS D1 4M, Structural Welding Code - Reinforcing Steel.

For Steel Bars conforming to ASTM A706, Standard Specification for Deformed and Plain Low-Alloy Steel Bars for concrete reinforcement the bars can be welded without preheating. Steel bars conforming to ASTM A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement shall be preheated to 260⁰ C.

After completion of welding on epoxy-coated bars, the damaged areas shall be repaired using patch materials conforming to ASTM A47M, Standard Specification for Ferritic Malleable Iron Castings.

902.4 Method of Measurement

The quantity of reinforcing steel to be paid for will be the final quantity placed and accepted for the completed structure as shown on the plans.

902.5 Basis of Payment

The accepted quantity, measured as prescribed in Section 902.4, Method of Measurement

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 shall be made under:

Pay Item Number	Description	Unit of Measurement
902 (1) a	Reinforcing Steel Bar (Deformed) Grade 40	Kilograms

ITEM 903 - FORMWORKS AND FALSEWORKS

903.1 Description

This item covers the furnishing, fabrication, installation, erection, and removal of forms and falseworks for cast-in-place concrete.

903.2 Material Requirements

Forms shall be constructed with metal or timber. For timber forms, it is important that the moisture content of the timber that will be used to make the formwork between 15% to 20%. Low Moisture content means the timber is very dry thus can absorb moisture from the wet concrete resulting in swelling and bulging of timber and weak hardened concrete. Use of tough resin as wood coating is the treatment used to overcome the moisture problem in timberworks though painting wood with varnish is an alternative cheaper treatment. Forms for surfaces which will be exposed to view when construction is completed shall be prefabricated plywood panel forms, job-built plywood forms, or forms that are lined with plywood or fiberboard.

For metal forms, it is important that the metal used as sheathing should be free from rust and nonreactive to concrete or concrete containing calcium oxide. Plywood lined forms will not be required for surfaces which are normally submerged or not ordinarily exposed to view. Other types of forms, such as steel or unlined wooden forms, may be used for surfaces which are not restricted to plywood or lined forms, and may be used as backing for form linings. Forms are required above all extended footings.

903.3 Construction Requirements

903.3.1 General

Forms shall be furnished, fabricated, installed, erected, and removed as specified herein and shall be of a type, size, shape, quality and strength to produce hardened concrete having the shape, lines and dimensions indicated on the drawings. The forms shall be true to line and grade in accordance with the tolerances as specified for cast-in-place concrete and shall be mortar tight and sufficiently rigid to resist deflection during concrete placement. The surface of forms shall be smooth and free from

irregularities, dents, sags, and holes that would deface the finished surfaces.

The minimum thickness used for metal forms remain true to shape. For timber formworks plywood is used for sheathing with a minimum thickness of 18 mm to 25 mm though the thickness of the plywood to be used will depend on the pressure that wet concrete will put on the formwork. The design of formwork will specify the thickness of the plywood that will be incorporated in the project. All tie bars with bolts used in fastening forms should be countersunk to a depth similar to the required concrete covering and patched with cement mortar. The use of approved internal steel ties or steel or plastic spacers shall be permitted. The fabricated spacer blocks shall have an embedded No. 16 G.I Tie Wire with sufficient length to be attached to the reinforcing steel bars to hold the spacers in place after closure of forms and during pouring, Structural steel tubes used as support for forms shall have a minimum wall thickness of 4mm.

The design and construction of formworks and falseworks, shall be the responsibility of the Contractor and for the approval of the Engineer. The Contractor shall employ competent professional engineering services to design forms to be approved by the Engineer and supervise the erection of all formworks needed for the completion of the project. All materials to be incorporated to the site shall be inspected and approved by the Engineer.

903.3.2 Fabrication and Erection

Formworks to be used shall conform to ACT 347 – Guide to Formwork for Concrete, Forms shall be substantial and sufficiently tight to prevent leakage of mortar. Forms shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement. Walers, studs, internal ties, and other form supports shall be sized and spaced so that proper working stresses are not exceeded, Joints in forms shall be bolted tightly and shall bear on solid construction. Forms shall be constructed so they can be removed without hammering, wedging, or prying against the concrete. Form ties shall be approved by the Engineer and shall be of the snap cone or she-bolt with cone type. The spacing of form ties shall be designated to withstand concrete pressures without bulging, spreading, or lifting of the forms. The forms shall produce finished surfaces that are free from offsets, ridges, waves and concave or convex areas. Forms to be reused shall be thoroughly cleaned and repaired. Split, frayed, delaminated or otherwise damaged forms shall not be used. All form panels shall be placed in a neat, symmetrical pattern with level and continuous horizontal joints, The contractor shall place special attention on mating forms to previously placed walls so as to minimize steps or rough transitions. Form panels shall be of the largest practical size to minimize joints and to improve rigidity which is to be designated by the formworks engineer of the Contractor. For engineered wood, available panels sizes of 1.20 m x 2.70 m and 3.00 m x 2.40 m can be ordered. Beams and slabs supported by the concrete columns shall be formed in a way that column forms can be removed without disturbing the supports of the beams or slabs.

Wherever the top of a wall will be exposed to weathering, the forms on a least one side shall not extend above the top of the wall and shall be brought to true line and grade. At other locations, forms for concrete which is to be finished to a specified elevation, slope or contour, shall be brought to a true line and grade, or a wooden guide strip shall be provided at the proper location on the forms so that the top surface can be finished with

screed or template. At horizontal construction joints walls, the forms on one side shall not extend more than 7 m above the joints.

When necessary temporary openings shall be provided at the bottom of column and wall forms and other points in order to facilitate cleaning and inspection prior to concrete placement. Unless otherwise shown on the drawing, all salient corners and edges of beams, columns, walls, slabs, and curbs shall be provided with a 25 mm x 25 mm chamfer formed by a wood or metal chamfer strip.

Forms exposed surfaces and all steel forms shall be coated with non-staining form release agent which shall be applied just prior to replacement of steel reinforcement. After coating with industrial lubricants such as form oil, any surplus release coating on the form surface shall be removed. Wood forms for unexposed surfaces may be thoroughly wetted with water in lieu of coating with industrial lubricant immediately before concrete placement, except in freezing weather form release coating shall be used. Should misalignment of forms or screeds, excessive deflection of forms, or displacement of reinforcement occur during concrete placement, immediate corrective measures shall be taken to ensure acceptable lines and surface to required dimensions and across sections. If any forms bulge or show excessive deflection, in the opinion of the Engineer, the concrete shall be removed and the forms shall be rebuilt and strengthened.

903.3.2.1 Foundations for Formworks

Proper foundations on ground, such as mudsills, spread footings, or pile footings should be provided, If soil under mudsills is or may become incapable of supporting superimposed loads without appreciable settlement, it should be stabilized or other means of support should be provided.

903.3.3 Safety

Forms must be strong sound (made of good quality and durable material in order to carry the full load and side pressure form freshly placed concrete. To ensure that forms are safe, correctly designed and strong enough for the expected load, Occupational Safety and Health Administration (OSHA) regulations under Section 1926.703 Safety and Health Regulations for Construction, American Concrete Institute 347 (ACI 347) – Guide to Formworks recommendations under Section 3.1 Safety Precautions in Construction and Section 3.2 Construction Practices and Workmanship, and local code requirements for formwork should be followed.

903.3.4 Delivery, Storage, Maintenance and Handling

Any formwork with steel components should be stored in a dry place. Avoid direct sunlight on timber forms. Store form materials and accessories above ground with a minimum height of 100 mm on framework or blocking without twist or bend, and shall be covered with a suitable waterproof covering providing adequate air circulation and free from dirt. Store and handle form coating to prevent contamination in accordance with manufacturers recommendation. For maintenance of the forms, use stiff brush and clean water for cleaning of forms. Use scrapers only as a last resort for maintenance purposes. Keep forms well-oiled to prevent delamination of plywood or rusting of steel and always oil the edges.

903.3.5 Removal of Forms

Forms, falseworks and centering shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and the loads, or until the concrete has attained the minimum percentage of specified design strength listed in the Table below. Shoring beneath beams or slabs shall be left in place and reinforced as necessary to carry any construction equipment or materials placed thereon.

No forms shall be removed without the approval of the Engineer. In general and under normal conditions, the Engineer will approve removal of forms after the following time has elapsed:

Description of Structural Member	Period of Time (days)	Minimum % if Design Strength
Walls, column and vertical sides of beams	1 to 2	70%
Beam soffits (steel formwork props/shorting left under)	7	80%
Soffits of slabs (steel formwork props/shoring left under)	7	70%
Removal of steel formwork props/shoring to slabs: Soffits of slabs, for slabs spanning over 4.5 m	7	70%
Removal of steel formwork props/shoring to slabs: Soffits of slabs, for slabs spanning over 4.5 m	14	70%
Removal of steel formwork props/shoring to beams and arches Centering under girders, beam frames and arches spanning up 6.0 m	14	80%
Removal of Steel formwork props/shoring to beams and arches: Centering under girders, beam frames and arches spanning over 6.0 m	21	80%

Order and method of removing formwork:

1. Shuttering forming the vertical faces of walls, beams and columns sides shall be removed first as they bear no load but only retain the concrete.
2. Shuttering forming soffit of slabs shall be removed next.
3. Shuttering forming soffit of beams, girders or other heavily loaded shuttering shall be removed in the end.

Care shall be taken into consideration during the removal to avoid surface gouging, corner or edge breakage, or other damage to the concrete.

Immediately after form removal, any damaged or imperfect work shall be repaired as

specified by the Engineer.

903.3.6 Quality Control and Inspection

Materials and components used for formworks shall be examined for damage or excessive deterioration before use. Reuse of forms shall be allowed only if found suitable after necessary repairs. In case of timber forms, the inspection shall not only cover physical damages but also signs of attacks by decay, rot or insect attack or the development of splits. Reuse of job-built forms shall be permitted only when specifically approved by the Engineer.

The Engineer shall inspect the completed formwork, before carrying out any work, including fixing of reinforcing support.

903.4 Method of Measurement

Forms installed for cast-in-place concrete according to shop drawings and design calculations shall be measured in square meters. The Pay Item will include all materials and components used for furnishing, fabrication, installation, erection and removal forms. The quantity to be paid for shall be the square meters of formwork used and accepted by the Engineer.

903.5 Basis Payment

The quantity measured as prescribed above shall be paid for at the Contract Unit Price bid for the pay item listed below that is included in the Bill of Quantities. This unit price shall cover full compensation for all materials, labor, tools, equipment, and related services necessary for the design, construction and removal of formwork and falsework. Properly supported members as required until the concrete is cured, set and hardened is also part of the Contract Unit Price.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
903 (2)	Formworks and Falseworks	Square Meter

PART E - FINISHING AND OTHER RELATED ITEM

ITEM 1034 - DAMPPROOFING

1034.1 Description

This Item shall consist of furnishing all dampproofing materials on concrete surfaces, labor, tools, equipment and other facilities and undertaking the proper installation works in accordance with the Plans and this Specification

1034.2 Material Requirements

1034.2.5 Polyethylene Sheet

Polyethylene (Polythene) sheet shall be used over bitumen painter surface where specified and shall consist of 0.13 mm thick polythene sheet (500 gauge) complying with ATM D2103, Standard Specification for Polyethylene Film and Sheeting.

1034.3 Construction Requirements

Dampproofing coating shall not be used if the concrete surface involve was subjected to a continuous or even an intermittent head of water. Drainage system shall be provided to prevent development of such a head. Dampproofing coating shall not be used to bridge or seal cracks, so that if cracks are present or will develop later, dampproofing will not be effective.

1034.3.1 Surface Preparation

The surface preparation shall be in accordance whenever applicable with Subsection 1016.3.1 Surface Preparation.

Prior to the application of a barrier material, it is generally considered necessary to test for adequacy of surface preparation. Before dampproofing, the surface shall be inspected and approved by the Engineer.

1034.3.2 Release Agents on Forms

Release agents on forms, such as oil, wax, grease and silicone, which will transfer to the concrete surface during placement, shall not be used if a damping barrier system will be applied later. Trademark paint systems approved by the Engineer applied to forms and formulated to prevent contamination of the concrete surface shall be used.

1034.3.3 Tests for Surface Quality Prior to Application

The quality of the concrete surface is an important factor affecting adhesion of damping barrier systems. Tests for cleanliness and dryness of the surface shall be conducted prior to dampproofing the surface. The number of tests and the areas to be tested shall be as directed by the Engineer.

1034.3.3.1 Cleanliness of Surface

In a dusty condition, wipe the surface with a dark cloth. If white powder sticks to the cloth, the surface is considered to be too dusty and therefore unsatisfactory to receive a damping system.

On an only condition, sprinkle water on the dried concrete surface. If the water spreads out immediately instead of standing as droplets, it may be concluded that the surface is not contaminated by oils or dust. The test will not reveal the presence of other surface contaminants such as carbonates and alkalies.

The pH of the concrete shall be tested in accordance with ASTM d4252, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces. A pH below four (4)

shall be considered unacceptable.

1034.3.3.2 Dryness of Surface

In cases where there is a question about the moisture content, evaluate the concrete in accordance with ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method, or other suitable test procedures and treatment in accordance with the surfacing manufacturer's recommendations.

1034.3.4 Ambient Conditions Prior to Application

Dampproofing should be applied in the afternoon after the concrete surface had been exposed to the sun and air for at least 6 h.

1034.3.5 Application

The work shall be done by workmen experience in the application of dampproofing and the Contractor shall coordinate dampproofing operations with other phases of the work to prevent staining or damaging finished work. The Contractor shall repair or replace damaged finished work to the satisfaction of the Engineer. Dampproofing shall be applied as shown on the Plans.

Curing concrete or masonry surface shall be in accordance with Subsection 900.3.13, Curing concrete of Item 900, Structural Concrete except for the use of liquid membrane curing compound. Allow the concrete surface to dry at least 10 days after completion of curing. Apply damp proofing material to a dry, clean, reasonably smooth surface that is free of dust and loose materials.

Damp proofing shall not be applied when the ambient temperature or the concrete temperature is below 7.2 °C, unless the Engineer specifically allows.

Apply a single layer of polyethylene sheet 0.13 mm thick (500 gauge) on dampproof course (generally applied at basement levels which restricts the movement of moisture through walls and floors) or as specified. The polyethylene sheet shall be place in such a way to ensure proper bond with the asphalt layer.

1034.4 Method of Measurement

This Item shall be measured in square meters for areas actually applied with damp proofing materials and accepted by the Engineer.

1034.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 1034.4, Method of Measurement shall be paid for at the Contract Unit Price for Dampproofing work which price and payment shall be full compensation for furnishing and applying dampproofing materials including the use of equipment and tools, labor and incidentals necessary to complete the work.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1034(1)b	Dampproofing, Polyethylene Sheet	Square Meter

ITEM 1000 - TERMITE CONTROL WORK

1000.1 Description

This Item shall consist of furnishing and applying termite control chemicals, including the use of equipment and tools in performing such operations in accordance with this Specification.

1000.2 Material Requirements

Termite control chemicals or toxicants shall be able to immediately exterminate termites or create barriers to discourage entry of subterranean termites into the building areas. Chemical or toxicants to be used shall be in accordance with the governing laws and the manufacturer shall be accredited by the Department of Health through Food and Drug Administration (FDA). The toxicants may be classified into the following types and according to use:

Type I. Liquid Termicide Concentrate

This type of toxicant shall be specified for drenching soil beneath foundations of proposed buildings. The concentrate shall be diluted with water in the proportion of 1 L of concentrate material to 65 L of water or as specified by the manufacturer.

Type II. Liquid Termicide Ready Mixed Solution

This type of toxicant which comes in ready mixed solution shall be used as wood preservative by drenching wood surfaces to the point of run-off.

Type III. Powder Termicide

This type of toxicant shall be applied to visible or suspected subterranean termite mounds tunnels where termites are exterminated through Trophallaxis method (exchange or nourishment between termites while greeting each other upon meeting).

1000.3 Construction Requirements

Before any termite control work is started, thorough examination of the site shall be undertaken by the Contractor so that the appropriate method of soil poisoning can be applied.

The Contractor shall coordinate with other related trades through the Engineer to avoid delay that may arise during the different phases of application of the termite control chemicals.

This work shall be done by trained personnel with a minimum two (2) years' experience

for proper execution of the work of this Specification.

1000.3.1 Soil Poisoning

There are two (2) methods usually adopted in soil poisoning which are as follows. Other methods as recommended by the manufacturers and approved by the Engineer may also be used.

1. Cordoning

This method is usually adopted when there is no visible evidence of termite infestation. Trenches in concentric circles, squares or rectangles are dug 150 mm to 220 mm wide and at least 1 m apart and applied with Type I working solution at the rate of 8 L/1.m within the cordoned area.

2. Drenching

When soil shows termite infestation, this method shall be applied. The building area shall be thoroughly drenched with Type I working solution at the rate of 24 L/m².

1000.3.2 Surface Preparation

All organic matter, construction debris, rubbish, etc. which could decrease effectiveness of treatment on areas to be treated shall be removed. Water logged foundations shall be treated after drying when the soil is absorbent. For low penetration and sloping sites, surface to be scarified shall be 75 mm deep. Cutting, excavation, leveling and grading shall be completed before starting treatment. Loosen, rake and level soil to be treated, except previously compacted areas under slabs and foundations.

1000.3.3 Application

Before the application of soil treatment, the Contractor shall coordinate with the Engineer prior to excavating, filling, grading and concreting works

At the time soil poisoning is to be applied, the soil to be treated shall be in friable condition with low moisture content so as to allow uniform distribution of the toxicant agents. Toxicant shall be applied at least 12 h prior to placement of concrete which shall be in contact with treated materials.

Treatment of the soil on the exterior sides of the foundation walls, grade beams and similar structures shall be done prior to final grading and planting or landscaping work to avoid disturbance of the toxicant barriers by such operations.

Areas to be covered by concrete slab shall be treated before placement of granular fill used as capillary water barrier at a rate of 12 L/m² with Type I working solution after it has been compacted and set to required elevation. Additional treatment shall be applied as follows:

1. In critical areas, such as utility openings for pipes, conduits and ducts, apply additional treatment at the rate of 6 L/l.m. in a strip 150 mm to 200 mm wide.

2. Along the exterior perimeter of the slab and under expansion joint, at the rate of 2.5 L/l.m. in a strip 150 mm to 200 mm wide in a shallow trench.

Apply an overall treatment under the entire building slab, and moving strips adjacent to the building. Treat sidewalks or other such paved areas abutting the building for a distance not less than 1 m from the building. Apply along each side of foundation walls and at penetrations through slabs such as pipes, ducts, etc. apply at application rate of 5 L per linear meter around the perimeter of the building.

Post signs in areas of application to warn workers that soil termicide treatment has been applied. Remove signs when areas are covered by other construction.

1000.3.4 Wood Protection

Where the application of wood preservative is necessary, the Contractor shall use Type II working solution as recommended by the manufacturer.

All wood materials not pressure treated as specified in Item 1003, Carpentry and Joinery shall be treated with Type II ready mixed solution as herein called for or as directed by the Engineer.

Wood treatment shall be applied after framing, sheathing, and exterior weather protection is completed but before the electrical and mechanical systems are installed.

1000.3.5 Powder Termicide

When powder termicide is to be applied to eradicate subterranean termites, extreme caution and care shall be done at the time of application. It shall not be allowed to enter drains, waterways, streams or rivers. It shall not be used if rain is expected to occur within 48 h of application. All heating and air conditioning ducts, air vents, floor drains, and edible plants shall be covered prior to application of powder termicide.

1000.3.6 Delivery, Storage and Handling

Deliver termiticides to the project site in sealed and labeled containers in good condition as supplied by the manufacturer. Store, handle and use termiticides in accordance with manufacturer's labels. Labels shall bear evidence of registration and Material Safety Data Sheet (MSDS) shall also be provided.

1000.3.7 Safety Requirements

Formulate, treat and dispose of termiticides and their containers in accordance with label directions. Draw water for formulating only from sites designated by the Engineer and fit the filling hose with backflow preventer meeting local plumbing codes or standards. The filling operation shall be under the direct and continuous observation of the Contractor to prevent overflow. Secure pesticides and related materials under lock and key when unattended. Ensure that proper protective clothing and equipment are worn and used during all phases of termiticide operation.

Disposal of used pesticide containers off the project site shall comply with the latest

requirements of DENR Administrative Order for Revised Procedures and Standards for Management of Hazardous Waste, Material Safety Data Sheet (MSDS) shall also be strictly followed.

1000.3.8 Warranty

Upon completion and acceptance of the work, the Contractor shall furnish the Engineer a written guarantee stating that termite control is guaranteed for a minimum period of three (3) years and annual inspections or as requested by the Engineer shall be done by both the Contractor and Engineer to ensure the quality of their work.

1000.4 Method of Measurement

Liquid termite control chemicals or toxicants shall be measured by actual number of liters used in the cordoning and drenching of lot areas and soil poisoning of granular fill or actual number of liters used in drenching wood surfaces, while powder chemical/toxicant shall be measured by kilograms applied to suspected subterranean termite mounds and tunnels. The quantity to be paid for shall be determined and accepted by the Engineer.

1000.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 1000.4, Method of Measurement shall be paid for at the Contractor Unit Price for Termite Control Work which price and payment shall be full compensation for furnishing and applying termite control chemicals including the use of equipment and tools, labor and incidentals necessary to complete the work prescribed in this Item.

Payment shall be made under:

Pay Item Number	Description	Unit Of Measurement
1000 (1)	Soil Poisoning	Liter

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 which include all pipings, gutters, canals, catch basins, junction boxes, handholes, manholes and other appurtenant structures, and sewerage system which include all sanitary sewer piping and septic vault/tank where no public sewer exist, from the building to the point of discharge.

1001.2 Material Requirements

1001.2.1 Storm Drainage System

Materials for storm drainage system shall meet the requirements specified in the following Standard Specifications:

Material	Standard
Portland Cement	ASTM C150M, Standard Specification for Portland Cement
Fine and Coarse Aggregate	ASTM C33M, Standard Specification for Concrete Aggregates
Reinforcing Steel	ASTM A615M, Standard Specification for Reinforcing Steel
Polyvinyl Chloride (PVC) (For conductors and downspouts)	ASTM D2729, Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
	AASHTO M 278, Standard Specification for Class PS46 Polyvinyl Chloride (PVC) Pipe
	AASHTO M 304, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
	PNS 1950:2003, Plastic Piping Systems for Soil and waste Discharge (low and high temperature) inside buildings - Unplasticized Poly(Vinyl Chloride) (PVC-U)

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 Sewerage System

Materials for sewerage system shall meet the requirements specified in the following Standard Specifications:

Material	Standard
Pig Lead (for securing and sealing joints)	ASTM B29, Standard Specification for Refined Lead
PVC Pipes and Fittings (where called in Plans)	ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
	PNS 1950:2003, Plastic Piping Systems for Soil and waste Discharge (low and high temperature) inside buildings - Unplasticized Polyvinyl Chloride (PVC-U)
Solvent Cement (for Securing PVC joints)	ASTM D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

Where PVC pipes and fittings are used, joints shall be secured with rubber "O" ring or solvent cement, as the case may be.

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.

1001.2.3 Structure Materials

All storm drainage structures such as manholes, inlets, junction boxes and catch basins shall be constructed of either brick, solid block or precast concrete.

1. Clay Brick shall be solid, rough, sound clay brick conforming to ASTM C32, Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale). The brick shall be laid with full shove joints, filling up the joints with mortar. The thickness of the joints shall not exceed 9.53 mm.
2. Concrete Block or brick shall be solid and conforms to ASTM C139, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes as to design and manufacture. The block or brick shall be embedded in a mortar bed to form a 12.70 mm mortar joint.
3. Precast concrete manhole shall conform to ASTM C478, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections. Fabricate precast concrete manhole to the sizes indicated on the Plans.
4. Concrete for drainage structures shall meet the applicable requirements of Item 900, Structural Concrete.

1001.2.4 Frames, Covers and Gratings

Metal units shall conform to the Plan dimensions and to the following specification requirements for the designated materials:

Material	Standard
Reinforcing Steel	ASTM A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
	AASHTO M 31M, Standard Specification for Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement

Samples of the material in casting shall be taken during the casting of the units and shall be separate casting poured from the same material as the casting they represent.

Metal gratings and covers which are to rest on frames shall bear on them evenly. They shall be assembled before shipment and so marked that the same pieces may be reassembled readily in the same position when installed. Inaccuracy of bearings shall be corrected by machining, if necessary. A frame and grating or cover to be used with it shall constitute one (1) pair.

All castings shall be uniformly coated with asphalt-based emulsion meeting the requirements of ASTM D1187, Standard Specification for Asphalt – Base Emulsion for Use

in Protective Coating for Metal.

1001.2.7 Septic Tank

1. Materials used in constructing a septic tank shall be in accordance with the latest Unified Plumbing Code of the Philippines.
2. The minimum wall thickness of a steel septic tank shall be 2.77 mm and each Such tank shall be protected from corrosion both externally and internally by an approved bituminous coating or by other acceptable means.
3. Septic tanks Constructed of alternate materials shall be permitted to be approved by the Engineer in accordance with approved application standards. Wooden septic tanks shall be prohibited

Sizes, dimensions, reinforcing, structural calculations and such other pertinent data as required for septic tank shall | be indicated on the Plans.

1001.3 Construction Requirements

1001.3.1 Installation of Pipes

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

1. Bedding

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

2. 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 with the caulking and shall not affect the water tightness of the joint.

No building sewer or other drainage piping or part thereof, which is Constructed of materials other than those approved for use under or within a building, shall be installed under or within 610 mm of any building or structure, or part thereof, not less than 305 mm below the surface of the ground. The provisions of this subsection include structures such as porches and steps, whether covered or uncovered; breezeways; roofed porte-

cocheres; roofed patios; carports; covered walks; covered driveways, and similar structures or appurtenances.

Septic tanks shall have not less than two Compartments or as shown on the Plans.

Warning tape shall be laid above main pipes. The tapes shall be flexible and Subject to the Engineer's approval. Width of the tape should be at least 150 mm. The text on the tape shall be permanent ink bonded to resist prolonged chemical attack by corrosive acids and alkaline with message repeated at a maximum interval of 2 m. The tapes shall be laid 300 mm above the pipeline. The tape shall be continuous over pipelines and at joints there should be a minimum of 1 m over lapping.

3. 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 shall immediately be protected with a cover of wet burlap or wet earth for at least 3 days for curing.

4. 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.

5. Mortar for Joint

Mortar shall be a mixture of Portland cement, sand and water mixed in the proportion by volume of one (1) part cement to two (2) parts of clean sand with just sufficient amount of water for plasticity.

6. 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 20 mm below the rim of the hub or bell and this space be filled with molten pig lead in one (1) 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.

1001.3.3 Sewer Connections and Clean-Outs

1. The outlet of the septic vault shall be connected to the street drain or to other discharge point where 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 purpose may in the discretion of the proper authorities, be allowed not to flow into the sanitary sewer.
2. Clean-outs or rodding holes consisting of cast iron extensions with long Sweep elbow fittings shall be provided at the ends of the runs and at every change of directions. Clean-outs shall be capped with cast t 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 terminate with the same cast brass ferrule with brass plug set in to a concrete slab shall be 150 mm thick and 300 mm square, finish flush with grade.
3. Additional building sewer cleanouts shall be installed at intervals not to exceed 30,480 mm in straight runs and for each aggregate horizontal change in direction exceeding 135 degrees. When a building sewer or a branch there of does not exceed 3,048 mm in length and is a straight-line projection from a building drain that is provided with a clean out, no cleanout will be required at its point of connection to the building drain.

1001.3.4 Septic Tank Construction

Septic tanks shall be constructed in accordance with the Plans and requirements of the latest Uniform Plumbing Code.

1001.3.5 Incidental Earthwork

Incidental earthwork for the storm drainage and sewerage systems, such as excavation and backfilling shall be undertaken in accordance with applicable requirements of Item 803, Structure Excavation.

1001.3.6 Inspection and Quality Control

Materials shall be inspected and accepted as to quality before same are installed. Piping installed in trenches shall first be inspected, tested and approved by the Engineer before these are covered or backfilled. All defects/leaks 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.

1001.3.6.1 Building Sewer Test

Building sewers shall be tested by plugging the end of the building sewer at its points of connection with the public sewer or private sewage disposal system and completely filling the building sewer with water from the lowest to the highest point thereof, or by approved equivalent low-pressure air test. Plastic drain, waste, and vent piping systems shall not be tested by the air test method. The building sewer shall be water-tight at all points.

1001.3.6.2 Testing for Storm Drainage Systems

Except for outside leaders and I perforated or open-jointed drain tile, the piping of storm drain systems shall be tested upon completion of the rough piping installation by water or air, except that p plastic pipe shall not be tested with air, and proved tight.

The Engineer shall be permitted to require the removal of any cleanout plugs to ascertain whether the pressure has reached parts of the system. One of the following test methods shall be used:

1. Water Test

After piping has been installed, the water test shall be applied to the drainage system, either to the entire system or to sections. If the test is applied to the entire system, all openings in the piping shall be tightly closed except for the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening shall be tightly plugged except for the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 3,000 mm head of water. In testing successive sections, not less than the upper 3,000 mm of the next preceding section shall be tested so that no joint of pipe in the building (except the uppermost 3,000 mm of a roof drainage system which shall be filled with water to the flood level of the uppermost roof drain) shall have been submitted to a test of less than a 3,000 mm head of water. The water shall be kept in the system or in the portion under test for not less than 15 min before inspection starts. The system shall then be tight at all points.

2. Air Test

The air test shall be made by attaching an air compressor testing apparatus to any suitable opening after closing other inlets and outlets to the system, forcing air into the system until there is a uniform gauge pressure of 34.5 kPa or sufficient pressure to balance a column of mercury 250 mm in height. This pressure shall be held without introduction of additional air for a period of not less than 15 min.

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/tank shall be measured by the number of units or lump sum, completed and accepted by the Engineer.

Sewer Line works, Storm drainage and downspout and Pipes w/ Fittings connection shall

be measured by lump sum, completed and accepted by the Engineer.

1001.5 Basis of Payment

The quantities as determined in Section 1001.4, Method of Measurement 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(5)b	Catch Basin, CHB	Each
1001(8)	Sewer Line Works	Lump Sum
1001(9)	Storm Drainage and Downspouts	Lump Sum
1001(11)	Septic Tank, CHB	Lump Sum

ITEM 1002 - PLUMBING

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 and fire protection system including installation in accordance with the latest edition of the Revised National Plumbing Code, Uniform Plumbing Code of the Philippines, The Fire Code of the Philippines, The National Building 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.

1002.2.2 Water Supply Pipes and Fittings

1. Pipes shall be galvanized iron pipe schedule 40 conforming to specification requirements defined in ASTM A53M, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless with threaded connection. Under roads where necessary shall suitably protected as shown on the Plans.

Fittings shall be malleable iron Type II, galvanized iron conforming to specification requirements defined in ASTM A338, Standard Specification for Malleable Iron Flanges, Pipe Fittings, and Valve Parts for Railroad, Marine, and Other Heavy Duty Service at Temperatures up to 345°C. Water pipe and fittings with a lead content which exceeds 8% shall be prohibited in piping systems used to convey potable water.

Where required for large diameter pipes (315 mm up to 800 mm) with elastomeric rubber sealed ring, the Oriented Polyvinyl Chloride (PVC-O) Cass 500 shall be in

accordance with the applicable requirements defined in ISO 16422:2014, Pipes and Joints Made of Oriented Unplasticized Polyvinyl Chloride (PVC-O) for the Conveyance of Water under Pressure on ISO 1452:2009, Plastics Piping Systems for Water Supply and for Buried and Above-Ground Drainage and Sewerage Under Pressure – Unplasticized Poly(Vinyl Chloride) (PVC-U).

2. Valves

Valves for water supply shall be bronze body with threaded ends rated 21 kg/cm². 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 B62, Standard Specification for Composition Bronze or Ounce Metal Castings. Globe valves shall have plug type discs with ferrule threaded ends and bronze body. Valves up to and including 51 mm in size shall be brass or other approved materials. Sizes exceeding 51 mm shall be permitted to have cast-iron or brass bodies.

3. Water Meter

Water meter when required to be furnished by the Contractor shall be of the type tested and approved by Metropolitan Waterworks and Sewerage System (MWSS) or Local Water Utilities Authority (LWUA) or any agency/ (ies) accredited by both.

1002.2.3.1 Unplasticized Polyvinyl Chloride (uPVC)- Potable Water

1. Pipes and fittings for water lines and pressure lines shall conform to PNS 65: 1993: - Unplasticized Polyvinyl Chloride (uPVC) Pipes for Potable Water Supply.
2. Pipes and fittings shall be made of materials in its natural state with a medium K-Value, K65 grade resin by mass conforming to specification requirements defined in ASTM D2241, Standard Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
3. Maximum levels of toxic substances shall conform to Table 3 of PNS 65: - Unplasticized Polyvinyl Chloride (uPVC) Pipes for Potable Water Supply.
4. Pipes and fittings for water lines, sizes 20 mm to 63 mm shall be designed for solvent cement jointing connection conforming to specification requirements defined in ASTM D2564, Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Piping Systems.
5. Pipes and fittings for pressure lines, sizes 63 mm and larger shall be designed for manually-installed or machine-installed fixed seal gasket type jointing connection. Gaskets is to be made of Ethylene Propylene Diene Monomer (EPDM) rubber homogeneously bonded to stiff polypropylene (PP) ring or metal reinforced embedded in EPDM rubber gasket.

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.

1. Water closet shall be vitreous China, free standing toilet combination, round front bottom outlet siphonic washdown 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 or unless otherwise specified on the Plans.
2. Plastic toilet bowl shall be a high-quality polypropylene virgin material Composition, complete with integrated parts and other accessories or unless otherwise specified on the Plans.
3. 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.
4. Urinal shall be China vitreous, wall hung wash-out urinal with extended shields and integral flush spreader, concealed wall-hanger pockets, 19 mm top spud complete with fitting and mounting accessories. Model make and color shall be approved by the Engineer.

1002.2.5.1 Prohibited Fixtures

Water closets having an invisible seal or an unventilated space or having walls which are not thoroughly washed at each discharge shall be prohibited. Any water closet that might permit siphonage of the contents of the bowl back into the tank shall be prohibited. Drinking fountains shall not be installed in public toilet rooms.

Trough urinals and urinals with an invisible seal shall be prohibited. Non-Water urinals are an exception.

1002.2.6 Bathroom and Toilet Accessories

1. 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.
2. Grab bars shall be made of tubular stainless steel pipe provided with safety grip and mounting flange.
3. Floor drains shall be made of stainless steel beehive type, measuring 100 mm by 100 mm, and provided with detachable stainless strainer, expanded metal lath type.
4. Toilet paper holder shall be vitreous China wall mounted. Color shall reconcile with the adjacent fixture and facing tiles.

5. Soap holder shall be vitreous China wall mounted. Color shall reconcile with the adjacent tile works.
6. Faucet(s) shall be made of stainless steel for interior use.
7. Hose-bib(s) shall be made of bronze cast finish.

1002.2.9 Fire Protection System

Firestop materials shall be installed in accordance with Uniform Plumbing Code of the Philippines, the National Building Code of the Philippines, Fire Code of the Philippines and the manufacturer's instructions.

1. 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.

1002.2.10 Built-in Appliances

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

1002.3 Construction Requirements

The Contractor before any installation work is started shall carefully examine the Plans and shall investigate actual structural and finishing work condition affecting all 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.

For approved alternate pipes and fittings, installation work shall conform to the approved Plans or manufacturer's recommendation.

1002.3.1 Installation of Soil, Waste, Drain and Vent Pipes

1. All cast iron soil and drainage pipes shall be pitch 6 mm per 300 mm but in no case flatter than 3 mm per 300 mm.
2. 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.
3. 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.
4. 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.

5. 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.

6. 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.

7. 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 degrees 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.

8. All joints of cast iron pipes in bell and spigot shall be firmly packed with oakum or hemp and caulked with peg lead at least 25 mm deep.

9. 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.

10. 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 shall be installed at the foot of soil, waste and drain stacks and on each building drain outside the building.

11. Vent pipe shall be flashed and made watertight at the roof with ferrule lead sheet. Flashing shall be turned down into pipes.

12. 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.

13. Overhead horizontal runs of pipes shall be hung with adjustable wrought iron on 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, PVC-U, HDPE, PPR and ductile iron.

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

2. 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.

3. Mains and Branches

- a. 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.
- b. All piping above the ground shall be run parallel with the lines of the building unless otherwise indicated on the Plans.
- c. All service pipes, valves and fittings shall be kept at sufficient distance from other work to permit finished covering not less than 12.5 mm from such work or from finished covering on the different service.
- d. No water piping shall be buried in floors, unless specifically indicated on the plans and approved by the Engineer.
- e. Changes in pipes shall be made with reducing fittings.

4. 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.

5. 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 (3) threads on the pipe shall remain exposed.

6. Expansion and Contraction Pipes

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

7. Pipe Standpipe System

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

8. Valves and Hose Bibs

- a. Valves shall be provided on all supplied fixture as herein specified.
- b. The cold-water connections to the domestic hot water heater shall be provided with

gate valves and the return circulation connection shall have a gate and a check valve.

- c. All connection to domestic hot water heaters shall be equipped with unions between valve and tanks,
- d. Valve shall not be installed with its stem below the horizontal. All valves shall be gate valves unless otherwise indicated on the Plans.
- e. Valves up to and including 50 mm diameter shall be threaded ends, rough bodies and finished trimmings, except those on chromium plated brass pipe.
- f. Valves 63 mm in diameter and larger shall have iron bodies, brass mounted and shall have either screws or flange ends.
- g. Hose bibs shall be made of brass with 12.5 inlet threads, hexagon shoulders and 19 mm male.

1002.3.3 Fixtures, Equipment and Fastenings

All fixtures and equipment shall be supported and fastened in a safe and satisfactory workmanship as practiced.

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.

Inserts shall be securely anchored and properly flushed into the walls. Inserts shall be concealed and rigid.

Bolts and nuts shall be horizontal and exposed. It shall be provided with washers and chromium plate finish.

1002.3.4 Pipe Hangers, Inserts and Supports

- I. Pipe hangers shall be wrought iron or malleable iron pipe spaced not more than 3 mm 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.
2. Chains, straps perforated turn- -bucklers or other approved means of waste lines or individual toilet rooms to maintain stacks when spaced does adjustment except the turn-buckles may be omitted for hangers on soil or waste lines or individual toilet rooms to maintain stacks when spaced does not permit.
3. Trapeze hangers may be used in lieu of separate hangers on pipe running parallel to and close to each other.
4. 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.

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

1002.3.5 Plates and Flashing

1. 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.
2. 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.
3. 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.

1002.3.6 Protection and Cleaning

1. 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.
2. All exposed metal surfaces shall be cleaned and polished upon completion.
3. 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 approved by the Engineer and inspected both by the Engineer and the Contractor's duly designated representative (Licensed Master Plumber or Sanitary Engineer) to insure compliance with all requirements of all Codes and Regulations referred to in this Specification.

1002.3.7.1 Drainage System Test

1. The entire drainage and venting system shall have all necessary openings which can be plugged to permit the entire system to be filled with water to the level of the highest stack vent above the roof.
2. The system shall hold this water for a full 30 min during which time there shall be no drop greater than 102 mm.
3. Where only a portion of the system is to be tested, the test shall be conducted in the same manner as described to the entire system except that a vertical stack 3 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.
4. 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.

1002.3.7.2 Water Test on System

1. Upon completion of the rough-in and before connecting fixtures the entire cold water piping system shall be tested at a hydrostatic pressure 1 ½ times the expected working pressure in the system during operation and remained tight and leak-proofed.
2. 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 presence of the Engineer or his duly designated representative.
3. The water test shall be applied to the drainage and vent systems either in entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system filled with water to the point of overflow, If the system is tested in sections, each opening shall be tightly plugged except the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 3 m head of water. In testing successive sections at least the upper 3 m height of the preceding section previously tested shall be tested again so that no joint or pipe in the building (except the uppermost 3 m of the system) shall have been submitted to a test of not less than 3 m head of water. The water shall be kept in pipe system or in the portion under test, for at least 15 min before inspection starts. The system shall be tight at all joints.

1002.3.7.3 Defective Work

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

1002.3.8 As-Built Drawings

Upon completion of the work, the Contractor shall submit two (2) 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.

Plumbing Fixtures shall be measured by set, piece, square meter and/or lump sum.

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(4)	Plumbing Fixtures	Lump Sum
1002(24)	Cold Water Lines	Lump Sum

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 accordance with the Plans and this Specification.

1003.2 Material Requirements

1003.2.5 Materials other than Lumber

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 a sealed container and shall be without evidence of lumping or deterioration in quality.

1003.2.5.3 Fasteners

Nails, screw, bolts 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.

1. Nails of adequate size shall be steel wire, diamond-pointed, ribbed shank and bright finish.
2. Screws of adequate size shall be cadmium or brass plated steel with a slotted head.
3. Lag screws of adequate size, for anchoring heavy timber framing in concrete or

masonry, shall be galvanized steel.

4. Bolts and Nuts shall be of steel having a yield point of not less than 245 MPa. Bolts shall have square heads and be 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.
5. 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.

1003.2.5.4 Fiber Cement Board

It shall comply with the applicable requirements of ASTM C1186, Standard Specification for Flat-Fiber Cement Sheets for exterior application and ASTM C1288, Standard Specification for Fiber-Cement Interior Substrate Sheets for interior application.

1003.2.5.5 Gypsum Board

It shall comply with the applicable requirements of Item 1041, Gypsum Board.

1041.2 Material Requirements *“Gypsum board shall comply with the ASTM C1396M, Standard Specification for Gypsum Board regular and Type X (special fire-resistant gypsum board) with thickness as indicated on drawings, 1,200 mm wide by maximum practical length, ends square cut and edges beveled.”*

1041.2.1 Accessories

1. Joint materials shall be as recommended by gypsum board manufacturer for intended purpose.
2. Metal furring runners, hangers, tie wires, inserts, and anchors galvanized.
3. Drywall furring channels shall be 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
4. Resilient drywall furring shall be 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
5. Nails shall conform to ASTM C514, Standard Specification for Nails for the Application of Gypsum Board with heads, lengths, configurations, and finish as recommended by panel manufacturer.
6. Steel drills screws shall conform to ASTM C954, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness or ASTM C1002, Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs or both with heads, threads, and finish as recommended by panel manufacturer.
7. Laminating compound shall be as recommended by the manufacturer, asbestos-free.

8. Casing beads, corner beads, control joints and edge trim shall conform to ASTM C1047, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

9. Insulating strip shall be rubberized, moisture resistant, 3 mm thick cork strip, 12 mm wide with self-sticking permanent adhesive on one (1) face, lengths as required.

10. Joint compound shall conform to ASTM C475, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board, asbestos-free.

1003.2.5.6 Pre-painted Metal Panel

It shall comply with the applicable requirements of Item 1014, Pre-Painted Metal Sheets.

1003.3 Construction Requirements

1003.3.1 Quality Materials

All materials to be incorporated in the carpentry and joinery works shall be of the quality specified under Section 1003.2, Material Requirements.

Before incorporation in work, all materials shall have been inspected/accepted by the Engineer or his authorized representative.

1003.3.2 Storage and Protection of Materials

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

1. Rough carpentry shall be done true to lines, levels and dimensions. It shall be squared, aligned, plumbed and well fitted at joints.
2. Trusses and other roof framing shall be assembled, fitted and set to exact location and slope indicated on the Plans.
3. Fasteners, connectors and anchors of appropriate type and number shall be provided and fitted where necessary.

4. 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.

1003.3.5 Finished Carpentry

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

1. Framing lumber shall be select grade, free from defects and where exposed in finished work, shall be selected for color and grain.
2. Joints of framing shall be tenoned, mortised or doweled where suitable, closely fitted and secured with water resistant resins and glue. Exterior joints shall be mitered and interior angles coped.
3. Panels shall be fitted to allow for contraction or expansion and insure that the panels remain in place without warping, splitting, and opening of joints.

1003.3.6 Fiber Cement Board

Examine, clean, and repair as necessary any substrate conditions that would be detrimental to proper installation. Do not begin installation until unacceptable conditions have been corrected.

Prior to commencing installation, verify governing dimensions of building and condition of substrate. If substrate preparation is the responsibility of another installer, notify the Engineer of unsatisfactory preparation before proceeding. Installation requirements shall be in accordance with the manufacturer's instructions and drawing details approved by the Engineer.

- a. Use trim details indicated on drawings.
- b. Touch up all field cut edges before installing.
- c. Pre-drill nail holes if necessary to prevent breakage.

Over Masonry Walls. Install furring strips of adequate thickness to accept full length of nails and spaced at 406 mm on center.

Over Steel Studs. Minimum 20-gauge steel, 92 mm C-studs, size as indicated on drawings or as required by limiting span. Use 41 mm long, #8-18 x 9.50 mm HD self-tapping, corrosion-resistant ribbed bugle head screws. Attach a panel at each stud ensuring that at least three (3) screw threads penetrate the studs.

After installation, seal of joints. Seal around all penetrations.

For finish painting, follow the manufacturer's recommendation timeline for painting primed and unprimed products. Paint all exposed cut edges.

1003.3.7 Gypsum Board

Installation requirements shall conform to the applicable requirements of Item 1041, Gypsum Board.

1041.3 Construction Requirements *"All gypsum board works shall be installed by experienced personnel qualified to do this particular requires specialty trade."*

1041.3.1 Manufacturer's Qualifications *"The manufacturer shall have a minimum of 5 years in experience."*

1041.3.2 Preparation *"Protect surrounding areas and surfaces to preclude damage. Avoid soiling, spatter, and damage to work of other trades. Use cover cloths or other means of protection. Remove, clean and repair soiled or damaged work."*

1041.3.3 Application

- 1. Gypsum board shall not be applied until bucks, anchors, blocking, sound attenuation, electrical, plumbing, sanitary and mechanical works are approved.*
- 2. Single/double layer gypsum board shall be applied to wood or metal furring or framing using screw fasteners. Maximum spacing of screws shall be 300 mm on center.*
- 3. Base layer shall be applied to ceilings prior to base layer application apply face layers in same sequence. Offset joints between layers at least 250 mm.*
- 4. Base layers shall be applied at right angles to supports unless otherwise indicated in the Plans.*
- 5. Base layer on walls and face layers shall be applied vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.*
- 6. Single layer gypsum board shall be applied to concrete or concrete block surfaces, where indicated, using laminating adhesive.*
- 7. Gypsum board shall be braced or fastened until fastening adhesive has set.*
- 8. Gypsum board shall be mechanically fastened through of each sheet.*

1041.3.4 Installation of Gypsum Board *"Gypsum board shall be installed in accordance with ASTM C840, Standard Specification for Application and Finishing of Gypsum Board and manufacturer's instruction. Gypsum boards shall be used in maximum practical length to minimize number of end joints. Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-*

resistant surfaces complying with ASTM C1658, Standard Specification for Glass Mat Gypsum Panels where shown and in locations which might be subject to moisture exposure during construction.”

For Ceilings:

- 1. For single-ply construction, perpendicular application shall be used.*
- 2. For 2-ply assemblies:*
 - a. Perpendicular application shall be used.*
 - b. Face ply of gypsum board shall be applied so that joints of face ply do not occur at joints of base ply with joints over framing members.*

For Accessories:

- 1. Accessories shall be set plumb, level and true to line, neatly mitered at corners and intersections and securely attach to supporting surfaces as specified.*
- 2. Install in one (1) piece without the limits of the longest commercially available lengths.*
- 3. Corner Beads a. Shall be installed at all vertical and horizontal external corners. b. Use screws only and do not use crimping tool.*
- 4. Edge Trim (Casing Beads)*
 - a. At both sides of expansion and control joints unless shown otherwise.*
 - b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.*
 - c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.*

1041.3.5 Finishing of Gypsum Board

- 1. Joints, edges, corners, and fastener heads shall be finished in accordance with ASTM C840.*
- 2. Before proceeding with installation of finishing materials, the following shall be assured:*
 - a. Gypsum board is fastened and held close to framing or furring.*

b. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

3. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non-decorated smoke barrier, fire rated and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintains the integrity of the smoke-barrier, fire rated and sound rated construction. Sanding shall not be required on non-decorated surfaces.

1041.3.6 Field Conditions

1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

2. Do not install interior products until installation areas are enclosed and conditioned.

3. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

4. There shall be sufficient temporary lighting to perform work to achieve specified finishes.

1041.3.7 Delivery and Storage

1. Delivery materials in original unopened packages, containers or bundles bearing the manufacturer's name, and product name and number.

2. Store materials in compliance with the manufacturer's recommendations, and in an enclosed ventilated shelter providing protection from the elements. Neatly store and enclosed stack board flat, not on its end or edge, to prevent toppling sagging or damage to the ends, edges or surfaces.

3. Remove damaged or deteriorated materials and replace with new at no additional cost.

4. Plastic packaging used to wrap gypsum panel products shall be removed immediately upon receipt of the shipment to avoid damage due to condensation, including mold.

1041.3.8 Acceptance Requirements *"The surfaces of installed gypsum board shall be true and free from imperfections, properly aligned and properly fixed and joined."*

1003.3.9 Pre Painted Metal Panel

It shall comply with the applicable requirements of Item 1014, Pre Painted Metal Sheets.

1003.4 Method of Measurement

The quantity to be paid for will be measured as per individual item detailed in Section 1003.5, Basis of Payment for the complete Carpentry and Joinery as furnished on site and in accordance with these design standards, specifications and as accepted by the Engineer.

1003.5 Basis of Payment

The Items measured and determined as provided in Subsection 1003.4, Method of Measurement shall be paid for at the unit bid price which payment constitute full compensation of materials, labor, equipment, tools and incidentals necessary to complete the work.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1003(17)	Carpentry and Joinery Works	Lump Sum

ITEM 1004 - HARDWARE

1004.1 Description

This Item shall consist of furnishing and installing all building hardware required to: (1) ensure rigidity on joint/connections of different parts of the structure, and (2) equip in a satisfactory operating condition parts of the structure such as doors, windows, cabinets, lockers, drawers and other similar operating parts in accordance with the Plans and this Specification.

1004.2 Material Requirements

1004.2.2 Finishing Hardware

All finishing hardware consisting of locksets, latches, bolts and other devices, door closers, knobs, handles, hinges, ladder, grab bar and other similar hardware shall be first-class quality available locally and conforming with the following Specifications:

1004.2.2.1 Door Locksets

Door locks appropriate for particular functions shall be of durable construction preferably the product of a single reputable manufacturer for consistent quality and master keying.

Cylindrical lockset for swing wood door shall of sturdy Construction and knob design. The cylindrical case shall be made of steel, zinc Coated, and dichromate dip. The knobs,

latch, strike and pin tumbler assembly shall be cast brass or bronze. The spring and spindle shall be steel, zinc coated. The pins and the key shall be nickel-silver. The latch, with a minimum throw of 16 mm, shall be retracted by knob from either side except when the outside knob is locked by key in the outside knob or by the turn/push button on the inside knob.

Mortise lock for swing door shall have cast bronze latch bolt with steel compression spring, cast bronze deadbolt with hardened steel inserts, wrought bronze or brass knobs heavy gauge and cold-formed steel operation levers. The pin tumbler cylindrical assembly shall be cast bronze or brass and fitted with five (5) Spring pressed nickel silver pins. Mortise lock used in conjunction with fire exit bolts shall have armored fronts.

Unit of monolock for swing door shall be factory assembled in one piece, with knobs and escutcheons attached, ready for installation. All parts of unit lock shall be non-ferrous metal. Frame shall be one-piece cast bronze or extruded brass, and the front shall be flat for door 35 mm thick and beveled for door 45 mm thick, and latch bolt shall be pivoted swing type with minimum 26 mm throw. Cylinder shall be extruded brass with five (5) spring-pressed pins and keys shall be nickel silver.

Mortise type deadlock shall have cast bronze case, front, latch bolts, strike and cylinder. Operation of deadbolt shall be by drop handles from either side. When locked by key from outside, or by thumb knob from inside, drop handle will not operate the deadbolt.

Surface type deadlock shall have cast bronze case, strike and cylinder. Interlocking vertical bolt shall be hardened steel operated by key from outside and thumb turn from inside. Strike shall be angle type.

Deadlock for swinging door shall be tubular design with a mechanism made of heavy-gauge cold-rolled steel, zinc coated and dischromated. Deadbolt, strike and pin tumbler cylinder shall be bronze. Deadbolt, with at least 25 mm throw, shall be operated by key from outside and by thumb from inside.

Lock for the door of emergency /fire exit (panic hardware) shall be cast bronze or brass and heavy duty, locking device coupled with a horizontal crossbar. Latch shall be operated by key from outside and by crossbar from inside. Locking device shall be surface or mortise type suitable for a particular application. Inactive leaf of double doors or emergency/fire exit shall be fitted with vertical rod actuated by crossbars, such vertical rod providing two (2) point locking, bottom and overhead.

Lock for drawers and cabinets shall be bronze or brass with latch operated by key through a pin-tumbler cylinder 22 mm in diameter. Backplate of the lock shall be provided with four (4) screw holes for mounting.

Hasp lock, when required as indicated on the Plans shall be hinge hasp with an integral padlock. The hinge hasp shall be zinc coated wrought steel, 475 mm in width and 100 mm in length when closed. The integral padlock shall be pin tumbler type with solid or laminated zinc-coated wrought steel case with hardened steel shackle securely attached to the draw bolt.

1004.2.2.2 Door Closers

1. All door closer shall be made of materials as specified in the Plans provided with a key valve or cap valve for making the necessary adjustment.

2. The following table shall serve as a guide in determining door closer sizes:

Door Maximum Width (m)	Size of Closer
0.76	Size 2
0.90	Size 3
1.07	Size 4
1.20	Size 5
1.37	Size 6

Use large size where unusual conditions exist.

1004.2.2.3 Hinge

Hinge unless otherwise indicated on the Plans shall be brass Coated wrought iron steel for interior doors and wrought bronze for exterior doors with non-rising loose steel pins with button tips and mounting screws of the same materials.

1004.2.2.5 Miscellaneous Hardware

1. Flush Bolt

Flush/extension flush type bolt shall be made of stainless steel with a proper length suitable to the door specified.

2. Barrel Bolt

Barrel bolts shall be of wrought steel brass coated with an attachment of at least four (4) screws.

3. Door Pull and Push Plate

Door pull and push plate shall be made of stainless steel with concealed attachments.

4. Hook, Bumper and Silencer

Hook, bumper and silencer shall be made of extruded brass or bronze, dull chrome finish with at least two (2) screw attachments.

5. Furniture and Cabinets Hardware

Furniture and cabinet hardware like a piano hinge, invisible hinge, floor pivot hinge, cabinet door catches, shall be made from extruded brass or bronze with dull chrome

finish, of sizes and type suited for use.

1004.3 Construction Requirements

1004.3.1 Submittals:

The Contractor shall submit all necessary information to the Engineer prior to placing of order.

1. Manufacturer's data such as catalog for every hardware item to be furnished, showing all finishes, sizes, catalog numbers and pictures, with all abbreviations fully explained shall be submitted as general information and reference.
2. Hardware templates for fabricated doors and windows shall be furnished to each fabricator to confirm that adequate provision will be done for proper installation of the hardware.
3. Operation and maintenance data shall be provided and submitted to the Engineer – showing all the hardware component part lists and maintenance instructions for each type supplied including the necessary wrenches of tools required.

1004.3.2 Packaging and Marking

Each article shall be individually packaged in the manufacturer's Commercial carton/container properly marked or labeled so as to be readily identified and delivered to the project site in the original manufacturer's container/package.

All hardware shall be provided with fasteners necessary for the installation packed in the same container with the hardware.

1004.3.3 Delivery, Storage and Protection

It shall be delivered in original, unbroken packages, containers or bundles bearing the name of the manufacturer. Hardware shall be properly stored in a dry and secured place. It shall be protected from damage at all times prior to and after installation.

1004.3.4 Installation of Hardware

1. All hardware shall be installed in a neat workmanship manner following the manufacturer's instruction manual to fit details as indicated on the Plans.
2. Except as indicated or specified otherwise, fasteners furnished with the hardware shall be used to fasten hardware in place.
3. After installation works are completed, the hardware shall be protected from paints, stains, blemishes, and other damage until the work are properly turned over and accepted.
4. All hardware shall be properly checked and adjusted in the presence of the Engineer and all hinges, locks, catches, bolts, pulls, closers and other miscellaneous items shall

operate properly.

5. After hardware are properly checked and adjusted keys shall be properly identified with key tags and turned over to the Engineer.

1004.3.5 Keying

Locks shall be keyed in sets and subsets. Where locks are required by the owner to be keyed alike in one system furnish a total of four (4) keys for each set.

1004.4 Method of Measurement

All hardware actually installed shall be measured and determined by the number of pieces or units ready for service as provided in the Bill of Quantities accepted to the satisfaction of the Engineer.

1004.5 Basis of Payment

The Items measured and determined as provided in Subsection 1004.4, Method of Measurement shall be paid for at the unit bid price, which payment constitutes full compensation of materials, labor, and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1004(2)	Finishing Hardware	Lump Sum

ITEM 1005 - STEEL WINDOWS

1005.1 Description

This Item shall consist of furnishing and installing steel windows, (fixed) fully equipped with fixing accessories and locking devices in accordance with the Plans and this Specification.

1005.2 Material Requirements

1005.2.1 Steel Windows -Hot Rolled and Hot Rolled Fire Rated (Fixed)

The frame and ventilator sections shall be hot rolled steel. Steel sheet shall conform to ASTM A1011M, Standard Specification for Steel Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low Alloy with Improved Formability and Ultra-High Strength. The frame or ventilator sections shall have a minimum thickness of 3 mm and a front to back depth dimension of 35 mm. Muntin bars shall be hot rolled steel. Glazing beads shall be extruded aluminum or steel. Weather-stripping shall be extruded vinyl.

1005.2.2 Steel Windows - Cold-Formed and Cold-Formed Fire Rated (Fixed)

The frame and ventilator shall be composed of ASTM A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process, low carbon cold rolled formed Steel sections with a minimum thickness of 0.90 mm. Windows shall be defined and categorized as commercial and industrial windows with a minimum Combined weight of frame and ventilator of 4.0 kg/m and capable of passing a structural load test of 146.50 kg/m². The frame and ventilator sections shall have a minimum front to back depth dimension of 47.50 mm. Only labeled fire protection rated glazing material shall be used in fire-rated windows. The individual glazing material exposed area shall not exceed 0.85 m² with no dimension exceeding 1,370 mm unless otherwise tested. When Continuous glazing angles or channels are used to hold the glass in a window, these continuous members must be steel. Muntin bars shall have a tee shaped face min. of 30 mm. Glazing beads shall be cold rolled steel with a minimum thickness of 0.90 mm. Weatherstripping shall be extruded vinyl or Ethylene Propylene Diene Monomer (EPDM) rubber.

1005.2.7 Accessories

Steel windows shall be provided with first-class quality and locally available hardware, clips, pins, anchors, glazing beads and fastenings, necessary for complete installation and operation of ventilators.

1005.2.7.1 Anchors

Hot-dip galvanized steel anchors shall be used. Anchors and fastenings to heads, jambs, and sills of openings shall be fastened securely to windows or frames. Each frame shall be anchored at jambs with a minimum of three (3) steel anchors. Perforated anchor stems shall be provided for mortar keying with anchor flanges of sufficient width to provide sliding friction fit inside frames. Perforated stems shall be extended not less than 100 mm into masonry. For anchorage at concrete walls and prepared openings, equip frames with manufacturer's standard bent-clips located approximately 150 mm from each end and at the midpoint.

1005.2.7.2 Hardware

All operable sash shall be equipped with a latching device which can be secured from inside. The item, type, and function of hardware required shall be specified under individual window type. Hardware shall be attached securely to windows with corrosion-resistant bolts or machine screws. Use of sheet metal screws shall not be allowed. At fixed screens, adapt the hardware to permit operation of ventilators. Hardware for each window furnished at the factory shall be fitted and tested to ensure satisfactory operation and security.

Hardware Materials and Finish

Non-magnetic type stainless steel exposed hardware shall be provided with Satin finish; white bronze with satin finish; yellow bronze with the dull (Oxidized) finish. Use steel or malleable iron hinges, with non-ferrous pins, or with steel pins and non-ferrous bushings or washers.

1005.2.7.3 Fasteners

Fasteners shall be fabricated from 100% re-melted steel. prime exposed heads of coated or plated fasteners and finished to match adjacent material.

1005.2.7.4 Metal I Sub-frames and Stools

Metal sub-frames and stools shall conform with the Plans to suit the particular window. It shall match exposed surfaces with the windows.

1005.2.7.5 Screens

Screens shall conform to ASTM D3656M. Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns. It Shall be Class 2, 18 by 14 mesh and the color shall be either charcoal or gray.

1005.3 Construction Requirements

1005.3.1 Submittals

The Contractor shall submit shop drawings showing window and installation details, including anchorage, fastening, and recommended sealing methods. Show dimensioned elevations with opening and window sizes. Test reports shall be provided for all pertinent standards.

1005.3.2 Fabrication and Welds

All steel windows shall be fabricated in accordance with the approved shop drawings. Frame and ventilator sections shall be solid one-piece sections and corners shall be welded and dressed. Flanges forming the weathering Contacts shall be rolled integral with sections to provide close contact with both inside and outside points of contact. Muntin bars shall be interlocked and continuous from head to sill and jamb to jamb except those bars in one direction may be discontinued if they are securely welded at the intersection. All windows shall be designed for inside (or outside) glazing.

The screen shall be provided with frames of steel with finish matching that of windows. Equip frames with removable splines of steel or vinyl. Form groove in the frame for holding screen cloth in place with non-cylindrical splines. Make spline and groove assembly so that cloth cannot be removed from the groove by pressure on cloth. Make splines of such size and shape that rotation of spline in the groove will be prevented and spline will tightly hold the cloth in place.

1005.3.3 Installation

Steel windows shall be installed by experienced personnel and in strict accordance with the approved shop drawings. All steel window shall be set plumb and true to line, without warp or rack of frames or ventilators. 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.

Attach ventilator hardware and adjust ventilators to operate smoothly, free from the twist and be weather tight when closed prior to field glazing. Ventilators shall remain closed and locked during glazing. The field painting of windows must be performed prior to installation and shall include paint coverage to all surfaces of the frames. Cleaning of masonry and other exterior or interior surfaces shall be done prior to installation.

The exterior joints between the windows, trim and muntins shall be properly sealed watertight with an approved sealant and neatly pointed. Attach ventilator hardware, as required, and adjust ventilators to operate smoothly free from the twist and to be weather tight when closed and latched. Any abraded Surface of the window finish shall be cleaned and touched up with air dry paint, as approved and furnished by the Contractor in color to match factory applied finish.

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

Insect Screens

Screens with hinged or sliding wickets shall be provided as required. The wire cloth shall be held taut with a removable spline. Screens shall be removable from the window, held in place by clips. After assembly, windows shall be pretreated, epoxy or zinc coated, followed by the manufacturer's Standard finish.

Screens shall be installed with weave parallel to frames. It shall stretch tight for a smooth appearance. Edges shall be concealed in spline channels.

1005.3.4 Cleaning

The Contractor shall be responsible for protecting the windows and related materials during storage on the job and during and after installation, The Contractor shall leave the window surfaces clean after installation.

Any protection necessary due to the cleaning of materials adjacent to the windows shall be the responsibility of the Contractor.

1005.3.5 Delivery and Storage

All steel windows shall be delivered to the project site in undamaged condition. All steel windows and components shall be stored on edge, out of contact with the ground, under a watertight covering, and arranged to avoid bending, warping, or other damage.

1005.4 Method of Measurement

Steel windows shall be measured by actual in place installed with respective design/style and type of operation in square meters or lump Sum. Window accessory shall be measured by actual in place installed in lump sum.

1005.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 1005.4, Method of Measurement 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.

Payment shall be made under:

Payment Item Number	Description	Unit of Measurement
1005(5)	Steel Windows	Lump Sum

ITEM 1007 - ALUMINUM GLASS DOORS

1007.1 Description

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

1007.2 Material Requirements

Frame and panel members shall be fabricated from extruded aluminum sections true to details with clean, straight, sharply defined profiles and free from defects impairing strength or durability. Extruded aluminum sections shall conform to the specification requirements as defined in ASTM B 211, Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finish Bar, Rod, and Wire.

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

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

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

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

Glazing shall conform to the requirement specified in Item 1012 - Glass and Glazing.

1007.3 Construction Requirements

For all assembly and fabrication works the cut ends shall be true and accurately jointed, free of burrs and rough edges. Cut-out recesses, mortising, grinding operation for hardware shall be accurately made and properly reinforced when necessary.

1007.3.1 Installation Procedure

The width for door stiles and top, bottom and center rails shall be as shown on the Plans.

Main frame shall consist of head sill and jamb stiles specifically designed and machined to interfit and are joined at corners with self-threading screws.

Frame sill shall be stepped and sloped with offset weep holes for efficient drainage to the exterior.

Door panel shall be accurately joined at corners assembled and fixed rigidly to ensure weather tightness.

Aluminum glass door and main frame shall be installed in a prepared opening to be set plumb, square, level and true to details.

All joints between metal surface and masonry shall be fully caulked to ensure weather tightness.

Double action type door panel shall be equipped with heavy duty hinges that will control the door leaf in a close or open position.

Weatherstrip shall be furnished on edges at the meeting stiles of doors.

Where aluminum is to be in contact with steel concrete cinder, block, tile, plaster or other similar masonry construction the aluminum surface shall be back painted before erection with a bituminous paint.

1007.3.2 Shop Finish

Exposed aluminum surfaces shall be electro type hard coats.

1007.3.3 Protection

All aluminum parts shall be protected adequately to ensure against damaged during transit and construction operations.

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

1007.3.4 Cleaning

The Contractor does not only protect all entrance units during construction but also responsible for removal of protective materials and cleaning aluminum surfaces.

Aluminum shall be thoroughly cleaned with plain water with kerosene or gasoline and then wipe surfaces using clean cotton fabric. No abrasive cleaning agents shall be permitted.

1007.4 Method of Measurement

Aluminum glass doors, fully equipped with fixing accessories and locking devices shall be measured in square meters based on actual in place installed as shown on the Plans accepted to the satisfaction of the Engineer.

1007.5 Basis of Payment

The area in square meters of aluminum glass doors installed including the main frame and ready for service as provided in Section 1007.4 shall be the basis of payment based on the unit bid or contract unit price.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1007(1)b	Aluminum Frame Glass Door, Swing Type	Square Meter

ITEM 1008 - ALUMINUM GLASS WINDOWS

1008.1 Description

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

1008.2 Material Requirements

Frame and panel members shall be fabricated from extruded aluminum section true to details with clean, straight, sharply defined profiles and free from defects impairing strength or durability. Extruded aluminum section shall conform to the specification requirements defined in ASTM B 211, Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod and Wire. Screws, nuts, washers, bolts, r rivets and other miscellaneous fastening devices shall be made of non-corrosive materials such as aluminum, stainless steel, etc. Hardware for fixing and locking devices shall be closely matched to the extruded aluminum section and adaptable to the type and method of opening. Weather-strip shall be first class quality flexible vinyl forming an effective seal and without adverse deformation when installed. Glazing shall conform to the requirements specified in Item 1012, Glass and Glazing.

1008.3 Construction Requirements

For all assembly and fabrication works the cut end shall be: true and accurate, free of burrs and rough edges. Cut-outs recesses, mortising and grinding operations for hardware shall be accurately made and properly reinforced. Main frame shall consist of head, silt and jamb. All joints between metal surface and masonry shall be fully caulked. Aluminum parts in contact with steel members shall be properly insulated by a coat of zinc chromate, primer/ bituminous paint applied to the steel surface. Weather strips shall be furnished on edges at the meeting stiles. Shop drawings which include window schedules, sections and multiple window assembly details shall be submitted to the Engineer for approval before installation.

1008.3.1 Window Sash

Window panels shall be joined at corners with a miter and fixed rigidly to ensure weather tightness. Corners should be fastened with corrosion resistant screws and aluminum corner angles sealed with an acrylic sealant. All fixed glass is exterior glazed and all sashes are marine glazed with flexible PVC glazing. The fixed glazing shall be removed without disassembly of a sash. The vents will need to be disassembled to replace the glazing.

1008.3.2 Sliding Window

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

1008.3.6 Shop Finish

Exposed aluminum surfaces shall be electrolyte hand coats such as anodize, satin, powder coated, among others.

1008.3.7 Protection

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

1008.3.8 Cleaning

The contractor does not only protect all entrance units during the construction phase but shall also be responsible for removal of protective materials and clearing the aluminum surface including glazing before work is accepted by the cleaning solution and then wipes surface using clean cloth rags. No abrasive cleaning materials shall be permitted in cleaning surface.

1008.4 Method of Measurement

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

1008.5 Basis of Payment

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

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
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1008 (1)a	Aluminum Glass Window, Sliding Type	Square Meter
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ITEM 1010 – WOODEN DOORS

1010.1 Description

This Item shall consist of furnishing all materials, hardware, plant, tools, labor and services necessary for complete fabrication and installation of wooden doors and 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.

1010.2.6 Hardware

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

1010.3 Construction Requirements

1010.3.1 Fabrication

Wooden doors, 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 warpage.

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

Door Frames

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

1010.3.2 Installation

1. Frames

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

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

2. 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.

3. Lock Installation

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

1010.4 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.

1010.5 Basis of Payment

Payment for completely installed and accepted wooden doors and windows shall be based on actual measurement and the corresponding contract unit price thereof. Payment based on Contract Unit Price shall constitute full compensation.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1010 (4)	Wooden Doors	Lump Sum

ITEM 1011 - ROLL - UP DOORS

1011.1 Description

This Item shall consist of furnishing all roll-up door materials, labor, tools and equipment required in accordance with the Plans and this Specification.

1011.2 Material Requirements

Roll-up doors shall be surfaced mounted type designed for exterior service opening as indicated on the Plans. Component parts shall conform to the following material specifications:

1. Curtain - shall be manufactured of interlocking curved or flat slats, rolled from galvanized and bonderized steel, aluminum or stainless steel as the case may be.

Curtain is composed of:

a. Interlocking slats shall roll up on a drum supported at head of opening on brackets and shall be balanced by helical springs. Slats shall be formed in a cold-rolled process in continuous lengths of galvanized steel interlocked to form curtains.

b. Endlocks - shall be malleable iron riveted to each end of alternate slats to achieve slat alignment and to serve as a wearing surface. These are called continuous when they reinforce both ends of all slats, alternate when every other slat.

c. Bottom bar - shall be manufactured from two (2) equal sized angles, minimum 3 mm thick bolted back-to-back with appropriate half slat at lowest edge of curtain. In addition, the exterior door shall have a compressible and replaceable rubber or vinyl weather seal attached to the bottom rail.

2. Counterbalance barrel assembly - shall include spring barrel which serves as load carrying beam encases counter balance mechanism and provide axis around Curtain coils. As it arises barrel rings are involute shapes of malleable iron to assure proper Counter balance for all points of travel. Oil tempered torsion type counter balance springs are Wound from heat treated steel, to provide accuracy in balancing doors.

3. Hood - shall be manufactured from 0.60 mm thick (minimum) galvanized sheet metal, flanged at top for attachment to header and flanged at bottom to provide longitudinal stiffness. Hood shall enclose curtain col and Counter balance mechanism.

4. Bracket Plates - shall be made of precisely formed plate with permanently sealed ball bearings, designed to enclose the end of the curtain coil and provide support for counter balance pipe at each end. The bracket plates shall have a minimum thickness of 6.35 mm.

5. Guides/Wall Angles - shall be fabricated from structural steel angles or precision roll formed channels and angles. Especially adaptable for doors exposed to heavy wind pressure. Wall angles of structural steel shall have a minimum thickness of 3.18 mm. Designed with groove depths varying from 50 mm to 150 mm depending upon the width of the door, and set cut from the face of the wall to facilitate the travel of the curtain.

1011.2.1 Wind Load

Steel and aluminum roll-up doors shall be designed to withstand wind loads of 0.957 KPa and 2.87 KPa respectively, in a fully-closed position, and can be designed to withstand higher wind loads upon request.

1011.3 Construction Requirements

Roll-up doors shall be electronically or mechanically operated and with provision for manual operation by means of hand chain. Accessories needed for the satisfactory performance of the roll-up door shall be built-in with the unit as per manufacturer's instruction.

1011.3.1 Erection/ Installation

1. Structural steel angles shall be set and installed properly aligned, plum, level, square true to profile section and rigidly anchored with adjacent Concrete surface walls.
2. All adjacent items of work shall be allowed to be completed before any installation work is started except the installation of structural steel angles.
3. Roll-up doors shall be allowed in accordance with the manufacturer’s instruction manual or as indicated in the shop drawing approved.
4. All anchors and insets for guides, brackets and other accessories shall be located accurately.

1011.3.2 Locking Devices

Curtain shall be located at each end of the bottom bar by concealed side bolts which shall engage a lock wedge in each guide. A plunger type cylinder lock is provided as standard equipment.

1011.4 Method of Measurement

The work executed under this Item shall be measured by the number of sets or lump sum of roll-up doors installed at jobsite completed and ready for service. The computed unit shall bear type of materials and area of opening covered and shall be accepted by the Engineer.

1011.5 Basis of Payment

The accepted work quantified and provided in the Bill of Quantities shall be paid for at the unit Bid price which constitutes full compensation for furnishing all materials, labor, tools, equipment and other incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1011 (1)a	Roll-Up Door, Steel	Set

ITEM 1013 - CORRUGATED ROOFING

1013.1 Description

This Item shall consist of furnishing all plant equipment, tools, materials and labor required to properly perform and complete the corrugated metal roofing, together with related accessories such as ridge/hip rolls, valleys, gutters and flashing, when called for on Plans all in conformity with his Specifications.

1013.2 Material Requirements

1013.2.1 Corrugated and Plain Galvanized Iron Sheets

Corrugated galvanized iron (G.I.) sheets, including plain G.I. sheets for roofing accessories, shall be cold-rolled meeting ASTM A 153 and with spelter coating of zinc of not less than 0.381 kg/m² (1.25 ounces/square foot), conforming to ASTM A 525 OR PNS 67, Hot-dip Metallic-coated Steel Sheets for Roofing. Unless otherwise specified or shown on Plans roofing sheets shall be gauge 26 (0.48 mm thick) and provided in long span sizes to minimize end laps. Sheets shall weigh not less than 3.74 kg/m² and shall be marked or stamped showing the gauge, size, amount of zinc coating, brand and name of manufacturer. Test specimens shall stand being bent through 180° flat on itself without fracture of the base metal and without flaking of the zinc coating.

1013.2.2.1 Packaging and Marking

Asphalt roofing products may be slipped in container or bill of lading on bulk shipment as agreed upon by the manufacturer and the purchaser where each shall be marked with the following information:

1. Name of manufacturer or seller
2. ASTM designation
3. Type of product
4. Flash point
5. Equiviscous temperature (EVT) for map and for mechanical spreader application

1013.2.2.2 Dimensions

Dimensions for each delivered corrugated asphalt roofing sheet shall conform to the Table 1013.1.

Table 1013.1 Dimensions for Corrugated Asphalt Roofing

Physical Property	Dimension (mm)
Width	930.00 - 970.00
Length	1990.00 - 2010.00
Thickness	2.60 - 3.30
Pitch	90.00 - 100.00
Corrugated Height	35.00 - 40.00
No. of Corrugations	9.00 - 11.00

1013.2.2.3 Bitumen Properties

The oxidized bitumen prepared from crude petroleum shall be homogenous and free of water in which each type shall conform to the physical properties prescribed in Table 1013.2. This covers four (4) types of asphalt intended for use in built-up roof construction, bituminous vapor retarded, and some modified bitumen systems and for adhering insulation boards used in various types of roof systems.

Sampling shall conform to the requirements of ASTM D140M, Standard Practice for Sampling Bituminous Materials.

Table 1013.2 Physical Requirements of Asphalt Roofing

Property	Test Method	Type I		Type II		Type III		Type IV	
		Min	Max	Min	Max	Min	Max	Min	Max
Softening point, °C***	ASTM D36	57	66	70	80	85	96	99	107
Flash point, °C	ASTM D92	260	...	260	...	260	...	260	...
Penetration, units at 25°C	ASTM D5	18	60	18	40	15	35	12	25
Ductility at 25°C, cm	ASTM D113	10.0	...	3.0	...	2.5	...	1.5	...
Solubility in trichloro-ethylene, %	ASTM D2042	99	...	99	...	99	...	99	...

Note:

*** In cases where a disagreement exists between the Engineer and the Contractor, ASTM D 36 shall be used as the referee method.

ASTM D36M - Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)

ASTM D92 - Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester

ASTM D5M - Standard Test Method for Penetration of Bituminous Materials

ASTM D113 - Standard Test Method for Ductility of Asphalt Materials

ASTM D2042 - Standard Test Method for Solubility of Asphalt Materials in Trichloroethylene

1013.2.3 Strap Fasteners

Strap fasteners shall be gauge 26 G.I. sheet 25 mm wide and sufficiently long to bend around up to the opposite face of purlin, with corners chipped off at the riveting ends.

1013.2.4 Rivets, Washers and Burrs

Rivets and washers shall be galvanized mild iron. Rivets shall not be less than 5 mm in diameter and 10 mm in length. Washers shall not be less than 1.5 mm thick and 20 mm

in outside diameter. Washers inside diameter shall provide snug fit to the rivet.

1013.2.5 Soldering Lead

Soldering lead shall have a composition of 50% tin and 50% lead, conforming to ASTM B 32, Standard Specification for Solder Metal.

Rivets and burrs for lap joints of gutters, downspouts and flashing shall be copper not less than 3.175 mm in diameter (No. 8).

1013.2.6 Fabricated Metal Roofing Accessories

Ridge/hip rolls, valleys, flashing and counter flashings, gutters and downspouts, whenever required, shall be fabricated from plain G.I. sheets. Ridge/hip rolls, flashings and counter flashings shall be gauge 26. Valleys, gutters and downspouts shall be gauge 24 unless otherwise specified on Plans. Wire basket strainers shall be galvanized, gauge 24.

Roof ventilators, whenever required shall be fabricated from gauge 26 plain G.I. sheets and constructed to the dimensions and details shown on Plans.

1013.2.7 Rejection and Resubmittal

Materials failing to meet the requirements of this Specification shall constitute grounds for rejection. The Contractor may request for re-inspection/test of the rejected materials and resubmits the lot after removal of those packages not conforming to the requirements as approved by the Engineer.

1013.3 Construction Requirements

1013.3.1 Preparatory Work

Preparatory Work to the installation of the corrugated G.I. roofing, purlins should have been placed and spaced properly to fit the length of roofing sheets to be used such that the centerline of the purlins at end laps are 150 mm from the bottom line of end laps and intermediate purlins are placed equidistantly. Top of purlins should be at the same plane.

1013.3.2 Installation of Corrugated Roofing Sheets

1013.3.2.1 General

Valleys, ridge/hip rolls and flashings when required, shall be installed before fastening the roofing sheets with galvanized straps and rivets. One strap shall be riveted at each alternate corrugation at the gutter line, the ridge line and at end laps and the straps bent around and nailed to the purlins. Riveting at intermediate purlins between end laps shall be done at every fourth corrugation. Rivet shall be provided with a galvanized mild iron washer below and one (1) lead and one (1) galvanized iron washer above the sheet. Rivet shall be sufficiently long to permit forming a hemispherical head. Riveting shall be done such that the lead washer shall be compressed to provide a watertight fit around the rivet.

1013.3.2.2 Installation of Corrugated Metal Roofing

Installation of corrugated G.I. sheets with end laps shall start at the lower part of the roof and proceed towards the direction of monsoon wind with side laps of two-and-a-half (2-1/2) corrugations. End laps shall be 250 mm minimum. Each sheet shall be fastened temporarily by 1.83 mm diameter by 25 mm long galvanized flat head nails at valleys of corrugations covered by side or end laps.

Succeeding upper rows of corrugated G.I. sheets shall be installed in the same manner until the entire roof area is covered.

1013.3.3 Installation of Roofing Accessories

1. Ridge and Hip Rolls

Ridge and hip rolls shall lap at least 250 mm over roofing sheets and, together, shall be riveted at every second corrugation.

2. Valleys

Valleys shall lap at least 450 mm each way under the roofing sheets and shall be secured to the framework with galvanized nails, such nails placed below the roofing sheets. Rivets alongside of the valley shall be at every second corrugation.

3. Flashing

Flashing, of gauge 26 plain G.I. sheets, unless otherwise specified, shall be installed along intersections of roofs with concrete or masonry walls in accordance with details shown on Plans. Flashing running parallel to sheet corrugation shall lap at least two corrugations with edge turned down. Flashing across sheet corrugation or at an angle thereto, shall lap at least 250 mm and the edge of flashing turned down at each corrugation. The vertical portion of flashing adjoining wall shall be at least 200 mm wide and provided with counter flashing.

4. Counter Flashing

Counter flashing sheets of gauge 24 plain GI shall be built into preformed wedge-shape groove of concrete or masonry wall. The edge to be built into wall groove shall have a 25 mm strip bent 45 degrees and shall be sealed in the groove with cement mortar or caulking compound.

5. Reglets

Reglets, when required per plans in connection with counter flashing shall be fabricated products approved by the Engineer, complete with fittings. Reglets shall be located not less than 200 mm or more than 40 mm above roofing. Reglet plugs shall be spaced not more than 300 mm on centers. Open-type reglets shall be filled with fiber board or other suitable separator to prevent crushing of the slot during installation. The counter flashing shall be inserted into the full depth of reglet and the reglet lightly punched- every 300' mm to crimp the reglet and the counter flashing together.

6. Gutters

Gutters, from gauge 24 plain G.I. sheets, shall be fabricated to the shape and dimensions indicated on the Plans. The rear side of the gutter shall have a 12.5 mm strip bent 30 degrees and shall be not less than 12.5 mm higher than the opposite side. Gutter joints shall be flat seam folded in the direction of flow and soldered evenly. Otherwise, gutter joints shall be lapped at least 25 mm, fastened together with 3.175 mm diameter (No.8) copper rivets and burrs, and sealed by soldering along both exposed edges of lap.

Gutter shall be attached to fascia board or roof nailer with galvanized nails or screws spaced at not more than 900 mm on centers and at a point slightly higher than leading edge of gutter. As additional support, gutter shall have plain G.I. strap hangers 25 mm wide fastened to roof nailers by screw shank-type nails and riveted to the gutter's leading edge. Strap hangers shall be spaced at not more than 900 mm on centers. When shown on Plans that gutter is not fixed to fascia board or purlin, gutter shall be supported by wrought iron (W.I.) hangers not less than 4.75 mm thick and 19 mm wide spaced at not more than 900 mm on centers. W.I. hanger shall be fabricated to fit configuration of the gutter and attached to fascia board or purlin with two (2) No.8 flat head wood screws.

Gutter shall be installed with a pitch of 1 in 100 slopes to downspout.

7. Downspouts

a. Downspouts

Unless specified otherwise, downspouts shall be plain G.I., thickness fabricated to the dimensions shown on the Plans and installed at indicated locations. Downspout shall be secured to the wall with G.I. straps 25 mm wide, spaced at more than 1000 mm and anchored with concrete nails. Inlets of downspouts shall be fitted with gauge 14 wire basket strainers.

b. Unplasticized Polyvinyl Chloride Downspouts

When shown on Plans that downspout are other than G.I. sheets, downspouts shall be unplasticized polyvinyl chloride (UPVC) pipes and fittings with dimensions indicated and conforming with ASTM D 3033 and D 3034.

Joints shall be made with either solvent cement or rubber "O-rings" depending on the design of fitting for the joints. Rubber "O-rings" shall be neoprene type, heat and oil resistant, complying with ASTM F-477. Downspout shall be secured to adjoining wall with plain G.I. straps 25 mm wide and spaced at not more than 1000 mm.

c. Roof Ventilators

Roof ventilators, whenever shown on Plans shall be firmly secured to the roofing or roof structure by means of rivets, Roof ventilators installed on the roof at places other than the ridge shall be provided with adequate flashing around intersection with roofing to ensure watertight joints.

1013.3.4 Joints of G.I. Roofing Accessories

1. Soldered Joints

Joints made by lapping coupled with riveting shall be rendered watertight by soldering. All edges of uncoated sheet metal to be soldered shall be pretinned before soldering. Soldering shall be done slowly with well heated iron in order to thoroughly heat the seam and sweat the solder completely through the full length of the seam. Upon completion of soldering, acid shall be neutralized by washing thoroughly with water.

2. Non-soldered Joints

Non-soldered joints of G.I. gutters, downspouts and flashings shall be done by flat lock seams. Two adjoining edges of lock seam shall be bent 90°. One bent strip shall be at least 15 mm wide and the connecting piece shall have a bent strip twice in width which shall be bent down over the upturned narrower strip and pressed together. Once properly interlocked, the joint shall be flattened such that the edge of the wider strip be concealed.

1013.3.5 Roof Installation on Metal Purlins

Installation on metal purlins shall follow the same procedure as that on wood purlins, except that fastening shall be done with thread-cutting, zinc-coated steel screws, No. 12 by 50 mm. having hexagonal heads and provided with neoprene washers. Screw holes shall be drilled using 5 mm (13/64") diameter bit.

1013.3.6 Water Leak Test

The completed roofing shall be tested for water tightness at side and end laps at joints of roofing sheets with ridge/hips rolls, valleys and flashings by means of water spray system. The water-spray system shall have nozzle which will deliver water pressure of 2 kg/cm² directly to the joint being tested in such manner and for a duration directed by the Engineer. All defective works as determined by this test shall be remedied by the contractor at his expense and the test shall be repeated until the work is found satisfactory.

1013.4 Method of Measurement

Roofing sheets shall be measured and paid for on an area basis in square meters or part thereof, such roofing sheets including all laps, fasteners and rivets as installed complete and accepted.

Ridge/hip rolls, flashings, valleys, gutters and down-spouts shall be measured in linear meter of completed and accepted work; such measurement shall include necessary straps and fixings required for complete installation.

Roof ventilators shall be measured and paid for per unit completely installed and accepted.

1013.5 Basis of Payment

The quantity as determined in Section 1013.4, Method of Measurement, shall be paid for at unit price stipulated in the Contractor's Bill of Quantities. The payment shall constitute the full compensation for furnishing all the necessary materials, providing necessary equipment and tools in installing corrugated metal or asphalt roofing, labor cost and all

the incidental expenses necessary to complete the work.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1013(2)	Fabricated Metal Roofing Accessories	Linear Meter

ITEM 1014 - PRE-PAINTED METAL SHEETS

1014.1 Description

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

1014.2 Material Requirements

All pre-painted metal sheet and roofing accessories shall be oven baked painted true to profiles indicated on the Plans as approval of the Engineer.

1014.2.1 Pre-Painted Roofing Sheets

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

Gutters, Valleys, Flashings Hip and Ridge roll shall be fabricated from gauge 24 (.600 mm thick) cold-rolled plain galvanized iron sheets specially tempered steel. Profile section shall be as indicated on the Plans. Fastening hardware shall be of galvanized iron straps and rivets. G.I. straps are of .500 mm thick x 16 mm wide x 267 mm long (gauge 26 x 5/8" x 10-1/2") and standard rivets.

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

1. Coating Thickness

Protective Coatings	Thickness (Coating Mass)
Zinc	14 microns (100 g/m ²)
55% Aluminum Zinc	14 microns (50 g/m ²)
Zinc-5% Aluminum	14 microns (95 g/m ²)
Top coat	15.20 microns

Bottom coat	6.8 microns
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2. Overall thickness with protective coats

Nominal thickness (mm)	Thickness Range
0.20	0.16 - 0.25
0.30	0.26 - 0.35
0.40	0.36 - 0.44
0.50	0.46 - 0.54
0.60	0.55 - 0.64
0.70	0.65 - 0.74
0.80	0.75 - 0.86

Note: Nominal thickness refers to the Total Coated Thickness (TCT) and defined as the sum of the Base Metal Thickness (BMT) and coating thickness

1014.3 Construction Requirements

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

1014.3.1 Handling/Lifting/Positioning of Sheets

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

1014.3.2 Installation Procedure

The laying of the roofing panels should begin on the end of the building away from the prevailing wind so that the side-lap seams face away from the prevailing wind-driven rain thus providing additional security against water penetration. Start roofing installation by placing the first sheet in position with the downturned edge in line with other building elements and fastened to supports as recommended. Fasteners should have corrosion resistance at least equivalent to the expected life of the base material. Place the downturned edge of the next sheet over the edge of the first sheet, to provide side lap and hold the side lap firmly in place. Continue the same procedure for subsequent sheets until the whole roofing area is covered and/or (Adopt installation procedure provided in the instruction manual for each type of architectural molded rib profile section) Pre-painted metal sheet should not come in direct contact with wet concrete. Concrete's high alkalinity attacks the aluminum, causing the coating to peel. It shall also not be place in

contact with copper, lead, or the water run-off. Electrochemical reaction between these elements and the aluminum-zinc alloy coating will lead to premature corrosion of the coating. For walling applications follow the procedure for roofing and allow a minimum end lap of 100mm for vertical walling. For panel lapping, requirements depend on the product installation guide of a specific type of pre-painted metal sheet as per approval of the Engineer. Provide sealant, butyl tape or caulking along the lap edge to prevent any leaking. Specifications of the sealant and butyl tape shall be as per manufacturer's recommendation per Engineers approval.

1014.3.3 Gutters, Valleys, Flashing ridge and Hip rolls

Gutters, valleys, flashing ridge and hip rolls shall be fastened where indicated on the Plans by self-tapping screws or galvanized iron straps and rivets. Always begin flashing installation from bottom and work up, so that flashing are lapped on top of the lower flashing. This will prevent moisture from leaking under the flashing and into structure.

1014.3.4 End Laps

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

1014.3.5 Anchorage/Fastening

Pre-painted steel roofing sheets shall be fastened to the wood purlins with standard length G.I. straps, rivets or J-bolts. For steel frame up to 4.5 mm thick use self-drilling screw No. 12 by 35 mm long hexagonal head with neoprene washer shall be used. For steel support up to 5mm thick or more, thread cutting screw No. 12 by 40 mm long hexagonal head with neoprene washer shall be used. Self-drilling screw No. 10 by 16 mm long hexagonal head with neoprene washer shall be used for side lap fastener. For valley fastened to lumber and for walling, self-drilling wood screw No. 12 by 25 mm long hexagonal head with neoprene washer shall be used. Self-drilling screws hexagonal head with neoprene washer shall be used for valleys fastened to steel supports. Drill size shall be 5mm diameter.

1014.3.6 Cutting of Sheets

In cutting pre-painted steel roofing sheets and accessories to place the exposed color side down. Cutting shall be carried out on the ground and not over the top of other painted roofing products. Power cutting or drilling to be done or carried out on pre-painted products already installed or laid in position, the area around holes or cuts shall be masked to shield the paint from hot fillings.

1014.3.7 Storage and Protection

Pre-painted steel roofing, walling products and accessories should be delivered to the jobsite in strapped bundles. Sheets and/or bundles shall be neatly stacked in the ground and if left in the open it shall be protected by covering the stack materials with loose tarpaulin. Bundles should be stored above the ground at a slight angle, to prevent water

or condensation build up between adjacent sheets. Removing installation debris and metal fines due to drilling and cutting from the sheet surface and avoiding exposure of insulation to the weather shall be practice at all times.

1014.4 Method of Measurement

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

1014.5 Basis of Payment

The area of pre-painted steel roofing and/or walling in square meters as provided in Section 1014.4, shall be paid for at the unit bid or Contract Unit Price which payment shall constitute full compensation including labor, materials, tools and incidental necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1014 (1)b2	Pre-painted Metal Sheets, 0.6mm, Rib type, Long Span	Square Meter

ITEM 1018 - CERAMICS AND GRANITE 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

Ceramic tiles are thin slabs made from clay and/or other organic raw material, generally used as coverings for floors and walls, usually shaped by extruding, pressing at room temperature but may be formed by other processes, then dried and subsequently fired at temperatures sufficient to develop the required properties. Ceramic tiles can be classified as glazed or unglazed.

All ceramic tiles shall be sound, durable, and free of spalls, cracks, open seams, pits, or other defects, which may impair its structural integrity or function. Table 1018.1 shows the required test methods for ceramic tiles. Texture, finish and color shall be within the range of samples approved by the Engineer

Table 1018.1 Physical Test for Ceramic Tiles

Physical Property	Test Method	Description
Abrasion Resistance- Glazed	ASTM C1027	Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
	ISO 10545-7	
Abrasion Resistance- through body	ISO 10545-6	Ceramic Tiles- Part 6: Determination of Resistance to Deep Abrasion for Unglazed Tiles
Water Absorption	ASTM C373	Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products
	ISO 10545-3	Determination of Water Absorption, Apparent Porosity, Apparent Relative Density and Bulk Density
Chemical Resistance	ASTM C650	Standard Test Method for Resistance of Ceramic Tile to Chemical Substances
	ISO 10545-13	Determination of Chemical Resistance
Break Strength	ASTM C648	Standard Test Method for Breaking Strength of Ceramic Tile
	ISO 10545-4	Determination of Modulus Rupture and Breaking Strength
Stain Resistance	ASTM C1378	Standard Test Method for Determination of Resistance to Staining
	ISO 10545-14	Determination of resistance to stains

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 however 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.

1018.2.4 Accessories

Tile accessories such as round edge ceramic tiles, cove tiles, step treads and nosing to stairs, landings, and thresholds, skirting, skills, copings, and bath vents, shall match the composition, color and finish of the surrounding tiles.

1018.2.5 Mortar Materials

1018.2.5.1 Portland Cement

Portland Cement shall comply with the applicable requirements of AASHTO M 85, Standard Specification for Portland Cement (ASTM C150M).

1018.2.5.2 Sand

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

1018.2.6 Grouting Materials

1018.2.6.1 Sand-Portland Cement Grout

Sand-Portland cement grout is used with ceramic mosaic, quarry and paver tiles on floors and walls. Damp curing is necessary.

And on-the-job mixture of one (1) part Portland Cement to one (1) part of sand shall be used for joints up to 4.23 mm wide; one (1) part cement and two (2) parts sand for joints up to 12.70 mm wide; and one (1) part cement and three (3) parts sand for joints over 12.70 mm wide. Up to $\frac{1}{5}$ part lime may be added.

1018.2.6.2 Standard Cement Grout

Standard Cement Grout shall be factory prepared mixture of cement, graded sand, and other ingredients to produce a water-resistant, dense, uniformly colored material, meant for joints 3.18 mm width or greater.

1018.2.6.3 Standard Unsanded Cement Grout

It shall be a factory prepared mixture of cement and additive that provides water retentivity, meant for joints 3.18 mm wide or less.

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.

1018.3.1 Setting Materials

1. Wall Tiling. A mix of one (1) part of cement and four (4) parts of sand backing of 10 mm thick shall be laid as base for wall tiling. The surface of backing shall be scratched in an approved manner, when completely set to form key. The surface of the backing shall be wetted before the tiling is applied and same shall be cured for 5 days before tiling starts. Tiles shall be fixed using the appropriate adhesive.
2. Floor Tiling, The Contractor shall either bed the tiles using cement/sand mortar with ratio of 1:3 and 20 mm thick or lay the tiles on screed using the appropriate adhesive.

1018.3.2 Substrates Preparation

1. With the installer present, substrates and areas where tiles are to be installed shall be examined, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

a. Substrates for setting tile shall be firm, dry, clean and free from oil or waxy films and curing compounds.

b. Installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind the tile shall be completed before installation of tile.

2. Substrate Levels shall consider the following allowable variations:

a. For tiles with all legal edges shorter than 380 mm, maximum allowable variation is no more than 6 mm in 3 m and no more than 1.6 mm in 0.3 m from the required plane, when measured from the high points in the surface.

b. For tiles with at least one (1) edge is 380 mm or longer, the maximum allowable variation is no more than 3 mm in 3 m and no more than 1.6 mm in 0.6 m from the required plane, when measured from the high points in the surface.

3. For thin set work, the variation can be no more than 1.6 mm in 1 m with no abrupt irregularities greater than 0.80 mm.

4. Concrete, masonry and plaster substrate shall be grinded or filled as required to comply with allowable variations. For fill and underlayment of concrete, masonry and plaster substrates, one (1) part Portland cement. Three (3) parts sand and sufficient mortar admixture, if needed, shall be utilized to provide workable mortar mix.

5. Substrates and adjoining construction, and the conditions under which the work will be installed, shall be examined. Before proceeding with the work, all unsatisfactory condition detrimental to the proper completion of the work should be corrected.

1018.3.3 General Installation

1018.3.3.1 Floor

1. Installation of each material requirement shall be in accordance with the

manufacturer's instructions.

2. Allowable Variations in Finished Work:

a. Floors: 3 mm in 2m in any direction \pm 3 mm at any location; 0.8 mm offset at any location.

b. Joints: \pm 0.8 mm joint with variation at any locations; 1.6 mm in 1 m deviation from plumb and true.

3. Tile work shall be laid out in pattern using field tile and trim shapes as shown on the Plans. Tile fields shall be centered on both directions in each space or on each wall area, and shall be adjusted to minimize the cutting. Uniform joint widths for ceramic tile and granite tile shall be used unless otherwise shown on the Plans or approved by the Engineer. Field tiles, not trim shapes, shall be cut unless otherwise shown on the Plans.

4. Tile works shall be extended into recesses and under equipment and fixtures in the space shown on the Plans or scheduled to receive tiles. A complete covering without interruptions shall be formed except for control and expansion joints as shown on the Plans and as required to comply with disruption of pattern or joint alignments.

5. Liquid Latex Mortar Thin-Set Installation: Liquid latex mortar for thin-set tile work shall be used, unless otherwise shown on the Plans.

6. Work shall be neatly terminated at obstructions, edges, and corners without disrupting pattern or joint alignments.

7. Intersections and return shall be accurately formed. Cutting the drilling of tile shall be performed without damaging visible surfaces. Edges of the abutting trim, finish or built-in items shall be carefully grind cut for straight aligned joints. Tiles shall be closely fit to electrical outlet, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.

8. Joining Pattern: Unless otherwise shown on the Plans, tiles shall be laid in grind pattern. Joints when adjoining tiles on floor, base, walls, and trim of the same size shall be aligned. Tile work shall be laid out and tile fields shall be centered in both directions in each space or on each wall area. Tile work shall be adjusted to minimize tile cutting. Uniform joint widths shall be provided unless otherwise shown on the Plans.

9. Tile lining shall be laid out to next full tile beyond dimensions indicated.

10. Control joints or expansion joints shall be provided where shown, or required on the Plans, or by job condition for proper workmanship. Removable divider strip or proper width and depth of the tile and setting bed shall be installed. Strips shall be removed after grouting tiles and properly curing the work. Joint fillers and sealants shall be installed in control joints and expansion joints, of type as recommended by the tiling manufacturer.

11. All floor tiling in water present are such as bathrooms, washing area, kitchens, pantries and mechanical room shall be laid with a joint filling of approved polyurethane sealant.

12 For areas with ceramic tile flooring, a thick creamy slurry of neat white or tinted cement mixed with sufficient water shall be brushed over the floor until all joints are thoroughly filled. The surface of the floor shall be gently rubbed with a wood block to bring the surface to true planes. Excess slurry shall be removed, and the floor shall be rubbed with burlap to clean the tiles and finish of the joints to the satisfaction of the Engineer. Walking on tiles shall not be allowed for 5 days after laying and all completed tiled areas shall be protected to the satisfaction and approval of the Engineer.

1018.3.3.2 Wall

1. Cement and sand (1:4) mix backing 10 mm thick shall be laid as base for wall tiling. The surface of the backing shall be scratched in an approved manner when completely set to form key. The surface of the backing shall be well wetted before the tiling is applied and same shall be cured before tiling starts.

2. Allowable Variations in Finished Work:

a. Walls: 3 mm in 2 m in any direction; ± 3 mm at any location; 0.8 mm offset at any location.

b. Joints: ± 0.8 mm joint with variation at any locations; 1.6 mm in 1 m deviation from plumb and true.

3. Wall tiles and fittings shall be set in cement and sand mortar (1:4) mix, 6 mm thick to a true vertical face with continuous horizontal and vertical joints. Joints shall be straight, level perpendicular and of even width not exceeding 1.5 mm. The vertical joints shall be maintained plumb for the entire true level and plane by tamping under a straight edge or rubber faced block. Misfits as well as damaged or defective tiles shall be removed and replaced by and at the Contractor's expense.

4. Tile adhesive for wall tiles shall not be used without the approval of the Engineer.

5. The external and internal angles and side angles of glazed wall tiling shall be formed with angles beads. Whereas top edges of tiles shall be formed with rounded edges tiles. Joints shall match the general tiling and special fittings shall be used.

6. After edges of tiles have been thoroughly wet, joints in glazed wall tiles and fittings shall be grouted with a plastic mix of neat white or colored cement immediately after a suitable area of tile has been laid.

7. The joints shall be tooled slightly concave and the excess mortar shall be cut off and wiped off with a damp cloth from the face tile before it sets hard.

8. All special purpose wall tiles such as skirting tiles, single round edge, adjacent round edge, external round edge and the like, shall be used in wall cladding, shall be submitted for approval prior to commencement to work.

9. All service points in wall tiling shall be drilled holes in the tiles if they are located in the center of tiles.

1018.3.3.3 Countertop

1. Solid surfacing components shall be installed plumb, level, and true according to approved shop drawings and manufacturer's published installation instructions. Woodworking and specialized fabrication tools that are acceptable to the Engineer shall be used.
2. Joint seams shall be formed with specified seam adhesive. Seams shall be in locations as shown on approved shop drawings and acceptable to the Engineer. Excess adhesive shall be promptly removed.
3. A minimum radius of 13 mm shall be provided for countertop inside corners.
4. Gaps shall be filled between countertop and terminating substrates with appropriate sealant.
5. Rout sink cut-outs shall be in accordance to manufacturer's template. Solid surface cast sink units shall be installed to countertops with appropriate adhesive.
6. Backsplashes and end slashes shall be installed where indicated on drawings. Install countertops with appropriate adhesive.
7. Vanities: Front panels shall be secured to solid substrate with appropriate adhesive. A 5 mm gap shall be maintained between fixed and removable panels.

1018.3.4 Grouting and Pointing

1. Tiles shall have laid in place for at least 24 h 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.
2. Grouting mortar shall be applied over the tile by float or squeegee stroked diagonally across the joints. Excess mortar shall be removed with a wet sponge stroked diagonally or in a circular-motion after 12 min to 15 min. A barely damp or dry sponge shall be used to remove remaining haze while smoothing all grouted joints.

1018.3.5 Cleaning

1. Tile surfaces shall be cleaned thoroughly as possible upon completion of grouting.
2. All grout haze shall be removed using the appropriate cleaner.
3. Tiles shall be thoroughly rinsed with clean water before and after using chemical cleaners.
4. Surface of the tile shall be polished with soft cloth.

1018.3.6 Protection from Construction Dirt

1. A protective coat of neutral cleanser solution diluted with water in the proportion of 1:4 (1 L cleanser concentrate to 4 L of water) shall be applied.
2. In addition, tile flooring shall be covered with heavy-duty non-staining construction paper, taped in place. The protective paper shall not be torn or removed.
3. Just before final acceptance of the work, the protective paper shall be removed and the protective coat of neutral cleaner from tile surface shall be rinsed off.

1018.3.7 Quality Control

1. Each type and color of tile, mortar adhesive and grout shall be obtained from a single source to minimize variations in appearance and quality.
2. Before installation of tiles, mock-up shall be erected for each tile and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of material and execution. Mock-ups shall be built using materials indicated for final of work.

1018.3.8 Delivery, Storage and Handling

1. Packaged materials shall be delivered and stored in original containers with seals unbroken and labels intact until ready for installation.
2. Damage or contamination of materials by water, foreign matter and other causes that may affect its appearance and quality shall be prevented.
3. Tiles and setting materials shall be stored on elevated platforms, under cover and in dry location and protect from contamination, dampness, or overheating.

1018.4 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(1)	Glazed Tiles and Trims	Square Meter
1018(2)	Unglazed Tiles	Square Meter

ITEM 1027 - 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 in accordance with the Plans and this Specification.

1027.2 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.

1027.2.1 Cement

Portland cement shall conform to the requirements as defined in Subsection 900.2.1, Portland Cement of Item 900, Structural Concrete.

1027.2.2 Hydrated Lime

Hydrated lime shall conform to the requirements as defined in Subsection 900.2.5, Admixtures of Item 900, Structural Concrete.

1027.2.3 Fine Aggregates

Fine aggregates shall be clean, washed 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.

Fine aggregates shall conform to ASTM C897, Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters, Grading.

Table 1027.1 Grading of Fine Aggregates for Portland Cement-Based Plasters

Sieve size No.	% Retaining by Weight
4.75 mm	0
2.36 mm	0
1.18 mm	40
600 um	65
300 um	90
150 um	100
75 um	100

1027.2.4 Water

It shall conform to the Specification requirements defined in Subsection 900.2.3, Water of Item 900, Structural Concrete.

1027.3 Construction Requirements

1027.3.1 Surface Preparation

All plaster bases and accessories shall be free of deleterious amounts of rust, oil, or other foreign matter, which could cause bond failure or unsightly discoloration.

1. After removal of formworks reinforced concrete surfaces shall be roughened to improve adhesion of cement plaster.
2. 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.
3. Metal bases and accessories used to receive plaster shall be installed in conformance with ASTM C1063, Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster, except as other specified. Non-metallic based used to receive plaster shall be installed in conformance with ASTM C1787, Standard Specification for Installation of Non-Metallic Plaster Bases Used with Portland Cement Based Plaster in Vertical Wall Application.
4. Surfaces of solid base to receive plaster, such as masonry, stone, cast in place or precast concrete shall be straight and true within 6 mm in 3 m and shall be free of form oil or other elements, which would interfere with bonding. Conditions where the surfaces are out of tolerance shall be corrected prior to the application of the plaster. Ferrous-containing form ties or other obstructions shall be removed or receded a minimum 3 mm below the surface of the solid base and treated with a corrosion-resistant coating. Non-ferrous protuberances shall be permitted to be trimmed back even with the surface of the solid base.

1027.3.2 Plaster Proportions

All plaster shall be mixed and proportioned in accordance with the applicable requirements of ASTM C926, Standard Specification for Application of Portland Cement-Based Plaster.

The method of measuring materials for the finish shall be such that the specified proportions are controlled and accurately maintained. The weights per cubic meter of the materials are considered to be as follows:

Table 1027.2 Measurement of Materials

Material	Weight, kg/m³
Portland Cement	1505
Blended Cement	Weight printed on Bag
Masonry or Plastic Cement	Weight printed on Bag
Hydrated Lime	640
Sand, Damp, and Loose	1280 of dry sand

For purposes of this specification, a weight of 1,280 kg of oven-dried sand shall be used. This is, in most cases, equivalent to 0.028 m³ of loose, damp sand.

Plaster mix used shall be designated and referenced to Table 1027.3. Base coat proportions shall be as shown in Table 1027.4 for the mix specified from Table 1027.3. Finish-coat proportions for job-mixed finish coats shall be as specified in Table 1027.5.

Table 1027.3 Plaster Bases - Permissible Mixes

Property Base	Mixes for Plaster Coats	
	First (Scratch)	Second (Brown)
Low absorption, such as dense, smooth clay tile, brick, or concrete	C CM or MS P	C, CL, M or CM CM, MS, or M P
High Absorption, such as concrete masonry, absorptive brick, or tile	CL M CM or MS P	CL M CM, MS, or M P
Metal plaster base	C CL CM or MS M CP P	C, CL, M, CM, or MS CL CM, MS, or M M CP or P P

Where specified, natural or synthetic fibers shall be free of contaminants and used only in the base coat(s). The quantities per batch shall be in accordance with the published directions of the fiber manufacturer.

Table 1027.4 Base-Coat Proportions, ^A Parts by Volume ^B

Plaster Mix Symbols	Cementitious Materials					Volume of Aggregate per Sum of Separate Volumes of Cementitious Materials	
	Portland Cement Blend	Plastic Cement	Masonry Cement		Lime	1 st coat	2 nd coat
			N	M or S			
C	1	-	-	-	0 - ¾	2 ½ - 4	3 - 5
CL	1	-	-	-	¾ - 1 ½	2 ½ - 4	3 - 5
M	-	-	1	-	-	2 ½ - 4	3 - 5
CM	1	-	1	-	-	2 ½ - 4	3 - 5
MS	-	-	-	1	-	2 ½ - 4	3 - 5
P	-	1	-	-	-	2 ½ - 4	3 - 5
CP	1	1	-	-	-	2 ½ - 4	3 - 5

Note:

^A The mix proportions for plaster scratch and brown coats to receive ceramic tile shall be in accordance with the applicable requirements of ANSI A108.1 series applicable to specified method of setting time.

^B Variations of lime, sand, and perlite contents are allowed due to variation in local sands and insulation and weight requirements. A higher lime content will generally support a higher aggregate content without loss of workability. The workability of the plaster mix will govern the amounts of lime, sand or perlite.

^C The same or greater sand proportion shall be used in the second coat than is used in the first coat.

Table 1027.5 Finish Coat Proportion Parts by Volume

Plaster Mix Symbols	Cementitious Materials					Volume of Aggregate per Sum of Separate Volumes of Cementitious Materials
	Portland Cement Blend	Plastic Cement	Masonry Cement		Lime	
			N	M or S		
F	1	-	-	-	¾ - 1 ½	1 ½ - 3
FL	1	-	-	-	1 ½-2	1 ½ - 3
FM	-	-	1	-	-	1 ½ - 3
FCM	1	-	1	-	-	1 ½ - 3
FMS	-	-	-	1	-	1 ½ - 3

FP	-	1	-	-	-	1 ½ - 3
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Note:

^A Additional Portland cement is not required when Type S or M Masonry cement is used.

^B In areas not subject to impact, perlite aggregate shall be permitted to be used over base-coat plaster containing perlite aggregate.

1027.3.2.1 Mixing

All plaster shall be prepared in a mechanical mixer, using sufficient water to produce a workable consistency and uniform color.

Base-coat plasters that have stiffened because of evaporation of water shall be permitted to be tempered one time only to restore the required consistency. Plaster not used within 90 min from start of initial mixing shall be discarded. Finish-coat plaster shall not be tempered.

1027.3.3 Mixture

1. Mortar mixture for brown coat shall be freshly prepared and uniformly mixed in the proportion by volume of one (1) part Portland cement, three (3) parts sand and one fourth (1/4) part hydrated lime.
2. Finish coat shall be pure Portland cement properly graded conforming to the requirements of Subsection 900.2.1, Portland Cement of Item 900, Structural Concrete and mixed with water to approved consistency and plasticity.

1027.3.4 Application

1. Brown coat mortar mix shall be applied with sufficient pressure starting from the lower portion of the surface to fill the groove and to prevent air pockets in the reinforced concrete/masonry work and avoid mortar mix drooping. The brown coat shall be lightly broomed/or scratched before surface had properly set and allowed to cure.
2. Finish coat shall not be applied until after the brown coat has seasoned for 7 days and corrective measures had been done by the Contractor on surface 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 true 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 sandpaper 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," or "Decorative Stone" the Contractor shall render brick design or stone on plaster surface before brown coat had properly set and then allowed to dry. Cement plaster shall not be applied directly to:

1. Concrete or masonry surface that had been coated with bituminous compound and;

2. Surfaces that had been painted or previously plastered.

Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1027.3.5 Workmanship

Cement plaster finish shall be true to details and plumb and do not deviate more than plus or minus 3 mm in 3 m from a true plane in finished plaster surfaces, as measured by a 3 m straight-edge placed at any location on the surface. Finish surface shall have no visible junction marks where one (1) day's work adjoins the other. Vertical and horizontal groove joints shall be 25 mm wide and 10 mm deep or as shown on the Plans.

1027.4 Method of Measurement

All cement plaster finish shall be measured in square meters, lump sum 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 shall be made under:

Pay Item Number	Description	Unit of Measurement
1027(1)	Cement Plaster 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 required and undertaking the proper application of painting, varnishing and related works in accordance with the Plans and this Specification.

1032.2 Material Requirements

1032.2.1 Paint Materials

Paint material shall conform to the requirements of the following Specifications:

Table 1032.1 Paint Material Specification Requirements

Material	PNS Code	Description	Application
Flat Latex Paint	PNS 139	Specification for Flat Latex Paint (white and light tints for exterior and interior use)	Properly prepared plaster, masonry and primed wood and other architectural surfaces
Semi-gloss Latex Paint	PNS 463	Specification for Semi-Gloss Latex Paint (white and light tints for exterior and interior use)	Properly prepared plaster, masonry and primed wood and other architectural surfaces
Semi-gloss Enamel Paint	PNS 225	Specification for Alkyd-based Semi-Gloss Enamel Paint (white and light tints for exterior and interior use)	Properly prepared plaster, masonry and primed wood and other architectural surfaces
Enamel Paint	PNS 226	Specification for Alkyd-based Gloss Enamel Paint (white and coloured for exterior and interior use)	Wood, metal and other architectural surfaces
Alkyd-based Metal Primer	PNS 366	Specification for Alkyd-based Metal Primer	Ferrous metal
Epoxy Metal Primer	PNS 2113	Specification of Epoxy Metal Primer	Ferrous metal
Flatwall Enamel Paint	PNS 227	Specification for Alkyd-based Flat Enamel Paint (white and light tints for exterior and interior use)	Wood
Gloss Latex Paint	PNS 462	Specification for Gloss Latex Paint (white and light tints for exterior and interior use)	Masonry
Water Based Gloss Roof Paint	PNS 612	Specification for Water Based Gloss Roof Paint	Concrete, metal, wood and other paintable roofing materials
Elastomeric Wall Coating	PNS 2116	Specification for Elastomeric Wall Coating	Plaster, masonry, other architectural surfaces
Epoxy Enamel	PNS 2118	Specification for Epoxy Enamel, white and coloured	Concrete, wood, metal and other architectural surfaces
Roof paint (water based,	PNS 464	Specification for Roof paint (water-based, flat)	Paintable roofing materials

flat)			
Roof paint (Portland Cement)	PNS 465	Specification for Roof paint (Portland Cement)	Paintable roofing materials

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. Same brand of paint and tinting color shall be used to effect good paint body.

1032.2.3 Acry-colors

It shall be high strength tinting colors for water-based coatings that are specially formulated from the finest blend of pigments combined with pure acrylic latex vehicle that is easy to disperse, fast drying, odorless, and gives maximum color retention.

1032.2.4 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.

1032.2.5 Silicon Water Repellant

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

1032.2.6 Patching Compound

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

1032.2.7 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.

1032.2.8 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. Clear gloss lacquer shall be in accordance with the requirements of PNS 368, Specification for Clear Gloss Lacquer.

1032.2.9 Shellac

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

1032.2.10 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. It shall be in accordance with the requirements of PNS 367, Specification for Lacquer Sanding Sealer.

1032.2.11 Oil Wood Stain

Oil-based stain shall be a penetrating stain for interior doors, windows, trim and furniture. It rejuvenates and transforms interior timber. Oil-based stain penetrates deeply and adds color without raising the grain. Oil-based stain is best used to rejuvenate old or used timber.

1032.2.12 Glazing Putty

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

1032.2.13 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.

1032.2.14 Schedule

Exterior

1. Plain cement plastered finish - Three (3) coats acrylic base masonry paint to be painted
2. Concrete exposed aggregate and/or tool finish - One (1) coat water repellent
3. Ferrous metal - One (1) coat primer and two (2) coats enamel paint
4. Galvanized metal - One (1) coat zinc chromate primer and two (2) coats Portland cement paint
5. Wood paint finish - Three (3) coats oil-based paint
6. Wood varnished finish - Varnish water repellent

Interior

1. Plain cement plastered finish - Two (2) coats acrylic base masonry paint to be painted
2. Concrete exposed aggregate and/or tool finish - Clean surface
3. Ferrous metal - One (1) coat primer and two (2) coats enamel paint
4. Woodwork sea-mist - Three (3) coats of three (3) parts thinner and one (1) part lacquer
5. Woodwork varnish - - First coat of one (1) part sanding sealer to one (1) part solvent
- Second coat of two-third (2/3) sanding sealer to one-third (1/3) solvent
6. Woodwork painted finish - Three (3) coats oil base paint
7. Ceiling boards textured finish - One (1) coat oil-based paint, all to dry the patch surfaces unevenness and apply textured paint coat

1032.2.15 Containers and Markings

It shall be in accordance with the requirements of PNS 140, General Requirements for Packaging, Packing and Marking of Paints and Other Protective Coatings.

All paints, varnishes, and other related products shall be shipped in strong, substantial containers marked in prints distinctive color of the label or in letters clearly visible to the naked eye with the following information:

1. Type of Paint
2. Brand or Trademark
3. Name and address of manufacturer
4. Net Volume and/or mass in metric units
5. Directions for use
6. Safety precautions
7. Batch or lot number

Any package or container not so marked will not be accepted for use under this Specification.

1032.3 Construction Requirements

Prior to commencement of the painting, varnishing and related work, the surfaces to be applied shall be examined in order not to jeopardize the quality and appearances of the painting, varnishing and related works.

1032.3.1 Surface Preparation

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

Interior woodworks shall be sandpapered between coats. Cracks, holes or 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 the 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 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 following shall be undertaken prior to painting, varnishing and other related works:

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

1032.3.2 Application

Paints when applied by brush shall become non-fluid, thick enough to lay down as

adequate film of wet paint. Brush marks shall be flawed out after application of paint.

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

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

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 one (1) pint of suitable thinner per gallon of the paint.

1032.3.4 Storage

All materials 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 times. 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. 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

1. 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.
2. All coats shall be thoroughly dry before the succeeding coat is applied.
3. 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.
4. 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.
5. 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

1. Depress wood grain by steel brush and sand surface lightly.
2. Apply sanding sealer.
3. Apply two (2) coats of industrial lacquer paint.
4. Spray last coat of industrial lacquer paint mixed with sanding sealer.
5. Apply wood paste filler thinned with turpentine or paint thinner into the wood surface.
6. Wipe off wood paste filler immediately.
7. Spray flat or gloss lacquer whichever is specified.

1032.3.8 Procedure for Varnish Finish

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

1032.3.9 Procedure for Ducco Finish

1. Sand surface thoroughly.
2. Apply primer surface white or gray by brush or spray.
3. Apply lacquer spot putty in thin coat. Allow each coat to become thoroughly dry before applying next coat.
4. Apply primer surfaces and then allow to dry in 2 h before applying the next coat.
5. 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 and proper application of all materials, labor, equipment, tools and other incidental necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1032(1)a	Painting Works, Masonry/Concrete	Square Meter
1032(1)b	Painting Works, Wood	Square Meter
1032(1)c	Painting Works, Steel	Square Meter

ITEM 1039 - ALUMINUM CLADDING

1039.1 Description

This Item covers furnishing of aluminum cladding as exterior materials complete with all necessary accessories, anchors, hardware and fittings, including equipment, tools and labor required for complete installation of the walls and/or ceiling of a structure to protect from effects of weather and for aesthetic purposes in accordance with the Plans and Specifications.

1039.2 Material Requirements

1039.2.1 Aluminum and Aluminum Alloy

It shall be flat sheet, coiled sheet, and plate, in the alloys and tempers in accordance with ASTM B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate, Table 2 - Mechanical Property Limits for Nonheat-Treatable Alloys, and Table 3 - Tensile Property Limits for Heat-Treatable Alloys, and in the following finishes:

1. The plate in all alloys and sheet in heat-treatable alloys shall be mill finish.
2. The sheet in non-heat-treatable alloys shall be mill finish, one-side bright mill finish, standard one-side bright mill finish, and standard two-sides bright mill finish.

Aluminum sheets shall be supplied without nail holes and are normally applied horizontally (ceilings) and vertically (walls) in accordance with accepted practices.

Aluminum composite panel shall be 4 mm thick (minimum) consisting of two 0.5 mm thick (minimum) aluminum sheets bonded to a 3 mm thick non-aluminum core. The

panel shall be heat resistant, while the core shall be made of non-combustible material. The framing system shall be made of aluminum to prevent corrosion of the panels. The panel coating shall meet the requirements specified on the Plan.

Other sizes of aluminum composite panels which depends on the thicknesses of the core and the aluminum sheets available shall be subject to the approval of the Engineer.

1039.2.2 Rivet

The rivet shall conform to the following requirements or as specified on the Plans:

Length	:	18.0 mm
Shaft Diameter	:	5.0 mm
Head Diameter	:	14.0 mm
Holes for Fixed Points	:	5.2 mm
Holes for Sliding Points	:	8.5 mm

1039.2.3 Quality Assurance

Unless otherwise specified, the material shall be supplied in the mill finish and shall be uniform as defined by the requirements of this Item and shall be commercially sound. Any requirement not so covered is subject to evaluation and approval of the Engineer.

Each sheet and plate shall be examined to determine conformance to this Specification with respect to general quality and identification marking.

1039.2.4 Tensile Properties of Material

The sheet and plate shall conform to the requirements for tensile properties of non-heat-treatable and heat-treatable alloys as specified in Table 2 and Table 3 of ASTM B209M, respectively.

One (1) sample shall be taken from each end of each parent coil, or parent plate, but no more than one sample (1) per 1,000 kg of sheet or 2,000 kg of plate, or part thereof, in a lot shall be required.

The method of tension test, geometry of test specimens and the location in the product from which they are taken shall be as specified in ASTM B557M, Standard Test Methods of Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products.

1039.2.5 Bend Properties

Sheet and plate shall be capable of being bent cold through an angle of 180 degrees around a pin having a diameter equal to N times the thickness (N x thk) of the sheet or

plate without cracking, where N is the Bend Diameter Factor as prescribed in Table 2 of ASTM B209M for the different alloys, tempers, and thicknesses.

Specimens for sheet subject to bend tests shall be the full thickness of the material, approximately 20 mm in width, and when practical, at least 150 mm in length. Such specimens shall be taken in any direction and their edges may be rounded to a radius of approximately 2 mm.

The bend tests shall be conducted in accordance with ASTM E290, Standard Test Methods for Bend Testing of Material for Ductility.

1039.3 Construction Requirements

Planning details shall be coordinated between the Engineer and the Contractor. Installation requirements shall be prepared by the Contractor and shall be approved by the Engineer.

1039.3.1 General

The Contractor/fabricator/installer shall be responsible for the designing, supplying and erecting the complete aluminum cladding system, coordinating and maintaining tolerances between the structures and cladding system. Aluminum cladding systems shall be installed by mechanical fasteners properly secure the system to the structure with the use of an appropriate fasteners. A pull-out test Mill Certificate shall be provided by the manufacturer in accordance with ASTM E2359M, Standard Test Method for Field Pull Testing of an In-Place Exterior Insulation and Finish System Clad Wall Assembly.

A back-ventilated curtain façade shall be constructed for aluminum cladding panels used as cladding to allow removal of condensation via the ventilation. The ventilation space between the outer wall/insulation and the aluminum cladding panels shall have a dimension conforming with the pertinent regulations and minimum ventilation gap requirement of 20 mm. The ventilation openings shall be ensured on top and bottom edges of the exterior cladding as well as in the area of window and door openings.

The load-bearing exterior wall shall require no special preparation and need not to be plastered.

The cladding structure shall be designed properly so that any effect of changing weather conditions and moisture with changes in dimension shall be captured in the weather shell and not transferred to the exterior wall.

The facade surfaces, corners and edges of aluminum cladding panels shall be optimally protected against high impacts and jolts. Dry construction materials in the case of back-ventilated cladding ensure reliable values for dew point calculation and determination of the insulation thicknesses.

Coats of paint for the purposes of renovation shall not be needed in the case of back-ventilated cladding with permanently treated weather shells, eliminating the problem of moisture migration from inside to outside that is associated with such painting measures.

Back-ventilated facades can be replaced at any location with panels of identical color.

1039.3.2 Manufacturing Tolerances

Preparatory to rolling aluminum cladding sheet and plate to the specified thickness, the aluminum or aluminum-alloy plates which are bonded to the alloy ingot or slab shall be of the composition shown in Table 1- Chemical Composition Limits, of ASTM B209M and each shall have a thickness of not less than that shown in Table 5- Components of Clad Products, of ASTM B209 for the alloy specified.

When the thickness of the cladding is to be determined on finished material, not less than one (1) transverse sample approximately 20 mm in length shall be taken from each edge and from the center width of the material. Samples shall be mounted to expose a transverse cross section and shall be polished for examination with a metallurgical microscope. Using 1003 magnification, the maximum and minimum cladding thickness on each surface shall be measured in each of five (5) fields approximately 2.5 mm apart for each sample. The average of the ten (10) values (five (5) minima plus five (5) maxima) on each sample surface is the average cladding thickness and shall meet the minimum average and, when applicable, the maximum average specified in Table 5 of ASTM B209M.

1039.3.3 Erection Tolerances

Limit variations from plumb, level, or dimensional angle to the following:

1. Not more than 3 mm deviation in one (1) storey height, in 3 m vertical, angular run, or in 6 m horizontal run.
2. Not more than 6 mm deviation in 12 m run, in any direction.
3. At battered wall areas, plumb is defined to match indicated slope.

Limit variations from location (theoretical calculated position in plan or elevated based on established floor lines and column lines), including variations from plumb and level, to the following:

1. Not more than 9.5 mm total deviation for member for 3 m run.
2. Not more than 3 mm change in deviation for member for 3 m run.

1039.3.4 Weathering Sealants

Sealants shall be installed as indicated and required to achieve water and airtight assembly.

1. Clean and prime joints with sealant. Install sealant and related backing material around the perimeter of frames.
2. Apply sealant filling joint and tool smooth to insure full contact with adjacent surfaces. Strike off excess material.

1039.3.5 Workmanship, Finish, and Appearance

1. Workmanship of the product shall be free of defects that will impair appearance, erection, or serviceability.
2. Appearance and finish of the exposed surface of the cladding shall be smooth or otherwise textured as specified on the Plans.

1039.3.6 Cleaning, Protection, Test and Rejection

Clean surfaces complying with the manufacturer's recommendations prior to substantial completion, exercising care to avoid damage to protective coatings and finishes.

Initiate and maintain protection and other precautions required to ensure that system will be without damage or deterioration at the time of acceptance.

If any material fails to conform to all of the applicable requirements of this Item, it shall be cause for rejection of the inspection lot.

When there is evidence that a failed specimen was not representative of the inspection lot and when no other sampling plan is provided or approved by the Engineer through the contract or purchase order, at least two (2) additional specimens shall be selected to replace each test specimen that failed. All specimens so selected for retest shall meet the requirements of the specification or the lot shall be subject to rejection.

Material in which defects are discovered subsequent to inspection may be rejected.

If material is rejected by the Engineer, the Contractor or supplier shall be responsible only on the replacement of the material.

1039.4 Method of Measurement

The area to be paid for shall be the number of square meters of aluminum sheet placed and accepted in the completed works. The Contractor's certified invoices may be accepted for the quantity furnished in each shipment provided such quantities are checked by measurement of water displacement of the shipping vessel or by volume measurement converted to weights by means of unit weight determinations.

1039.5 Basis of Payment

The square meter determined as provided in Section 1039.4, Method of Measurement shall be paid for at the Contract Unit Price for Aluminum Cladding which price and payment shall be full compensation for the preparation of all materials, for furnishing, and placing all materials, and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1039 (1)	Aluminum Cladding	Square Meter

ITEM 1046 - MASONRY WORKS

1046.1 Description

This Item shall consist of furnishing of all necessary materials, tools, equipment and labor necessary to complete the execution of the masonry works as shown on the Plans.

1046.2 Materials Requirements

1046.2.1 Hydraulic Cement

Hydraulic Cement shall conform to the applicable requirements of Subsection 900.2.1, Portland Cement of Item 900, Structural Concrete.

1046.2.2 Aggregates

1046.2.2.1 Aggregates for Concrete Hollow Blocks and Louver Blocks

Aggregates shall conform to the applicable requirements of Subsection 900.2.2, Concrete Aggregates of Item 900, Structural Concrete.

1046.2.3 Water

Water shall conform to the applicable requirements of Subsection 900.2.3, Water of Item 900, Structural Concrete.

1046.2.4 Reinforcing Steel

1046.2.4.1 Reinforcing Steel for Concrete Hollow Blocks and Louver Blocks

Reinforcing Steel shall conform to the applicable requirements of Item 902, Reinforcing Steel

1046.2.5 Mortar for Concrete Hollow Blocks and Louver Blocks

Mortar shall consist of sand, cement and water conforming to the requirements of Item 900, Structural Concrete, mixed in the proportion of one (1) part cement to three (3) parts sand by volume, and sufficient water to obtain the required consistency.

1046.2.11 Concrete Hollow Blocks and Louver Blocks

Width, height and length of concrete hollow blocks and louver blocks shall be $\pm 3.20\text{mm}$ from the specified dimension as shown on the Plans.

1046.2.11.2 Non-load bearing Concrete Hollow Blocks and Louver Blocks

Non-load bearing Concrete hollow blocks shall be clearly marked to prevent their use as load bearing units.

1. **Type I, Moisture-Controlled Units** – Units shall conform to the requirements of Tables 1046.3, 1046.4 and 1046.5.
2. **Type II, Non-Moisture-Controlled Units** - Units designated as Type II shall conform to the requirements of Table 1046.4.

Table 1046.3 Weight Classification

Weight Classification	Oven-Dry Density of Concrete, kg/m ³
Lightweight	Less than 1680
Medium Weight	1680 to less than 2000
Normal Weight	2000 or more

Table 1046.4 Strength Requirements

	Compressive Strength (Average Net Area, Min.) Mpa (Psi)
Average of 3 Units	4.14 (600)
Individual Unit	3.45 (500)

Table 1046.5 Moisture-Content Requirements for Type I Units

Total Linear Drying Shrinkage, %	Moisture Content, max., % of Total Absorption (Average of 3 Units)		
	Humidity Conditions at Job Site of Point of Use		
	Humid ^A	Intermediate ^B	Arid ^C
Less than 0.03	45	40	35
0.03 to less than 0.045	40	35	30
0.045 to 0.065, max	35	30	25

Note:

^A Mean annual relative humidity above 75%

^B Mean annual relative humidity 50 to 75%

^C Mean annual relative humidity less than 50%

1046.3 Construction Requirements

1046.3.1 Concrete Hollow Blocks and Louver Blocks

1046.3.1.1 Installation

1. All masonry work shall be laid true to line, level, plumb and neat in accordance with the Plans.
2. Units shall be cut accurately to fit all plumbing ducts, opening for electrical works, and all holes shall be neatly patched.
3. No construction support shall be attached to the wall except where specifically permitted by the Engineer.

4. Masonry units shall be sound, dry, clean and free from cracks when placed in the structure.
5. Proper masonry units shall be used to provide for all window, doors, bond, beams, lintels, plasters etc., with a minimum of unit cutting.
6. Where masonry units cutting is necessary, all cuts shall be neat and true to line.
7. Units shall be placed while the mortar is soft and plastic. Any unit disturbed to the extent that the initial bond is broken after initial positioning shall be removed and re-laid in fresh mortar.
8. Mortar shall not be spread too far ahead of units, as it will stiffen and lose plasticity, especially in hot weather. Mortar that has stiffened shall not be used. ASTM C270, Standard Specification for Mortar for Unit Masonry requires that mortar be used within 2/12 hours of initial mixing.

1046.3.1.2 Reinforcement for Concrete Hollow Blocks

Reinforcement shall be done in accordance with the structural Plans as to size, spacing and other requirements of Section 902.3, Construction Requirements of Item 902, Reinforcing Steel.

Reinforcement shall be clean and free from loose, rust, scales and any coatings that will reduce bond.

1046.3.1.3 Sampling and Testing for Concrete Hollow Blocks and Louvers

Method of Sampling for Quality Test shall be as follows:

1. One (1) Quality Test for every 10,000 units of fraction thereof.
2. Six (6) specimens shall be submitted for one (1) quality test in which three (3) specimens for Compression Test and the remaining three (3) for Moisture Content and Water Absorption.

Units shall be tested in accordance with ASTM C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units and ASTM C426, Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units.

1046.3.1.4 Storage and Handling of Masonry Works

The blocks shall be stockpiled on planks or other supports free from contact with ground and covered. The blocks shall be handled with care and damaged units shall be rejected.

1046.3.2.2 Finish and Appearance

1. All units shall be sound and free of cracks or other defects that interfere the proper placement of the unit significantly impair the strength or permanence of the construction. Minor cracks, incidental to the usual method of manufacture or minor

chipping resulting from customary methods of handling in shipment and delivery, are not grounds for rejection.

2. Where units are to be used in wall construction, the face or faces that are to be exposed shall not show chips or cracks, not otherwise permitted, or other imperfections when viewed from a distance of not less than 6.1 m under diffused lighting. 5% of a shipment containing chips and cracks not longer than 1/3 of the dimension where it is found and not wider than 5mm shall be permitted.
3. The color and texture of units shall be specified by the Engineer. The finished surfaces that will be exposed in place shall conform to an approved sample consisting of not less than four (4) units, representing the range of texture and color permitted.
4. A shipment shall not contain more than 5% of units, including broken unit that not meet requirements of the above provisions.

1046.4 Method of Measurement

The work to be paid for under this Item shall be number of square meters of masonry units that are satisfactorily completed and accepted.

1046.5 Basis of Payment

The accepted quantity, measure as prescribed in Section 1046.4, Method of Measurement shall be paid for at the Contract Unit Price for Masonry Works which price and payment shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1046(2)a1	CHB Non- Load-Bearing (including Reinforcing Steel), 100mm	Square Meter
1046(2)a2	CHB Non- Load-Bearing (including Reinforcing Steel), 150mm	Square Meter

ITEM 1047 - METAL STRUCTURES

1047.1 Description

This works shall consist of furnishing, fabricating, hauling, erecting, welding and painting of metal structure and accessories constructed in accordance with the Plans and this Specifications.

1047.2 Material Requirements

1047.2.1 Classes of Structural Steels

1047.2.1.1 Built-Up Shapes

Built-up shapes are defined as structural steel sections made up of steel plates with

thickness ranging from 5 mm to 45mm, welded together to form structural shapes. It shall conform to the requirements of ASTM A36M, Standard Specification for Carbon Structural Steel.

Built-up cross sections consisting of plates with a thickness exceeding 50 mm, used as members subject to primary tensile forces due to tension or flexural and spliced or connected to other members using complete joint-penetration groove welds that fuse through thickness of plate, shall conform to ASTM A6M, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling, Supplementary Requirement S5, Charpy V-Notch Impact Test and ASTM A673M, Standard Specification for Sampling Procedure for Impact Testing of Structural Steel.

1047.2.1.4 Rolled Steel Shapes

Rolled Steel shapes are structural steel sections produced by passing red hot blooms (for larger sections) or billets (for smaller sections) through rolls until the desired shape is attained.

Rolled steel shapes shall conform to the billet specifications for PNS 49, Steel Bars for Concrete Reinforcement – Specification, Grade 230.

1047.2.2 Structural Steel Materials

1047.2.2.1 General

For hot-rolled Structural shapes, plates and bars, such tests shall be made in accordance in ASTM A6M; for sheets, such tests shall be made in accordance with ASTM A568M, Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements; for tubing and pipe, such tests shall be made in accordance with the requirements of the applicable ASTM standards listed for those product forms.

Structural Steel shall be furnished according to the following applicable ASTM specifications:

1047.2.2.2 Hot-Rolled Structural Shapes

Hot-rolled structural shapes shall conform to the following specifications or as indicated in the Plans:

Designation	Title
ASTM A36M	Standard Specification for Carbon Structural Steel
ASTM A529M	Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A572M	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A588M	Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ks(345Mpa) Minimum Yield Point, with Atmospheric Corrosion Resistance
ASTM A709M	Standard Specification for Structural Steel for Bridges

ASTM A913M	Standard Specification for Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST)
ASTM A992M	Standard Specification for Structural Steel Shapes

1047.2.2.5 Steel Plates

Steel plates shall conform to the following specifications or as indicated in the Plans:

Designation	Title
ASTM A36M	Standard Specification for Carbon Structural Steel
ASTM A242M	Standard Specification for High-Strength Low-Alloy Structural Steel
ASTM A283M	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A514M	Standard Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A529M	Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A572M	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A588M	Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50ksi (345Mpa) Minimum Yield Point, with Atmospheric Corrosion Resistance
ASTM A709M	Standard Specification for Structural Steel for Bridges
ASTM A1011M	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra- High Strength

1047.2.2.6 Steel Bars

Steel bars shall conform to the following specifications or as indicated in the Plans

Designation	Title
ASTM A36M	Standard Specification for Carbon Structural Steel
ASTM A529M	Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A572M	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A709M	Standard Specification for Structural Steel for Bridges

1047.2.4 Bolts, Washers and Nuts

Bolts, washers and nuts shall conform to the requirements of the following specifications or as indicated in the Plans:

Designation	Title
Bolts	
ASTM A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM F3125M	Standard specification for High Strength Structural Bolts, Steel and Alloy

	Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions
ASTM A449	Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
Nuts	
ASTM A194M	Standard Specification for Carbon Steel, Alloy Steel, and Stainless-Steel Nuts for Bolts for High Pressure or High Temperature Service or Both
ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts
Washers	
ASTM F436M	Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
ASTM F959M	Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series

1047.2.5 Anchor Rods and Threaded Rods

Anchor rod and threaded rod material shall conform to the following specifications or as indicated in the Plans:

Designation	Title
ASTM A36M	Standard Specification for Carbon Structural Steel
ASTM A193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A354	Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and other Externally Threaded Fasteners
ASTM A449	Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A572M	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM F1554	Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength

1047.2.6 Consumables for Welding

Filler metals and fluxes shall conform to the following applicable specifications of American Welding Society or as indicated in the Plans:

Designation	Title
AWS A5.1M	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS A5.5M	Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding

AWS A5.17M	Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
AWS A5.18M	Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding
AWS A5.23M	Specification for /Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding
AWS A5.25M	Specification for Carbon and Low-Alloy Steel Electrodes and Fluxes for Electroslag Welding
AWS A5.26M	Specification for Carbon and Low-Alloy Steel Electrodes for Electrogas Welding
AWS A5.32M	Welding Consumables – Gases and Gas Mixtures for Fusion Welding and Allied Processes
AWS A5.36M	Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding

1047.2.7 Headed Stud Anchors

Steel stud shear connectors shall conform to the requirements of AWS D1.1M, Structural Welding Code – Steel.

Studs are made from cold drawn bar, either semi-killed or killed aluminum or silicon deoxidized, conforming to the requirements of the ASTM A29M, Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought.

1047.2.8 Turnbuckle

Unless otherwise specified, turnbuckle shall conform to the applicable requirements of ASTM F1145, Standard Specification for Turnbuckles, Swaged, Welded, Forged and AASHTO M 269, Standard Specification for Turnbuckles and Shackles.

1047.2.9 Stainless Steel Flagpole Post

Unless otherwise specified, stainless steel for flagpole shall conform to the applicable requirements of ASTM A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel pipes and ASTM A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.

1047.3 Construction Requirements

1047.3.1 Shop and Erection Drawings

Shop and erection drawings are permitted to be prepared in stages. Shop drawings shall

be prepared in advance of fabrication and give complete information necessary for the fabrication of the component parts of the structure, including the location, type and size of welds and bolts. Erection drawings shall be prepared in advance of the erection and give information necessary for erection of the structure. Shop and erection drawings shall clearly distinguish between shop and field welds and bolts and shall clearly identify pretensioned and slip-critical high-strength bolted connections.

1047.3.2 Fabrication

1047.3.2.1 Cambering, Curving and Straightening

Local application of heat or mechanical means is permitted to be used to introduce or correct camber, curvature and straightness. The temperature of heated areas as measured by the approved methods, shall not exceed 593 °C for ASTM A514M or as indicated in the Plans.

1047.3.2.2 Thermal Cutting

Thermally cut edges shall meet the requirements of AWS D1.1M clauses 5.14.5.2, 5.14.8.3 and 5.14.8.4 with the exception that thermally cut free edges that will be subject to calculated static tensile stress shall be free of round-bottom gouges greater than 5 mm and sharp V-shaped notches. Gouges deeper than 5 mm and notches shall be removed by grinding or repaired by welding.

Reentrant corners, except reentrant corners of beam copes and weld access holes, shall meet the requirements of AWS D1.1, Section 5.16. If another specified contour is required. It shall be shown on the contract. Beam copes and weld access shall meet the geometrical requirements of section 510.1.6, Beam Copers and Weld Access Holes of Chapter 5, Structural Steel of National Structural Code of the Philippines (NCSP), 2015 Edition. Beam copes and weld access holes in shapes that are to be galvanized shall be ground. For shapes with a flange thickness not exceeding 50 mm the roughness of thermally cut surfaces of copes shall be no greater than a surface roughness value of 50 µm as defined in ASME B46.1 Surface Texture (Surface Roughness, Waviness, and Lay). For beam copes and weld access holes in which the curved part of the access hole is thermally cut in ASTM A6M hot rolled shapes with a flange thickness exceeding 50 mm and welded built-up shapes with material thickness greater than 50 mm, a preheat temperature of not less than 66 °C shall be applied prior to thermal cutting. The thermally cut surface of access holes in ASTM A6M hot rolled shapes and built-up shapes with a thickness greater than 50 mm shall be ground and inspected for cracks using magnetic particle inspection in accordance with ASTM E709, Standard Guide for Magnetic Particle Testing. Any crack is unacceptable regardless of the size and location.

1047.3.2.3 Planning of Edges

Planning or finishing of sheared or thermally cut edges of plates or shapes is not required unless specifically called for in the Contract documents or included in a stipulated edge preparation for welding.

1047.3.2.4 Welded Construction

The technique of welding, workmanship, appearance and quality of welds, and the methods used in correcting nonconforming work shall be in accordance with AWS D1.1M.

1047.3.2.5 Bolted Construction

Parts of bolted members shall be pinned or bolted and rigidly held together during assembly. Use of a drift pin in bolt holes during assembly shall not distort the metal or enlarge the holes. Poor matching of holes shall be cause for rejection.

Bolts shall comply with the provisions of the Research Council on Structural Connections (RCSC) Specification for Structural Joints using ASTM F3125M except that thermally cut holes shall be permitted with a surface roughness profile not exceeding 25 μm as defined in ASME B46.1 Gouges shall not exceed a depth of 2 mm.

Fully inserted finger shims, with a total thickness of not more than 6mm within a joint, are permitted in joints without changing the strength (based upon hole type) for the design connections. The orientation of such shims is independent of the direction of application of the load. The use of high-strength bolts shall conform to the requirements of the RCSC Specification for Structural Joints using ASTM F3125M.

1047.3.2.6 Dimensional Tolerances

Dimension tolerances shall be in accordance with the American Institute of Steel Construction (AISC) Code of Standard Practice for Steel Buildings and Bridges.

1047.3.2.7 Finish of Column Bases

Column bases and base plates shall be finished in accordance with the following requirements:

1. Steel bearing plates 50 mm or less in thickness are permitted without milling, provided a satisfactory contact bearing is obtained. Steel bearing plates over 50 mm but not over 100 mm in thickness are permitted to be straightened by pressing, or if presses are not available, by milling for bearing surface (except as noted in subparagraph 2 and 3 of this section), to obtain a satisfactory contact bearing. Steel bearing plates over 100mm in thickness shall be milled for bearing surfaces (except as noted in subparagraph 2 and 3 of this section).
2. Bottom surfaces of bearing plates and column bases that are grouted to ensure full bearing contact on foundations need to be milled.
3. Top surfaces of bearing plates need not be milled when complete-joint penetration groove welds are provided between the column and bearing plate.

1047.3.2.8 Holes for Anchor Rods

Holes for anchor rods shall be permitted to be thermally cut in accordance with the provisions of Subsection 1047.3.2.2, Thermal Cutting.

1047.3.2.9 Drain in Holes

When water can collect inside Hollow Structural Sections (HSS) or box members, either during construction or during service, the member shall be sealed, provided with a drain hole at the base.

1047.3.2.10 Requirements of Galvanized Members

Members and parts to be galvanized shall be designed, detailed and fabricated to provide for flow and drainage of pickling fluids and zinc and to prevent pressure built up in enclosed parts.

Design and detailing of galvanized members shall conform to the requirements of the following:

1. ASTM A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings and Iron and Steel Products.
2. ASTM A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A384M, Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
4. ASTM A780M, Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

1047.3.3 Shop Painting

1047.3.3.1 General Requirements

Shop painting and surface preparation shall be in accordance with the provision of the AISC Code of Standard Practice for Steel Building and Bridges. Shop paint is not required unless specified in the Contract Documents.

1047.3.3.2 Inaccessible Surfaces

Except for contact surfaces, surface inaccessible after shop assembly shall be cleaned and painted prior to assembly.

1047.3.3.3 Contact Surfaces

Paint is permitted in bearing-type connections. For slip critical connections the faying surface requirements shall be in accordance with the RCSC Specification for Structural Joints Using ASTM F3125M.

1047.3.3.4 Finished Surfaces

Machine-finished surface shall be protected against corrosion by a rust inhibitive coating that can be removed prior to erection, or which has characteristics that make removal prior to erection unnecessary.

1047.3.3.5 Surfaces Adjacent to Field Welds

Unless otherwise specified, surface within 50 mm of any filed weld location shall be free of materials that would prevent proper welding or produce objectionable fumes during welding.

1047.3.4 Erection

1047.3.4.1 Alignment of Column Bases

Column bases shall be set level to the required elevation with full bearing concrete or masonry.

1047.3.4.2 Bracing

The frame of steel skeleton buildings shall be carried up true and plumb within the limits defines in the AISC Code of Standard Practice for Steel Buildings and Bridges. Temporary bracing shall be provided, in accordance with the requirements of the Code of Standard Practice for Steel Buildings and Bridges, wherever necessary to support the loads to which the structure may be subjected, including equipment and the operation of same. Such bracing shall be left in place as long as required safety.

1047.3.4.3 Alignment

No permanent bolting or welding shall be performed until the adjacent affected portions of the structure have been properly aligned.

1047.3.4.4 Fit Column Compression Joints and Base Plate

Lack of contact bearing not exceeding a gap of 2 mm, regardless of the type of splice used (partial-joint-penetrating groove welded or bolted), is permitted. If the gap exceeds 2 mm, but is less than 6 mm, and if an engineering investigation shows that sufficient contact area does not exist, the gap shall be pack out with non-tapered steel shims. Shims need not be other than mild steel, regardless of the grade of the main material.

1047.3.4.5 Field Welding

Shop paint of the surface adjacent to joints to be field welded shall be wire brushed to assure weld quality. Field welding of attachments to installed embeds in contact with concrete shall be done in such a manner as to avoid excessive thermal expansion of the embedment which could result in spalling or cracking of the concrete or excessive stress in the embedment anchors.

1047.3.4.6 Field Painting

Responsibility for touch-up painting, Cleaning and field paint shall be allocated in accordance with the accepted local practices, and this allocation shall be set forth explicitly in the design documents.

1047.3.4.7 Field Connections

As erection progresses, the structure shall be securely bolted or welded to support the dead, wind and erection loads.

1047.3.5 Quality Control

The Fabricator shall provide quality control procedures to the extent that the fabricator deems necessary to assure that the work performed is in accordance with his Specification. In addition to the fabricator's quality control procedures, material and workmanship at all time may be subject to inspection by the Engineer.

1047.3.5.1 Cooperation

As much as possible, the inspection by the Engineer shall be made at the fabricator's plant. The fabricator shall cooperate with the Engineer, permitting access for inspection to all places where work is being done.

1047.3.5.2 Rejection

Material or workmanship not in conformance with the provision of the Specification shall be rejected by the Engineer at any time during the progress of work.

1047.3.5.3 Inspection and Testing of Welding

The inspection and testing of welding shall be performed in accordance with the provisions of AWS D1.1 except as modified in Section 510.2, Welds of National Structural Code of the Philippines, 2015. The process, extent and standards of acceptance shall be clearly defined in the Contract.

1047.3.5.4 Inspection of Slip-Critical High Strength Bolted Connections

The Inspection of slip-critical high strength bolted connections shall be in accordance with the provisions of the RCSC Specification for Structural Joints Using ASTM F3125.

1047.3.5.5 Identification of Steel

The fabricator shall be able to demonstrate by a written procedure and by actual practice a method of material identification, visible at least through the "fit-up" operation for the main structural elements of each shipping piece.

1047.4 Method of Measurement

The quantity of structural steel to be paid for shall be the number of kilograms or lump sum installed in place and accepted.

The quantity of metal structure accessories to be paid for shall be the number of kilograms, pieces or lump sum installed in place and accepted.

1047.5 Basis of Payment

The accepted quantity, measure as prescribe in Section 1047.4, Method of measurement shall be paid for at the Contract Unit Price for Metal Structures which price and payment shall constitute full compensation for furnishing and placing all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribe in this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1047 (8)	Structural Steel, Roof Framing	Lump Sum
1047(10)	Metal Structure Accessories	Lump Sum

ITEM 1051 - RAILINGS

1051.1 Description

This Item shall consist of furnishing, fabricating, and installing the railings for buildings and other similar structures of the material or combination of materials in accordance with this Specification and in conformity with the Plans.

Railings shall be classified as concrete, wooden, masonry, stone, metal, stainless steel and glass, in accordance with the predominating material contained in each.

Railing shall not be considered a part of the structural system of the building unless it is stated in the design.

1051.2 Material Requirements

1051.2.10 Stainless Steel (Non-Ferrous Metal)

It shall conform to the requirements of ASTM A 276M, Standard Specification for Stainless Steel Bars and Shapes or as called for in the Plans.

1051.3 Constructions Requirements

1051.3.1 General

Railings shall be constructed in accordance with the Plans and shall not reflect any unevenness in the structure/building. All railing posts shall be set plumb unless otherwise indicated on the Plans.

1051.3.7 Stainless Steel Railing

The metal railing shall be fabricated in accordance with the dimensions shown on the Plans, during installation, stainless steel railing shall be free from rust and surface blemish. It shall be rust free until ten (10) years after completion.

1051.4 Method of Measurement

The quantity to be paid shall be the number of meters of specified railing materials and sizes or by lump sum for actually completed and accepted measures from center to center of end posts as shown on the Plans or as directed by the Engineer.

1051.5 Basis of Payment

The accepted quality, measured as prescribed in Section 1051.4, Method of Measurement shall be paid for at the Contract Unit Price for Railing, which price and payment shall be full compensation for furnishing and placing all materials including all labor, equipment, tools and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1051(6)	Stainless Steel Railing	Meter

ITEM 1100-CONDUITS, BOXES AND FITTING

1100.1 Description

This Item shall consist of furnishing and installation of the complete conduit work consisting of electrical conduits; conduit boxes; conduit fittings and other electrical materials in accordance with the Plans and this Specification.

1100.2 Material Requirements

All materials shall be of the approved type in accordance with the requirements of the Philippine Electrical Code (PEC), Part I and bearing the Philippine Standard (PS) mark for locally manufactured and Import Commodity Clearance (ICC) certification marks duly issued by Bureau of Philippine Standards (BPS) for imported materials.

1100.2.5 Rigid Polyvinyl Chloride Conduit (PVC)

PVC Conduit shall be made of rigid (nonplasticized) polyvinyl chloride (PVC). PVC conduit and fittings shall be composed of suitable nonmetallic material that is resistant to moisture and chemical atmospheres. For use above ground, it shall also be flame retardant, resistant to impact and crushing, resistant to distortion from heat under conditions likely to be encountered in service, and resistant to low temperature and sunlight effects. Where intended for direct burial, without encasement in concrete, the material shall also be capable of withstanding continued loading that is likely to be encountered after installation.

Markings in each length of PVC conduit shall be clearly and durably marked at least every 3,000 mm as required in the Subsection 1.10.1.21 (A) of Article 1.10 Requirements for Electrical Installations of PEC, Part I. The type of material shall also be included in the marking unless it is visually identifiable. For conduit recognized for use aboveground, these markings shall be permanent. For conduit limited to underground use only, these markings shall be sufficiently durable to remain legible until the material is installed. Conduit shall be permitted to be surfaced marked to indicate special characteristics of the material.

The physical and mechanical properties of PVC conduit shall conform to the requirements of PNS 14:2005, Unplasticized Polyvinyl Chloride (uPVC) electrical conduit -

Specification.

PVC shall have a minimum size of metric designator 16 (trade size 1/2) and a maximum size of metric designator 155 (trade size 6).

1100.2.8 Conduit Boxes, Fittings and Accessories

Conduit boxes, fittings and accessories shall comply with the applicable requirements of Article 3.14- Outlet, Device, Pull and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures of PEC, Part I.

1100.3 Construction Requirements

All works throughout shall be executed satisfactorily by qualified electricians under the supervision of a duly Registered Electrical Engineer and Shall be in accordance with the requirements of PEC, Part I.

1100.3.5 Rigid Polyvinyl Chloride Conduit

1100.3.5.1 Uses Permitted

The use of PVC conduit shall be permitted in accordance with the following:

1. Concealed. PVC conduit shall be permitted in walls, floors and ceilings.
2. Corrosive Influences. PVC conduit shall be permitted in location subject to severe corrosive influences as covered in Subsection 3.0.1.6, Protection against Corrosion and Deterioration of Article 3.0, General Requirements for Wiring Methods and Materials of PEC Part I.
3. Cinders. PVC conduit shall be permitted in cinder fill.
4. Wet Locations. PVC conduit shall be permitted in portions of dairies, laundries, canneries, or other wet locations, and in locations where walls are frequently washed, the entire conduit system, including boxes and fittings used therewith, shall be installed and equipped so as to prevent water from entering the conduit. All supports, bolts, straps, screws, and so forth, shall be of corrosion-resistant materials or be protected against corrosion by approved corrosion-resistant materials.
5. Exposed. PVC conduit shall be permitted for exposed work. PVC conduit used exposed in areas of physical damage shall be identified for the use.
6. Underground Installations. For underground installations, PVC Shall be permitted for direct embedment and underground encased in concrete accordance with Subsections 3.0.1.5 and 3.0.2.20, Underground Installations of Article 3.0, General Requirements for Wiring Methods and Materials of PEC, Part I.
7. Support of Conduit Bodies. PVC conduit shall be permitted to support nonmetallic conduit bodies not larger than the largest trade size of an entering raceway. These Conduit bodies shall not support devices other than splicing devices as permitted by

Subsection 1.10.1.14 (B), Mounting and Cooling of Subsection 33.14.2.2(C)(2), Conduit Bodies of Article 3.14, Outlet, Device, Equipment of Article 1.10, Requirements for Electrical Installations and Pull, and Junction boxes; Conduit Bodies; Fittings; and Handhole Enclosures of PEC, Part I.

8. Insulations Temperature Limitations. Conductors or cables rated at a temperature higher than the listed temperature rating of PVC conduit shall be permitted to be installed in PVC conduit, provided the conductors or cables are not operated at a temperature higher than the listed temperature rating of the PVC conduit.

1100.3.5.2 Uses Not Permitted

PVC Conduit shall not be used under the conditions specified in the following:

1. Hazardous (Classified) Locations. In any hazardous (classified) location, except as permitted by other articles of the PEC, Part I.
2. Support of Luminaires. For the support of luminaires or other equipment not described in Subsection 1100.3.5. 1 (7) Support of Conduit Bodies.
3. Physical Damage. Where subject to physical damage unless identified for such use.
4. Ambient Temperatures. Where subject to ambient temperatures in excess of 50°C unless listed otherwise.
5. Theaters and Similar Locations. In theaters and similar locations, except as provided in Subsection 5.18.1.4, Wiring Methods of Article 5.18, Assembly Occupancies and Subsection 5.20.1.5, Wiring Methods of Article 5.20, Theaters, Audience Areas of Motion Picture and Television Studios, Performance Areas, and Similar Locations of PEC, Part I.

1100.3.5.3 Number of Conductors

It shall comply with the requirements of Subsection 1100.3.1.3, Number of Conductors.

1100.3.1.3 Number of Conductors

The number of conductors in a conduit and tubing shall not exceed the permitted percentage fill specified in table below.

Table 1100.1. Percent of Cross Section of Conduit and Tubing for Conductors

<i>Number of Conductors and/or Cables</i>	<i>Cross-sectional Area (%)</i>
<i>1</i>	<i>53</i>
<i>2</i>	<i>31</i>
<i>Over 2</i>	<i>40</i>

Notes

1. Table 1100.1 is based on Common conditions of proper cabling and alignment of conductors. where the length of the pull and the number of bends are within reasonable limits. It should be recognized that, for certain conditions, a larger size conduit or lesser conduit fill should be considered.

2. When pulling three (3) conductors or cables into a raceway, if the ratio of the inside diameter (raceway) to the outside diameter (conductor or cable) is between 2.8 and 3.2, jamming can occur. While jamming can occur when pulling four (4) or more conductors into a raceway, the probability is very low.

3. Table 1100. 1 applies only to complete conduit or tubing systems and is not intended to apply to sections of conduit or tubing used to protect exposed wiring from physical damage.

Cables shall be permitted to be installed where such use is not prohibited by the respective cable articles of PEC, Part I.

The number of cables shall not exceed the allowable percentage fill specified in Table 1100.1.

1100.3.5.4 Bends

It shall comply the requirements of Subsection 1100.3.1.4, Bends.

1100.3.1.4 Bends

Bends of RMC shall be so made that the conduit will not be damaged and so that the internal diameter of the conduit will not be effectively reduced. The radius of the curve of any field bend to the centerline of the conduit shall not be less than indicated in Table 1100.2.

Table 1100.2. Radius of Conduit and Tubing Bends

Conduit or Tubing Size	One Shot and Full Shoe Benders	Other Bends
Raceway Size (mm)	(mm)	(mm)
15	100	100
20	115	125
25	145	150
32	180	200
40	210	250

50	240	300
65	265	375
80	325	450
90	375	525
100	400	600
125	600	750
150	750	900

There shall not be more than the equivalent of four (4) quarter bends (500 degrees total) between pull points, for example, conduit bodies and boxes.

1100.3.5.5 Trimming

All cut ends shall be trimmed and smoothed.

1100.3.5.6 Securing and Supporting

PVC Conduit shall be installed as a complete system as provided in Subsection 3.0.1.18, Raceway Installations of Article 3.0, General Requirements for Wiring Methods and Materials of PEC, Part I and shall be fastened so that movement from thermal expansion or contraction is permitted. PVC conduit shall be securely fastened and supported in accordance with the following:

1. Securely Fastened. PVC conduit shall be securely fastened within 900 mm of each outlet box, junction box, device box, Conduit body, or other conduit termination. Conduit listed for securing at other than 900 mm shall be permitted to be installed in accordance with the listing.
2. Supports. PVC conduit shall be supported as required in Table 1100.4 listed for support at spacings other than as shown in Table 1100.4 shall be permitted to be installed in accordance with the listing.

Horizontal runs of PVC conduit supported by openings through framing members at intervals not exceeding those in Table 1100.4 and securely fastened within 900 mm of termination points shall be permitted.

Table 1100.4 Support of Rigid Polyvinyl Chloride Conduit (PVC)

Conduit size		Maximum Spacing Between Supports
Metric Designator	Trade Size	(m)
16 - 27	½ - 1	0.90

35 - 53	1 ¼ - 2	1.5
63- 78	22 ½ - 3	1.8
91 - 129	3 ½ - 5	2.1
155	6	2.4

1100.3.5.7 Expansion Fittings

Expansion fittings for PVC conduit shall be provided to compensate for thermal expansion and contraction where the length change, in accordance with Table 3.52.2.35, Expansion Characteristics of PVC Rigid Nonmetallic Conduit Coefficient of Thermal Expansion = $6.084 \times 10^{-5} \text{ mm/mm/}^\circ\text{C}$, of PEC, Part 1 is expected to be 6 mm or greater in a straight run between securely mounted items such as boxes, cabinets, elbows, or other conduit terminations.

1100.3.5.8 Locknut and Bushings

Where a conduit enters a box, fitting, or other enclosure, a bushing or PVC adapter shall be provided to protect the wire from abrasion unless the box, fitting, or enclosure design provides equivalent protection.

1100.3.5.9 Joints

All joints between lengths of conduit, and between conduit and couplings, fittings, and boxes, shall be provided with PVC solvent and made by an approved method.

1100.3.7 Weatherhead

Weatherhead shall be installed in accordance with the PEC, Part I.

1100.3.8 Test and Guarantee

Upon completion of the electrical construction work, the Contractor shall provide all test equipment, materials and personnel for conducting the test and shall submit written copies of all test results to the Engineer.

The Contractor shall guarantee that the electrical installations are done in accordance with the approved Plans and Specifications.

The Contractor shall furnish a guaranty or warranty covering all labor and materials for period of 1 year from the date of the final acceptance of works and shall agree to repair all defects and any part of the work not satisfactory to the Engineer which may develop during the defects liability period arising from defective workmanship or materials at his Own expenses.

1100.4 Method of Measurement

The work under this Item shall be measured either by lengths, pieces, and lump sum actually placed and installed as shown on the approved Plans.

100.5 Basis of Payment

All works performed and measured in Section 1100.4, Method of Measurement 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
1100(10)	Conduits, Boxes & Fittings (Conduit Works/Conduit Rough-In)	Lump Sum

ITEM 1101 - WIRES, CABLES AND WIRING DEVICES

1101.1 Description

This Item shall consist of 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 in accordance with the approved Plans and this Specification.

1101.2 Material Requirements

1101.2.1 Wires and Cables

1101.2.1.1 Wires

All wires shall meet the requirements specified in the Philippine Electrical Code (PEC), Part 1 and PNS 35-1, Electric wires and cables-Thermoplastic-insulated copper wires and cables rated 600 volts - Part 1: General Specifications, and shall bear the Philippine Standard (PS) mark unless specified or indicated otherwise and shall be marked to indicate the following information:

1. The maximum rated voltage
2. The proper type letter or letters for the type of wire or cable as specified in the PEC Part I
3. The manufacturer's name, trademark, or other distinctive marking by which the organization responsible for the product can be readily identified
4. The size in square millimeter or millimeter diameter
5. Cable assemblies where the neutral wire is smaller

The letters such as TW, THHN, THWN and THW represent the main insulation types of

individual wires. These letters depict the following requirements:

1. T-Thermoplastic Insulation
2. H-Heat Resistance
3. HH-High Heat Resistance
4. W-Suitable for Wet locations
5. N-Thermoplastic Polyester, Tough and Very Resistant to Gas and Oil
6. X-Flame-Resistant Synthetic Polymer
7. Z-Modified ethylene tetrafluoroethylene

Conductors shall be insulated for 600 V and shall be aluminum, copper-clad aluminum, or copper unless otherwise specified. The minimum diameter size of conductors shall be 1.6 mm (2.0 mm²) for copper and 2.0 mm (3.5 mm²) for aluminum or copper-clad aluminum conductors. Solid aluminum conductors of diameters 3.2 mm, 2.6 mm, and 2.0 mm shall be made of an AA-8000 series electrical grade aluminum alloy conductor material. Stranded aluminum conductors 8.0 mm² through 500 mm² marked as Type RHH, RHW, XHHW THW, THHW, THWN, THHN, service-entrance Type SE Style U and SE Style R shall be made of an AA-8000 series electrical grade aluminum alloy conductor material.

Ampacities for conductors shall be as specified in the PEC Part 1. Where bare or covered conductors are used with insulated conductors, their allowable ampacities shall be limited to those permitted for the adjacent insulated conductors.

1101.2.1.2 Cables

1. Armored Cables (Type AC)

Type AC shall have ready identification of the manufacturer by distinctive external markings on the cable sheath throughout its entire length.

Type AC cable shall have an armor of flexible metal tape and shall have an internal bonding strip of copper or aluminum in intimate contact with the armor for its entire length. Insulated conductors of type AC shall be of type listed in the PEC Part 1. In addition, the conductors shall have an overall moisture resistant fibrous covering and fire-retardant fibrous covering. For Type ACT, a moisture-resistant fibrous covering shall be required only on the individual conductors.

2. Flat Cable Assemblies (Type FC)

Flat cable assemblies shall consist of two, three, four, or five conductors. The conductors shall be 5.5 mm² (2.6 mm dia.) special stranded copper wires. Type FC cable shall have the temperature rating durably marked on the surface at intervals not exceeding 600 mm.

3. Flat Conductor Cable (Type FCC)

Type FCC cable shall be clearly and durably marked on both sides at intervals of not more than 600 mm with the information required by the PEC Part 1. It shall consist of three (3), four (4), or five (5) flat copper conductors, one of which shall be an equipment grounding conductor. The insulating material of the cable shall be moisture resistant and flame retardant.

4. Integrated Gas Spacer Cable (Type IGS)

The conductors shall be solid aluminum rods, consisting of one to nineteen 13 mm diameter rods. The minimum conductor size shall be 125 mm², and the maximum size shall be 2375 mm². The insulation shall be dry kraft paper tapes and a pressurized sulfur hexafluoride gas (SF₆), both approved for electrical use. The nominal gas pressure shall be 138 kPa gauge.

5. Medium Voltage Cable (Type MV)

Type MV cables shall have copper, aluminum, or copper-clad aluminum conductors and shall be marked as required by the PEC Part 1.

6. Metal-Clad Cable (Type MC)

The conductors for type MC shall be of copper, aluminum, or copper-clad aluminum, solid or stranded. The minimum conductor size shall be 0.75 mm² (1.0 mm dia.) copper and 3.5 mm² (2.0 mm dia.) aluminum or copper-clad aluminum. Metallic covering shall be one of the following types: smooth metallic sheath, corrugated metal sheath, interlocking metal tape armor. The metallic sheath or armor shall be used on single conductor type MC. Supplemental protection of an outer covering of corrosion-resistant material shall be permitted and shall be required where such protection is needed. The sheath shall not be used as current-carrying conductor.

7. Mineral-Insulated, Metal-Sheathed Cable (Type MI)

Type MI cable conductors shall be of solid copper, nickel, or nickel-coated copper with a resistance corresponding to standard mm² and mm dia. sizes. The conductor insulation in Type MI cable shall be a highly compressed refractory mineral that provides proper spacing for all conductors.

8. Non-metallic - Sheathed Cable (Types NM, NMC, and NMS)

The 600 volt insulated conductors shall be sizes 2.0 mm² (1.6 mm dia.) through 30 mm² copper conductors or sizes 3.5 mm² (2.0 mm dia.) through 2.0 mm aluminum or copper-clad aluminum conductors. The signaling and communication conductors shall comply with the PEC Part 1. The insulated power conductors shall be one of the types listed in the PEC Part I that are suitable for branch circuit wiring or one that is identified for use in these cables. Conductor insulation shall be rated at 90°C.

The outer sheath of non-metallic-sheathed cable shall comply with the following:

- a. Type NM The overall covering shall be flame retardant and moisture resistant.

b. Type NMC - The overall covering shall be flame retardant, moisture resistant, fungus resistant, and corrosion resistant.

c. Type NMS - The overall covering shall be flame retardant and moisture resistant. The sheath shall be applied so as to separate the power conductors from the communications and signaling conductors. The signaling conductors shall be permitted to be shielded. An optional outer jacket shall be permitted.

9. Power and Control Tray Cable (Type TC)

A metallic sheath or armor shall not be permitted either under or over the nonmetallic jacket. Metallic shield(s) shall be permitted over groups of conductors, under the outer jacket, or both. The insulated conductors of Type TC tray cable shall be in sizes 0.75 mm² (1.0 mm dia.) through 500 m aluminum or copper-clad aluminum. Insulated conductors of sizes 2.0 mm (1.6 mm dia.) and larger copper and sizes 3.5 mm² (2.0 mm dia.) and larger aluminum or copper-clad aluminum shall be one of the types listed in the PEC Part 1 that is suitable for branch circuit and feeder circuits or one that is defined for such use.

The outer jacket for Type TC shall be a flame-retardant, nonmetallic material. There shall be no voltage marking on a Type TC cable employing thermocouple extension wire.

10. Service-Entrance Cable (Type SE and USE)

Cabled, single-conductor, Type USE constructions recognized for underground use shall be permitted to have a bare copper conductor cable with the assembly. Type USE single, parallel, or cabled conductor assemblies recognized for underground use shall be permitted to have a bare copper concentric conductor applied. These constructions shall not have an outer overall covering. Type SE or USE cable containing two or more conductors shall be permitted to have one conductor uninsulated.

11. Underground Feeder and Branch-Circuit Cable (Type UF)

The conductors shall be sizes 2.0 mm (1.6 mm dia.) copper or 3.5 mm² (2.0 mm dia.) aluminum or copper-clad aluminum through 100 mm². The conductors of Type UF shall be moisture-resistant type that is suitable for branch-circuit wiring or one that is identified for such use. Where installed as a substitute wiring method for NM cable, the conductor insulation shall be rated 90°C. The overall covering shall be flame retardant; moisture, fungus, and corrosion resistant; and suitable for direct burial in the earth.

1101.2.2 Switches

All switches shall conform to the requirements of the PEC Part 1. Switches shall be marked with the current voltage, and, if horsepower rated, the maximum rating for which they are designed. They shall be of the externally type mounted in an enclosure listed for the intended use.

Metal faceplates for switches shall be of ferrous metal not less than 0.75 mm in thickness or of non-ferrous metal not less than 1.00 mm in thickness. Faceplates of insulating material shall be non-combustible and not less than 0.25 mm in thickness, but they shall not be permitted to be less than 0.25 mm in thickness if formed or reinforced to provide

adequate mechanical strength.

1101.2.3 Receptacles

All receptacles shall conform to the requirements of the PEC Part 1. Receptacles shall be listed and marked with the manufacturer's name or identification and voltage and ampere ratings. The rating for receptacles shall not be less than 15 A, 125 V, or 15 A, 250 V. Table 1101.1 shows the receptacle ratings of various size circuits.

Table 1101.1 Receptacle Rating for Various Size Circuits

Circuit Rating (Amperes, A)	Receptacle Rating (Amperes, A)
15	15 Not over
20	15 - 20
30	30
40	40 or 50
50	50

Metal faceplates for receptacles shall be of ferrous metal not less than 0.75mm in thickness or of non-ferrous metal not less than 1.00 mm in thickness. Faceplates of insulating material shall be non-combustible and not less than 0.25 mm in thickness if formed or reinforced to provide adequate mechanical strength.

1101.3 Construction Requirement

Installation of electric wiring and wiring devices shall comply with the governing laws and applicable codes and standards such as the PEC Part 1 and Safety Standards.

1101.3.1 Installation

1101.3.1.1 Conductors

1. Conductors of the Same Circuit

All conductors of the same circuit and, where used, the grounded conductor and all equipment grounding conductors and bonding conductors shall be contained within the same raceway, auxiliary gutter, cable tray, cable bus assembly, trench, cable, or cord, unless otherwise permitted in accordance with the PEC 1.

a. Paralleled Installations

Conductors shall be permitted to be run in parallel in accordance with the provisions of the PEC Part 1. The requirement to run circuit conductors with the same raceway, auxiliary gutter, cable tray, trench, cable, or cord shall apply separately to each portion of the paralleled installation, and the equipment grounding conductors shall comply with the provisions of the PEC Part 1. Parallel runs in cable tray shall comply with the provisions of the PEC Part 1.

b. Grounding and Bonding Conductors

Equipment grounding conductors shall be permitted to be installed outside a raceway or cable assembly in accordance with the provisions of the PEC Part 1.

c. Non-ferrous Wiring Methods

Conductors in wiring methods with a nonmetallic or other nonmagnetic sheath, where run in different raceways, auxiliary gutters, cable trays, trenches, cables, or cords shall comply with the provisions of the PEC Part 1.

2. Conductors of Different Systems

Conductors of circuits rated 600 V, nominal or less, ac circuits, and dc circuits shall be permitted to occupy the same equipment wiring enclosure, cable, or raceway. All conductors shall have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway.

Conductors of circuits over 600 V, nominal, shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 V, nominal, or less unless otherwise permitted in the PEC Part 1.

1101.3.1.2 Switches

Installation of switches shall conform to the requirements of the PEC Part 1. All switches and circuit breakers used as switches shall be located in an accessible place to facilitate operation. They shall be installed such that the center of the position is not more than 1980 mm above the floor or working platform. Top of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 1980 mm above the floor or working platform.

Faceplates provided for snap switches mounted in boxes and other enclosures shall be installed so as to completely cover the opening and, where the switch is flush mounted, seat against the finished surface.

Metal enclosures for switches shall be grounded. Where nonmetallic enclosures are used with metal raceways or metal-armored cables, provision shall be made for grounding continuity. Snap switches, including dimmer and similar control switches, shall be effectively grounded and shall provide a means to ground metal faceplates, whether or not a metal faceplate is installed. Snap switches shall be considered effectively grounded if either of the following conditions met:

6. The switch is mounted with metal screws to a metal box or to a nonmetal box with integral means for grounding devices.
7. An equipment grounding conductor or equipment bonding jumper connected to an equipment grounding termination of the snap switch.

1101.3.1.3 Receptacles

General installation requirements for receptacles shall be in accordance with the PEC Part 1. Receptacle outlets shall be located in branch circuits in accordance with the PEC Part 1.

Receptacles shall be mounted in boxes or assemblies designed for the purpose and such boxes or assemblies shall be securely fastened in place unless otherwise permitted in the PEC Part 1.

Receptacles installed on 15- and 20-A branch circuits shall be of the grounding type, Grounding-type receptacles shall be installed only on circuits of the voltage class and current for which they are rated, except as provided in the PEC Part 1.

Receptacles and cord connectors that have grounding contacts shall have these contacts effectively grounded. They shall be grounded by connection to the equipment grounding conductor of the circuit supplying the receptacle or cord connector. The branch circuit wiring method shall include or provide equipment-grounding conductors to which the grounding contacts of the receptacle or cord connector are connected.

1101.3.2 Personnel Qualification

The installation of electrical wiring and devices shall be done by a certified installer under the supervision of an Electrical Engineer based on the guidelines of Republic Act No. 7920, New Electrical Engineering Law.

1101.3.3 Locations

1101.3.3.1 Dry Locations

Insulated conductors and cables, receptacles, switches and other devices used in dry locations shall be any of the types identified in the PEC Part 1.

1101.3.3.2 Dry and Damp Locations

Insulated conductors and cables used in dry and damp locations shall be Types FER, FEPB, MTW, PFA, RHH, RHW-2, SA, THHN, THW, THW-2, THHW, THHW 2, THWN, THWN-2, TW, XHH, XHHW, XHHW-2, Z, or ZW.

Receptacles installed outdoors in a location protected from the weather or in other damp locations shall have an enclosure for the receptacle that is weatherproof when the receptacle is covered (attachment plug cap not inserted and receptacle covers closed).

1101.3.3.3 Wet Locations

Insulated conductors and cables used in wet locations shall be Moisture impervious metal-sheathed, Types MTW, RHW, RHW-2, TW, THW, THW-2, THHW, THHW-2, THWN, THWN-2, Z, or ZW and Type for use in wet locations. Receptacles installed in wet locations shall have an enclosure that is weatherproof. Switches in a wet location or outside of a building shall be enclosed in a weatherproof enclosure or cabinet.

1101.3.3.4 Locations Exposed to Direct Sunlight

Insulated conductors or cables used where exposed to direct rays of the sun shall comply with one of the following:

- 1.Cables listed, or listed and marked, as being sunlight resistant.
- 2.Conductors listed, or listed and marked, as being sunlight resistant.
- 3.Covered with insulating material, such as tape or sleeving.

1101.4 Method of Measurement

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

1101.5 Basis of Payment

The quantity as determined in Section 1101.4, Method of Measurement shall be paid for at unit price stipulated in the Contract's Bill of Quantities. The payment shall constitute the full compensation for furnishing all the necessary materials, providing necessary equipment and tools in installing the wires and wire devices, labor cost and all the incidental expenses necessary to complete the work.

Payment shall be made under:

Pay Item Number	Description	Unit Of Measurement
1101(33)	Wires and Wiring Devices	Lump Sum

ITEM 1102 - POWER LOAD CENTER, SWITCHGEAR AND PANELBOARDS, AND OTHER OVERCURRENT PROTECTION DEVICES

1102.1 Description

This Item shall consist of furnishing and installation of the power load center unit substation or low voltage switchgear and distribution panelboards at the location shown on 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 applicable requirements of the Philippine Electrical Code Part and the products locally manufactured shall bear a Philippine Standard (PS) mark, while imported products shall bear Import Commodity Clearance (ICO certification marks duly issued by the Bureau of Philippine Standards (BPS).

1102.2.1 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. It shall be metal-enclosed, dead front and shall consist of the following parts:

1102.2.1.1 High Voltage Primary Section:

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

1. One (1) air-filled interrupter Switch, Two (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.
2. Three (3)-power fuses mounted in separate compartments within the switch housing and accessible by a hinged door.
3. One (1) set of high voltage potheads or three (3)-conductor cables or three (3) single conductor cables.
4. Lightning arresters shall be installed at the high voltage cubicle with the proper neutral and grounding system.

Items (1) and (2) above could be substituted with a power circuit breaker with the correct rating and interrupting capacity.

1102.2.2 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 or dry type and designed in accordance with the latest applicable standards.

The transformer shall be provided with four (4) approximately 2.5% 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 allowed, if necessary.

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.

1102.2.2.1 Current Transformers

Current transformers shall be of the straight-through type with suitable ratio, output and class of accuracy for their function and shall comply with IEC 600-44, Instrument transformers. Measuring current transformers shall have accuracy of Class 1 and protective transformers shall have an accuracy of 5P10.

Groups of current transformers used on three (3) phase systems shall have their secondary connections starred and earthed. When measuring line current value using a common meter with a selector switch, they shall be connected so that the current transformers shall be shorted out when not being used for indication. This shall be carried out in the selector switch by "make before break" contacts.

1102.2.2.2 Potential Transformers

Potential transformers shall conform to IEEE C57.13, IEEE Standard Requirements for Instrument Transformers for installation in metal-clad switchgear. Standard 120-volt secondary transformers shall be used. The transformer shall provide with burden, frequency, and accuracy as required. Indoor dry type two-winding construction for disconnecting potential transformers with integral fuse mountings and current-limiting fuses with primary and secondary voltage ratings as required.

1102.2.2.3 Distribution Transformer

A distribution transformer is a static device constructed with two or more windings used to transfer alternating current electric power by electromagnetic induction from one circuit to another at the same frequency but with different values of voltage and current. It is equipped with a lightning arrester, a weak link or protective-link expulsion-type fuse (installed under oil in the transformer tank), a secondary circuit breaker, and a warning light. The transformer primary bushing conductor is connected to one phase of the three-phase primary circuit through a partial-range current-limiting fuse. The transformer tank is grounded and connected to the primary and secondary common-neutral ground wire. The self-protected transformer contains core and coils, a primary fuse mounted on the bottom of the primary bushing, a secondary terminal block, and a low voltage circuit breaker.

Pad-mounted transformers are used with underground systems. Three-phase pad-mounted transformers are used for commercial installations, and single-phase pad-mounted transformers are used for underground residential installations. Vault-type distribution transformers are installed for commercial customers where adequate space is not available for pad-mounted transformers. The vault-type transformer may be installed in a vault under a sidewalk or in a building. They are often used in underground electric network areas. Submersible single-phase distribution transformers are used in

some underground systems installed in residential areas.

1102.2.3 Low-Voltage Switchboard Section

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

1. Switchboard Housing

The housing shall be fully type tested switchgear as duly certified by the Original Electrical Manufacturer.

2. Secondary Metering Section

The secondary metering section shall be digital type consisting 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 3-phase; 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.

3. 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 overcurrent protection and instantaneous short circuit trip and all necessary accessories to ensure safe and efficient operation.

4. Feeder Circuit Breaker

There shall be as many feeder breakers as shown on the single line diagram, or schematic riser diagram or schedule of loads. The circuit breakers shall be Air Circuit Breaker (ACB) draw-out or fixed type, Molded Case Circuit Breaker (MCCB). The circuit breakers shall each have sufficient interrupting capacity and shall be manually operated complete with trip devices and all necessary accessories to ensure safe and efficient operation. The number, ratings, capacities of the feeder branch circuit breakers shall be as shown on the approved Plans with short circuit and arc flash analysis.

Circuit breakers shall each be of the indicating type, with "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.

5. Automatic Transfer Switch

Automatic transfer switches shall be open transition switches, four-pole, draw out

construction, electrically operated, mechanically held open contact without integral overcurrent protection. Automatic transfer switches utilizing automatic or non-automatic molded case circuit breakers, insulated case circuit breakers, or power circuit breakers as switching mechanisms are not acceptable.

Automatic transfer switches shall be completely factory-assembled and wired such that only external circuit connections are required in the field.

Each automatic transfer switch shall be equipped with an integral bypass/isolation switch.

Automatic transfer switches Markings shall be in accordance with UL 1008, Transfer Switch Equipment.

Automatic transfer switches shall be tested in accordance with UL 1008. The contacts of the transfer switch shall not weld during the performance of withstanding and closing tests when used with the upstream overcurrent device and available fault current specified.

Enclose automatic transfer switches in wall or floor-mounted steel cabinets, with metal gauge not less than No. 14, in accordance with UL 508, Standard for Industrial Control Equipment, or in a switchboard assembly in accordance with UL 891, Switchboards, as shown on the Plans.

The enclosure shall be constructed so that personnel is protected from energized bypass-isolation components during automatic transfer switch maintenance.

Automatic transfer switch components shall be removable without disconnecting external source or load power conductors.

Cabinets shall be given a phosphate treatment, painted with rust-inhibiting primer, and finish-painted with the manufacturer's standard enamel or lacquer finish.

Actuated by an electrical operator.

Electrically and mechanically interlocked so that the main contact cannot be closed simultaneously in either normal or emergency position.

Normal and emergency main contacts shall be mechanically locked in position by the operating linkage upon completion of the transfer. Release of the locking mechanism shall be possible only by normal operating action.

Contact transfer time shall not exceed six cycles.

Operating mechanism components and mechanical interlocks shall be insulated or grounded.

1102.2.4 Low-Voltage Switchgear

The Contractor shall furnish and install a low-voltage fully type tested switchgear as duly certified by the Original Electrical Manufacturer at the location shown on the Plans.

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.

The equipment mounted in the Low voltage switchgear and controlgear assembly shall be fitted and wired in accordance with corresponding Manufacturer's instructions and recommendations. Minimizing the Low voltage switchgear and controlgear assembly size shall be taken into account. The equipment and circuits in the Low voltage switchgear and controlgear assembly shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety.

The equipment mounted within the assembly shall have a clearance of 100 mm minimum around the perimeter of the enclosure and 50 mm from the door.

All electrical equipment, bus bars, terminal blocks and covers of connections of Switching devices, mounted inside the assembly, shall be IP 20 or NEMA Type 1 (general use) protected at least.

1102.2.5 Grounding Systems

It shall conform to the applicable requirements of Item 1109, Grounding Systems.

1102.2.6 Panelboards and Cabinets

Panelboards shall be fully type tested panels as duly certified by the Original Electrical Manufacturer.

Main and branch circuit breakers for panelboards shall have the rating, capacity and number of poles as shown on the approved Plans. Breakers shall be thermal magnetic type. Multiple breaker 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.

1102.2.11 Fuses

All switches and switchgear shall be provided with a complete set of fuses. Fuses shall be provided voltage rating of not less than the circuit voltage.

For ratings 30 A, 125 V or less, nonrenewable cartridge type fuses shall be provided. Renewable cartridge type fuses shall be provided for ratings above 30 A, 600 V or less with time-delay dual elements, except where otherwise indicated. It shall conform to NEMA FU 1, Low Voltage Cartridge Fuses, for fuses.

Special fuses shall be installed such as extra-high interrupting-capacity fuses, fuses for welding machines, and capacitor fuses where required. Plug fuses are not permitted.

Power fuses shall be provided on ac systems above 600 volts in accordance with NEMA SG 2, High Voltage Fuses.

Fuses shall be labeled showing UL class, interrupting rating, and time-delay

characteristics, when applicable. Clearly, list fuse information on equipment drawings.

Porcelain fuse holders shall be provided when field-mounted in a cabinet or box. Do not use fuse holders made of such materials such as ebony asbestos, Bakelite, or pressed fiber for field installation.

1102.2.12 Protective Relays

1102.2.12.1 Overcurrent Relays

Overcurrent relays shall conform to IEEE C37.90, IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus. For protection against phase and ground faults provide a single-phase non-directional removable induction type overcurrent relays with built-in testing facilities designed for operation on the de or ac control circuit indicated.

Ground-fault overcurrent relays with short-time inverse time characteristics and with adjustable current tap range shall be provided as required.

Phase-fault overcurrent relays with varied inverse-time characteristics with adjustable current tap range shall be provided as required. Indicate instantaneous-trip attachments with an adjustable current range as required.

Trip unit shall employ a combination of discreet components and integrated circuits to provide the time-current protection functions required in a modern distribution system.

Complete system selective coordination by utilizing a combination of the following time-current curve-shaping adjustments: ampere setting; long-time delay; short-time pickup; short-time delay; instantaneous pickup; and ground fault.

Switchable or easily defeatable instantaneous and ground fault trips shall be provided.

Make all adjustments using non-removable, discrete step, highly reliable switching plugs for precise settings. Provide a sealable, transparent cover over the adjustments to prevent tampering.

Trip devices shall be furnished with three visual indicators to denote the automatic tripping mode of the breaker including overload; short circuit; and ground fault.

Make available for use a series of optional automatic trip relays for use with the trip unit to provide remote alarm and lockout circuits.

All trip units shall be with test jacks for in-service functional testing of the long time instantaneous and ground fault circuits using a small hand-held test kit.

1102.2.12.2 Directional Overcurrent Relays

Directional overcurrent relays shall conform to IEEE C37.90.

Single-phase induction type relays shall with adjustable time delay and instantaneous trip attachments for directional overcurrent and protection against reverse-power faults.

Provide removable type relays with inverse-time directional and overcurrent units with built-in testing facilities.

1102.3 Construction Requirements

The Contractor shall install the Power Load Center Substation and Low-Voltage fully type tested Switchgear and Panelboards at the locations shown on the Plans.

The switchboards shall be of enclosed assembly design, suitable for indoor use in the form of free standing or wall mounting, self-contained, flush fronted cubicles sectionalized as necessary to facilitate easy transportation and erection. The assembly shall be Type Tested in accordance with IEC 61439. The main incoming unit, functional units of metered and unmetered supply, the metered and unmetered busbar sections shall be separately housed in their own cubicles.

Wall mounted switchboards shall be suitable for front access only and the maximum height shall be 2.0 m.

Floor mounted switchboards shall be suitable for front and back access.

The cubicle sections shall be constructed of electro-galvanized sheet steel frames of a minimum thickness of 2.0 mm and the panels shall be constructed from electro-galvanized sheet steel of a minimum thickness of 1.6 mm. It shall be able to withstand a fault level of 36 KA for one (1) second unless otherwise specified in the single-line-diagrams. The enclosures for the switchboards shall provide a degree of protection of IP 4X.

Each cubicle unit shall be incorporated with a removable cover with hidden hinges. The front cover shall have apertures for the protrusion of operating handles of circuit breakers.

The various units comprising a complete switchboard shall be grouped in a multi-tier arrangement including cabling and wiring chamber of ample dimensions to accommodate terminal boards, cable boxes and gland plates.

All external panels of the switchboard shall be treated with a coat of finishing paint, giving a total paint thickness of not less than 50 microns. All coats of paint shall be oven-baked and dried.

Installation of panelboards and enclosures shall be coordinated with cable and raceway installation work.

Enclosures shall be anchored firmly to walls and structural surfaces to ensure that they are permanently and mechanically secure.

Panelboard's circuit directory shall be filled out upon completion of installation work and it shall be typewritten or printed.

The switchgear shall be provided with all small wiring, terminal boards, fuses links, labels, cable sockets, foundation bolts test, and earth connections

The Contractor shall follow the manufacturer's instructions for receiving handling, storage, and installation of a unit substation.

1102.3.1 Inspection and Tests

The Contractor shall submit a proposal of preliminary Test and Inspection Plan. Each Low voltage switchgear and controlgear assembly shall be tested in accordance with IEC Standard 60439-1, Low-voltage switchgear and controlgear assemblies Part 1: Type-tested and partially type-tested assemblies.

1102.4 Method of Measurement

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

1102.5 Basis of Payment

All works performed and measured and as provided for in this 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(1)	Panelboard with Main & Branch Breakers	Lump Sum

ITEM 1103 - LIGHTING FIXTURES

1103.1 Description

This Item shall consist of furnishing all lightning fixtures, accessories and fixings necessary for installation as shown on the Plans and in accordance with this Specification.

A light fixture or luminaire is an electrical device to create artificial light that serves as a tool to direct light using reflective and shielding materials.

1103.2 Material Requirements

1103.2.1 General

All fixtures shall be suitable for 220 V single phase 60 Hz power supply system. They shall be complete with accessories and fixings necessary for installation. Fixture housing, frame or canopy shall have a suitable cover for the fixture outlet box or fixture opening.

Fixtures shall be installed at mounting heights as shown on the Plans. The weight of the fixtures shall be adequately supported by hangers. The design of hangers and method of fastening other than shown on the Plans or herein specified shall be submitted to the Engineer for approval.

Wiring within the fixture and for connection to the branch circuit wiring shall not be less than 1.5mm² or equivalent for 250 V application. Insulation shall be silicon rubber for the lower temperature (fluorescent fixtures) and impregnated asbestos for the higher temperatures (incandescent fixtures).

All materials to be used for lighting fixtures shall be in accordance with the Plans and Specifications. The fixtures shall be completely free from burrs and tool marks, and solder shall not be used as a mechanical fastening device on any part of the fixture.

The color rendering index (CRI) scale shall be used to compare the effect of a light source on the color appearance of its surrounding. A scale of 0 to 100 defines the CRI. CRI shall not be less than 65. Under higher CRI sources, surface colors appear brighter, improving the aesthetics of the space.

Table 1103.1 Efficacy Ranges of Various Lamps

Lamp Type	Rated Power Ranges (watts)	Efficacy Ranges (lumens/watt)
Linear/Tubular Fluorescent Lamp		
Halophosphate	10 - 40	55 - 70
Triphosphor	14 - 65	60 - 83
Compact Fluorescent Lamp (CFL)	3 - 125	41 - 65
Light Emitting Diode (LED)	3 - 100	80 - 95
Incandescent Lamp	10 - 100	10 - 25
Mercury Vapor Lamp	50 - 2000	40 - 63
Metal Halide Lamp	Up to 1000	75 - 95
Low Pressure Sodium Lamp	20 - 200	100 - 180
High Pressure Sodium Lamp	50 - 250	80 - 130

Source: Guidelines on Energy Conserving Designs of Buildings

1103.2.1.1 Interior Lighting Fixtures

1. Linear Fluorescent Fixtures

- a. It shall be suitable for single or twin approximately 1.20 m of 40 watts alternatively 36 watts fluorescent tube as specified. It shall be complete with low loss heavy duty ballast(s), starter(s) and power factor improvement capacitor.
- b. It shall be decorative commercial or industrial type as specified. In case of industrial type, stove/vitreous enameled reflector shall be provided wherever specified. In case of decorative luminaire, Opal Acrylic diffuser/square polystyrene/vertical metal louvers shall be provided as specified.

- c. The fixture shall be surface or recessed mounted as indicated on the Plans. In some cases, single/twin tube fixtures for Offices/Commercial areas shall be decorative recessed mounting type with specially designed aluminum bright anodized reflectors. It shall have a bat wing wide spread distribution light and high optical efficiency. The reflector shall have Matt anodized cross louvers to minimize glare.
- d. Only single and/or two lamp ballast shall be used in any one fixture Ballast shall be completely enclosed inside sheet steel casing, and shall have a corrosion resistant finish. Ballast shall contain a thermosetting type compound not subject to softening or liquefying under any operating conditions or upon ballast failure. Under no condition shall the thermal device permit the enclosure temperature of the ballast to exceed 90°C. Make sure that the compound shall not support combustion.
- e. All fluorescent fixtures shall be provided with white lamp holders while industrial type shall have turret type lamp holders.
- f. Surface mounted fixtures longer than 600 mm shall have one (1) additional point of support besides the outlet box fixture stud when installed individually. Pendant individually mounted fixtures 1.2 m long and small-sized shall be provided with twin stem hangers. It shall have ball aligners or any similar device and having a provision of 25 mm (minimum) vertical adjustment.
- g. Items with appropriate length to suspend fixtures are required mounting height as specified on the approved Plans.
- h. Lamps shall be rapid or trigger start, bi-pin base and minimum approximate rated life of 20,000 hours.

2. Compact Fluorescent Fixtures

There are two (2) units specified under this type of fixture:

- a. Integral units – These consist of a compact fluorescent lamp and ballast in self-contained units. Some integral units also include a reflector and/or glass enclosure.
- b. Modular units – The modular type of retrofit compact fluorescent lamp is similar to the integral units, except that the lamp is replaceable.

Considerations before the Installation include:

- a. Reflectors shall be clear, with integral white trim ring, unless noted otherwise. Open reflectors shall have a minimum 18 mm diameter.
- b. Fixture installed outdoors and over food handling areas shall be lensed.
- c. Fixtures installed in shower locations shall be provided with flush type plastic reflector with opal lens.

Special Application and Function

- a. Teleconferencing areas shall have fixtures which match and are compatible with

existing facility installations, including lamp type, lamp color, fixture and lens type, controls, and minimum lighting levels for the vertical and horizontal planes.

- b. Low voltage fixtures utilizing MR16 lamps shall be lensed.
- c. "Clean-room" type fixtures for high purity areas and special laboratory functions shall be triple gasketed, with sealed cam latches.
- d. Warning signs (In Use, Beam On, X-Ray in Use, etc.) shall be light emitting diode (LED) illuminated with housing and face color as specified.
- e. Task lights shall be equipped with an integral rocker switch. Where two or more task lights are located in a room, a wall switch shall be installed at the entry door for control.

1103.2.1.2 Environmental Rooms and Exterior Lighting Fixtures

Enclosures shall be complete with gaskets to form weatherproof seal where no water can enter or accumulate in wiring compartments, lamp holders, or other electrical parts. It shall be provided with low temperature ballasts starting at 0 °C.

Garden and driveway lighting fixtures requirements:

1. It shall be suitable for mounting of GI poles 2 m to 3 m height. The fittings shall be waterproof, robust and shall have components which are not easily corroded.
2. The Connectors shall be easily accessible and suitable for a minimum 2 x 4 mm² PVC aluminum conductor cables.
3. The appearance with the reflector/shade shall be pleasing and aesthetic.
4. The fittings shall be suitable for mounting GLS lamps/ MLL blended lamps/80W/125W/ High Power Micro Wave (HPMW) /70W High Pressure Sodium Vapor (HPSV).

1103.2.1.3 Return Air Troffer

1. The return air troffer where indicated on the Plans, shall have white enamel finish, 4 mm clear prismatic acrylic lens, and shall be recessed in inverted "T" bar ceiling.
2. It shall have the capacity to handle 20 CFM of return air through the side slots of the nominal 1.2 m long fixture (without return air attachment) with a total pressure drop from the rooms to the return air ceiling plenum not to exceed 1.27 mm.

1103.2.2 Emergency Exit Signs

1. Provide exit signs with red Light-Emitting Diode (LED) illumination.
2. Exit signs shall have covers that are composed of a black face and body, smooth red diffusion material, with 152mm high red letters on black background, directional arrows as indicated. Individual LED's shall not be visible through the diffusion

material.

3. Fixtures installed in the areas shall have minimum five (5) year warranty.
4. Exit signs shall be rated for auto-volt (100-240) with back-up power supply.

1103.2.3 Lamps

1. Pin-based compact fluorescent lamps shall be quad or triple tube, 13,18, 26 or 32 watt similar to NEMA lamp type CFQ13W/G24Q/835 or sizes shall be acceptable. Compact fluorescent lamps shall be 3,500K color temperature. Original equipment manufacturer lamps that are only available from a single manufacturer shall not be acceptable.
2. Linear fluorescent rapid or instant-start lamps shall be medium bi-pin with minimum CRI of 85. If different lamp manufacturers are submitted, no noticeable difference in color temperature shall be allowed and performance shall be equal to or better than the base lamp. T-8 fluorescent lamps shall have a color temperature of 4,100K and be specified in 610 mm, 915 mm and 1,220 mm lengths only. Linear 1.2 m lamps used in open fixtures in environments below 21°C. or in operation rooms, shall be full wattage type.
3. Metal halide High Intensity Discharge (HID) lamps shall be ceramic metal halide type, clear, unless noted otherwise, with mogul or medium bases. Acceptable medium base lamp sizes are 50, 100 and 150 watts. Double-ended lamps are not acceptable. Any base type other than medium or mogul shall be submitted for Engineer's review and approval in advance. Metal halide fixtures shall be lensed or utilize a lamp (PAR type) which does not require special arc tube protection.
4. Cold cathode, neon, T-5 and T-2 systems shall not be approved for use.
5. The use of LED, induction and fiber optic lighting systems for special applications shall be approved by the Engineer.
6. Lamps, including linear fluorescent, compact fluorescent and high intensity discharge, shall be low-mercury and shall pass all federal Toxicity Characteristic Leaching Procedure (TCLP) test requirements at the time of manufacture.

1103.2.4 Ballast

1103.2.4.1 Ballast for Fluorescent

1. High frequency (20 kHz or greater) electronic type.
2. Total Harmonic Distortion (THD) shall be less than 10%.
3. Power factor shall be greater than or equal to 95%.
4. Ballasts shall operate with 265 MA lamps.

5. Unless noted otherwise (such as dual switching, etc.), provide one ballast per fixture.
6. All ballasts shall be auto-volt rated.
7. Ballasts shall be Class P minimum thermally protected.

1103.2.4.2 Ballasts for Compact Fluorescent Lamps

1. All ballasts shall be of high-power factor and capable of independent switching, if two (2) ballasts are provided with a fixture.
2. Dimming ballasts shall be electronic and compatible for line voltage or control wire dimming systems as specified on the Plans.
3. Ballast shall be magnetic for 2-pin lamp application. Electronic ballasts for other applications shall be submitted for Engineer's approval in advance.

1103.2.4.3 Ballasts for High Intensity Discharge (HID) Lamps

1. HID ballas shall be of the lead-peak auto-transformer type of metal halide lamps. The ballast shall start and operate the lamp at ambient temperatures ranging from minus 7°C to 41°C. All ballasts shall have automatic thermal protection, and high power factor, minimum of 90%. Ballasts for interior applications shall be encased and potted, or be of the electronic type.
2. HID ballasts for M90, M130, M139 and M140 rated lamps shall be electronic-type.

1103.3 Constructions Requirements

1103.3.1 Locations

1. Wet and Damp Locations – It shall be installed in areas where no water can enter or accumulate in wiring compartments, lampholders, or other electrical parts and shall be marked with “Suitable for Wet Locations” based on the Philippine Electrical Code (PEC) Part 1.
2. Corrosive Locations – Ferrous metal shall be bonded and given a corrosion resistant phosphate treatment or other approve rust inhibiting prime coat before application of finish.
3. Fixtures in Indoor Sport, Mixed-use, and All-Purpose Facilities – Fixtures subject to physical damage, using mercury vapour or metal halide lamp, installed in playing and spectator seating areas of indoor sports, mixed-use or all-purpose facilities shall be of the type that protects lamps with a glass or plastic lens. Such fixtures shall be permitted to have additional guard.
4. Fixtures Near Combustible Material – Fixtures shall be installed, or equipped with shades or guards so that combustible material is not subjected to temperatures in excess of 90 °C in compliance with the hazardous are of PEC, Part 1.

5. Fixtures Over Combustible Material – Lampholders installed over highly combustible material shall be of the unswitched type. Unless an individual switch is provided for each luminaire (fixture), lampholders shall be located at least 2,400 mm above the floor or shall be located or guarded so that the lamps cannot be readily removed or damaged.
6. Fixtures in Shows Windows – Chain-supported fixtures used in a show window shall be permitted to be externally wired. No other externally wired fixtures shall be allowed.
7. Fixtures in Clothes Closets – fixtures in clothes closets shall be permitted to be installed as follows:
 - a. Surface-mounted fluorescent or LED fixtures installed on the wall above the door or on the ceiling, provided there is a minimum clearance of 300 mm between the fixture and the nearest point of a storage space.
 - b. Surface-mounted fluorescent or LED fixtures installed on the wall above the door or on the ceiling, provided there is a minimum clearance of 150 mm between the fixture and the nearest point of a storage space.
 - c. Recessed fluorescent or LED fixtures with a completely enclosed lamp installed in the wall or the ceiling, provided there is a minimum clearance of 150 mm between the fixture and the nearest point of a storage space.
 - d. Recessed fluorescent or LED fixtures installed in the wall or the ceiling, provided there is a minimum clearance of 150 mm between the luminaire (fixture) and the nearest point of a storage space.

1103.3.2 Installation

1. Installation shall conform to the specifications of the PEC Part 1 and in accordance with the manufacturer's written instructions.
2. Building electrical system requirements shall be checked. Regardless of the catalog number prefixes and suffixes shown, fixtures shall be furnished with the proper trim, frames, supports hanger, ballasts, voltage rating, and other miscellaneous appurtenances to properly coordinate with the project conditions.
3. The type of ceilings to be installed shall be checked in each room and verify that the recessed lighting fixtures are proper for the type of ceiling to be installed before ordering fixtures. A frame compatible with the type of ceiling shall be provided in which the recessed lighting fixture is installed. The specified ceiling type shall be referred to the Architectural Room Finish Schedule.
4. Fixtures shall be securely attached to the ceiling-framing members by mechanical means. Clips identified for use with the type of ceiling framing members (s) and fixtures (s) shall also be permitted. Lighting fixtures shall be fastened in areas where there is no ceiling securely installed to the structure.

5. Immediately before final observation, all fixtures shall be cleaned, inside and out, including plastics and glassware, and all trim shall be adjusted to properly fit adjacent surface, broken or damaged parts and lamps shall be replaced, and all fixtures for electrical as well as mechanical operation shall be tested.
6. Installed fixtures shall be protected from damage during the remainder of the construction period.
7. When replacing an existing fixture, the old fixture shall be disconnected and removed.
8. Pendant fixtures within the same room shall be installed plumb and at a uniform height from the finished floor. Adjustment of height shall be made during installation as per Architect's instructions.
9. Flush mounted recessed fixtures shall be installed so as to completely eliminate light leakage within the fixture and between the fixture and adjacent finished surface. It shall be rigidly secured to a fixture stud in the outlet box. Extension pieces shall be installed where required to facilitate proper installation. Recessed fixtures shall be constructed so that all components are replaceable without removing housing from the ceiling.
10. Fixture shall be completely wired and constructed to comply with the regulations and standards of PEC, Part 1 for electrical lighting fixtures, unless otherwise specified.

1103.3.3 Wiring

Wiring of Fixtures shall comply with the existing standards of the PEC Part 1.

1. Lighting fixtures shall be connected to a typical metal conduit, junction box, and wire lighting grid system. MC (Metal-Clad Cable) and FMC (Flexible Metal Conduit), when permitted to be used, shall be properly concealed to prevent physical damage. Exposed MC and FMC installations shall not be acceptable.
2. Modular cabling, flexible whip assemblies, feed through wiring, 'daisy-chain' feeds, tandem wiring and other similar wiring methods shall not be acceptable for the lighting circuit distribution and wiring system.

1103.3.4 Testing

Upon completion of installation of interior lighting fixtures, and after circuitry has been energized, electrical energy shall be applied to demonstrate capability and compliance with requirements. When possible, malfunctioned units at the Project Site shall be rectified, then retested to demonstrate compliance; otherwise, defective items shall be removed and replaced with new units, and another test shall be conducted.

1103.3.5 Outlet Boxes, Canopies, and Pans

It shall be in accordance with the requirements of Item 1100, Conduits, Boxes and Fittings.

1103.3.6 Grounding and Bonding

Bonding and grounding shall be provided where necessary to ensure electrical continuity as well as the capacity to conduct safe installation. It shall be in accordance with the PEC Part 1.

1103.4 Method of Measurement

The work under this item shall be measured in lump sum placed and installed as shown on the Plans.

1103.5 Basis of Payment

The Accepted quantity, measure as prescribed in Section 1103.4, Method of Measurement shall be paid for at the 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
1103 (1)	Lighting Fixtures	Lump Sum

ITEM 1202 - AUTOMATIC FIRE SPRINKLER SYSTEM (AFSS)

1202.1 Description

This Item shall consist of furnishing and installation of Automatic Fire Sprinkler System (AFSS), inclusive of all piping and pipe fitting connections, valves, controls, electrical wiring connection and all other accessories ready for service in accordance with the Plans and this Specification.

1202.2 Material Requirements

1202.2.11 Fire Extinguisher

Fire extinguishers shall have a temperature range from -4° F to 120° F conform to the applicable requirements of National Fire Protection Association (NFPA) 10, Standard for Portable Fire Extinguishers.

1202.3 Construction Requirements

1202.3.2 Installation of Fire Extinguisher

Fire extinguishers shall be installed in accordance with Section 10.2.6.7, Portable and Wheeled Fire Extinguisher of the Fire Code of the Philippines and NFPA 10, Chapter 6, Installation of Portable Fire Extinguisher.

1202.3.4 Maintenance Service

1. Upon completion of the work and all tests, the services of one or more qualified personnel shall be provided by the Contractor for a period of not less than five (5) working days to provide an operating manual and train the representative of the Owner in the operation and maintenance of the fire protection system.
2. The Contractor shall provide, free of charge, maintenance service of the system for a period of at least 1 year reckoned from the date of acceptance of the work by the Engineer.

1202.3.5 Miscellaneous

The Engineer shall be provided with three (3) bound copies of serial number and inventory of equipment including manufacturers operating and maintenance manuals.

All standard tools and equipment shall be furnished for proper and regular maintenance of installed unit.

1202.4 Method of Measurement

The work under this Item shall be measured by set installed as indicated in the Plans.

1202.5 Basis of Payment

All work performed and measured and as provided for in this 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
1202 (6)a3	Fire Extinguisher(4.54kg) (CO2/HCFC 123 with Bracket)	Set

II. CONSTRUCTION OF MULTIPURPOSE DRYING PAVEMENT

ITEM 102 – EXCAVATION

102.1 Description

This Item shall consist of roadway and drainage and borrow excavation and the disposal of material in accordance with this Specification and in conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer.

102.1.1 Roadway Excavation

Roadway excavation will include excavation and grading for roadways, parking areas, intersections, approaches, slope rounding, benching, waterways and ditches; removal of unsuitable material from the roadbed and beneath embankment areas; and excavating selected material found in the roadway as ordered by the Engineer for specific use in the improvement. Roadway excavation will be classified as “unclassified excavation”, “rock excavation”, “common excavation”, or “muck excavation” as indicated in the Bill of Quantities and hereinafter described.

- (1) **Unclassified Excavation.** Unclassified excavation shall consist of the excavation and disposal of all materials regardless of its nature, not classified and included in the Bill of Quantities under other pay items.
- (2) **Rock Excavation.** Rock excavation shall consist of igneous, sedimentary and metamorphic rock which cannot be excavated without blasting or the use of rippers, and all boulders or other detached stones each having a volume of 1 cubic meter or more as determined by physical measurements or visually by the Engineer.
- (3) **Common Excavation.** Common excavations shall consist of all excavation not included in the Bill of Quantities under “rock excavation” or other pay items.
- (4) **Muck Excavation.** Muck excavation shall consist of the removal and disposal of deposits of saturated or unsaturated mixtures of soils and organic matter not suitable for foundation material regardless of moisture content.

102.1.2 Borrow Excavation

Borrow excavation shall consist of the excavation and utilization of approved material required for the construction of embankments or for other portions of the work, and shall be obtained from approved sources, in accordance with Clause 61 and the following:

(1) Borrow, Case 1

Borrow Case 1 will consist of material obtained from sources designated on the Plans or in the Special Provisions.

(2) Borrow, Case 2

Borrow Case 2 will consist of material obtained from sources provided by the Contractor.

The material shall meet the quality requirements determined by the Engineer unless otherwise provided in the Contract.

102.2 Construction Requirements

102.2.1 General

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

All excavations shall be finished to reasonably smooth and uniform surfaces. No materials shall be wasted without authority of the Engineer. Excavation operations shall be conducted so that material outside of the limits of slopes will not be disturbed. Prior to

excavation, all necessary clearing and grubbing in that area shall have been performed in accordance with Item 100, Clearing and Grubbing.

102.2.2 Conservation of Topsoil

Where provided for on the Plans or in the Special Provisions, suitable topsoil encountered in excavation and on areas where embankment is to be placed shall be removed to such extent and to such depth as the Engineer may direct. The removed topsoil shall be transported and deposited in storage piles at locations approved by the Engineer. The topsoil shall be completely removed to the required depth from any designated area prior to the beginning of regular excavation or embankment work in the area and shall be kept separate from other excavated materials for later use.

102.2.3 Utilization of Excavated Materials

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

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

Only approved materials shall be used in the construction of embankments and backfills.

All excess material, including rock and boulders that cannot be used in embankments shall be disposed off as directed.

Material encountered in the excavation and determined by the Engineer as suitable for topping, road finishing, slope protection, or other purposes shall be conserved and utilized as directed by the Engineer.

Borrow material shall not be placed until after the readily accessible roadway excavation has been placed in the fill, unless otherwise permitted or directed by the Engineer. If the Contractor places more borrow than is required and thereby causes a waste of excavation, the amount of such waste will be deducted from the borrow volume.

102.2.4 Prewatering

Excavation areas and borrow pits may be prewatered before excavating the material. When prewatering is used, the areas to be excavated shall be moistened to the full depth, from the surface to the bottom of the excavation. The water shall be controlled so that the excavated material will contain the proper moisture to permit compaction to the specified density with the use of standard compacting equipment. Prewatering shall be supplemented where necessary, by truck watering units, to ensure that the embankment material contains the proper moisture at the time of compaction.

The Contractor shall provide drilling equipment capable of suitably checking the moisture penetration to the full depth of the excavation.

102.2.5 Presplitting

Unless otherwise provided in the Contract, rock excavation which requires drilling and shooting shall be presplit.

Presplitting to obtain faces in the rock and shale formations shall be performed by: (1) drilling holes at uniform intervals along the slope lines, (2) loading and stemming the holes with appropriate explosives and stemming material, and (3) detonating the holes simultaneously.

Prior to starting drilling operations for presplitting, the Contractor shall furnish the Engineer a plan outlining the position of all drill holes, depth of drilling, type of explosives to be used, loading pattern and sequence of firing. The drilling and blasting plan is for record purposes only and will not absolve the Contractor of his responsibility for using proper drilling and blasting procedures. Controlled blasting shall begin with a short test section of a length approved by the Engineer. The test section shall be presplit, production drilled and blasted and sufficient material excavated whereby the Engineer can determine if the Contractor's methods are satisfactory. The Engineer may order discontinuance of the presplitting when he determines that the materials encountered have become unsuitable for being presplit.

The holes shall be charged with explosives of the size, kind, strength, and at the spacing suitable for the formations being presplit, and with stemming material which passes a 9.5 mm (3/8 inch) standard sieve and which has the qualities for proper confinement of the explosives.

The finished presplit slope shall be reasonably uniform and free of loose rock. Variance from the true plane of the excavated backslope shall not exceed 300 mm (12 inches); however, localized irregularities or surface variations that do not constitute a safety hazard or an impairment to drainage courses or facilities will be permitted.

A maximum offset of 600 mm (24 inches) will be permitted for a construction working bench at the bottom of each lift for use in drilling the next lower presplitting pattern.

102.2.6 Excavation of Ditches, Gutters, etc.

All materials excavated from side ditches and gutters, channel changes, irrigation ditches, inlet and outlet ditches, toe ditchers, furrow ditches, and such other ditches as may be designated on the Plans or staked by the Engineer, shall be utilized as provided in Subsection 102.2.3.

Ditches shall conform to the slope, grade, and shape of the required cross-section, with no projections of roots, stumps, rock, or similar matter. The Contractor shall maintain and keep open and free from leaves, sticks, and other debris all ditches dug by him until final acceptance of the work.

Furrow ditches shall be formed by plowing a continuous furrow along the line staked by the Engineer. Methods other than plowing may be used if acceptable to the Engineer. The ditches shall be cleaned out by hand shovel work, by ditcher, or by some other suitable method, throwing all loose materials on the downhill side so that the bottom of the finished ditch shall be approximately 450 mm (18 inches) below the crest of the loose material piled on the downhill side. Hand finish will not be required, but the flow lines shall be in satisfactory shape to provide drainage without overflow.

102.2.7 Excavation of Roadbed Level

Rock shall be excavated to a depth of 150 mm (6 inches) below subgrade within the limits of the roadbed, and the excavation backfilled with material designated on the Plans or approved by the Engineer and compacted to the required density.

When excavation methods employed by the Contractor leave undrained pockets in the rock surface, the Contractor shall at his own expense, properly drain such depressions or when permitted by the Engineer fill the depressions with approved impermeable material.

Material below subgrade, other than solid rock shall be thoroughly scarified to a depth of 150 mm (6 inches) and the moisture content increased or reduced, as necessary, to bring the material throughout this 150 mm layer to the moisture content suitable for maximum compaction. This layer shall then be compacted in accordance with Subsection 104.3.3.

102.2.8 Borrow Areas

The Contractor shall notify the Engineer sufficiently in advance of opening any borrow areas so that cross-section elevations and measurements of the ground surface after stripping may be taken, and the borrow material can be tested before being used. Sufficient time for testing the borrow material shall be allowed.

All borrow areas shall be bladed and left in such shape as to permit accurate measurements after excavation has been completed. The Contractor shall not excavate beyond the dimensions and elevations established, and no material shall be removed prior to the staking out and cross-sectioning of the site. The finished borrow areas shall be approximately true to line and grade established and specified and shall be finished, as prescribed in Clause 61, Standard Specifications for Public Works and Highways, Volume 1. When necessary to remove fencing, the fencing shall be replaced in at least as good condition as it was originally. The Contractor shall be responsible for the confinement of livestock when a portion of the fence is removed.

102.2.9 Removal of Unsuitable Material

Where the Plans show the top portion of the roadbed to be selected topping, all unsuitable materials shall be excavated to the depth necessary for replacement of the selected topping to the required compacted thickness.

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

The excavation of muck shall be handled in a manner that will not permit the entrapment of muck within the backfill. The material used for backfilling up to the ground line or water level, whichever is higher, shall be rock or other suitable granular material selected from the roadway excavation, if available. If not available, suitable material shall be obtained from other approved sources. Unsuitable material removed shall be disposed off in designated areas shown on the Plans or approved by the Engineer.

102.3 Method of Measurement

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

Measurement of Unsuitable or Surplus Material shall be the net volume in its original position.

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

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

102.4 Basis of Payment

The accepted quantities, measured as prescribed in Section 102.3 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 the removal and disposal of excavated 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
102 (2)	Surplus Common Excavation	Cubic Meter

ITEM 104 - EMBANKMENT

104.1 Description

This Item shall consist of the construction of embankment in accordance with this Specification and in conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer.

104.2 Material Requirements

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

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

Selected Borrow, for topping – soil of such gradation that all particles will pass a sieve with 75 mm (3 inches) square openings and not more than 15 mass percent

will pass the 0.075 mm (No. 200) sieve, as determined by AASHTO T 11. The material shall have a plasticity index of not more than 6 as determined by ASSHTO T 90 and a liquid limit of not more than 30 as determined by AASHTO T 89.

2. Unsuitable Material – Material other than suitable materials such as:
 - a. Materials containing detrimental quantities of organic materials, such as grass, roots and sewerage.
 - b. Organic soils such as peat and muck.
 - c. Soils with liquid limit exceeding 80 and/or plasticity index exceeding 55.
 - d. Soils with a natural water content exceeding 100%.
 - e. Soils with very low natural density, 800 kg/m³ or lower.
 - f. Soils that cannot be properly compacted as determined by the Engineer.

104.3 Construction Requirements

104.3.1 General

Prior to construction of embankment, all necessary clearing and grubbing in that area shall have been performed in conformity with Item 100, Clearing and Grubbing.

Embankment construction shall consist of constructing roadway embankments, including preparation of the areas upon which they are to be placed; the construction of dikes within or adjacent to the roadway; the placing and compacting of approved material within roadway areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits, and other depressions within the roadway area.

Embankments and backfills shall contain no muck, peat, sod, roots or other deleterious matter. Rocks, broken concrete or other solid, bulky materials shall not be placed in embankment areas where piling is to be placed or driven.

Where shown on the Plans or directed by the Engineer, the surface of the existing ground shall be compacted to a depth of 150 mm (6 inches) and to the specified requirements of this Item.

Where provided on the Plans and Bill of Quantities the top portions of the roadbed in both cuts and embankments, as indicated, shall consist of selected borrow for topping from excavations.

104.3.2 Methods of Construction

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

When embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is built one-half width at a time, the existing slopes that are steeper than 3:1 when measured at right angles to the roadway shall be continuously benched over those areas

as the work is brought up in layers. Benching will be subject to the Engineer's approval and shall be of sufficient width to permit operation of placement and compaction equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Material thus excavated shall be placed and compacted along with the embankment material in accordance with the procedure described in this Section.

Unless shown otherwise on the Plans or special Provisions, where an embankment of less than 1.2 m (4 feet) below subgrade is to be made, all sod and vegetable matter shall be removed from the surface upon which the embankment is to be placed, and the cleared surfaced shall be completely broken up by plowing, scarifying, or steeping to a minimum depth of 150 mm except as provided in Subsection 102.2.2. This area shall then be compacted as provided in Subsection 104.3.3. Sod not required to be removed shall be thoroughly disc harrowed or scarified before construction of embankment. Wherever a compacted road surface containing granular materials lies within 900 mm (36 inches) of the subgrade, such old road surface shall be scarified to a depth of at least 150 mm (6 inches) whenever directed by the Engineer. These scarified materials shall then be compacted as provided in Subsection 104.3.3.

When shoulder excavation is specified, the roadway shoulders shall be excavated to the depth and width shown on the Plans. The shoulder material shall be removed without disturbing the adjacent existing base course material, and all excess excavated materials shall be disposed off as provided in Subsection 102.2.3. If necessary, the areas shall be compacted before being backfilled.

Roadway embankment 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.

Where embankment is to be constructed across low swampy ground that will not support the mass of trucks or other hauling equipment, the lower part of the fill may be constructed by dumping successive loads in a uniformly distributed layer of a thickness not greater than necessary to support the hauling equipment while placing subsequent layers.

When excavated material contains more than 25 mass percent of rock larger than 150 mm in greatest diameter and cannot be placed in layers of the thickness prescribed without crushing, pulverizing or further breaking down the pieces resulting from excavation methods, such materials may be placed on the embankment in layers not exceeding in thickness the approximate average size of the larger rocks, but not greater than 600 mm (24 inches).

Even though the thickness of layers is limited as provided above, the placing of individual rocks and boulders greater than 600 mm in diameter will be permitted provided that when placed, they do not exceed 1200 mm (48 inches) in height and provided they are carefully distributed, with the interstices filled with finer material to form a dense and compact mass.

Each layer shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments of earth. Lifts of material containing more than 25 mass percent of rock larger than 150 mm in greatest dimensions shall not be constructed above an elevation 300 mm (12 inches) below the finished subgrade. The balance of the embankment shall be composed of suitable material smoothed and placed in layers not exceeding 200 mm (8 inches) in loose thickness and compacted as specified for embankments.

Dumping and rolling areas shall be kept separate, and no lift shall be covered by another until compaction complies with the requirements of Subsection 104.3.3.

Hauling and leveling equipment shall be so routed and distributed over each layer of the fill in such a manner as to make use of compaction effort afforded thereby and to minimize rutting and uneven compaction.

104.3.3 Compaction

Compaction Trials

Before commencing the formation of embankments, the Contractor shall submit in writing to the Engineer for approval his proposals for the compaction of each type of fill material to be used in the works. The proposals shall include the relationship between the types of compaction equipment, and the number of passes required and the method of adjusting moisture content. The Contractor shall carry out full scale compaction trials on areas not less than 10 m wide and 50 m long as required by the Engineer and using his proposed procedures or such amendments thereto as may be found necessary to satisfy the Engineer that all the specified requirements regarding compaction can be consistently achieved. Compaction trials with the main types of fill material to be used in the works shall be completed before work with the corresponding materials will be allowed to commence.

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.

Earth

The Contractor shall compact the material placed in all embankment layers and the material scarified to the designated depth below subgrade in cut sections, until a uniform density of not less than 95 mass percent of the maximum dry density determined by AASHTO T 99 Method C, is attained, at a moisture content determined by Engineer to be suitable for such density. Acceptance of compaction may be based on adherence to an approved roller pattern developed as set forth in Item 106, Compaction Equipment and Density Control Strips. The Engineer shall during progress of the Work, make density

tests of compacted material in accordance with AASHTO T 191, T 205, or other approved field density tests, including the use of properly calibrated nuclear testing devices. A correction for coarse particles may be made in accordance with AASHTO T 224. If, by such tests, the Engineer determines that the specified density and moisture conditions have not been attained, the Contractor shall perform additional work as may be necessary to attain the specified conditions.

At least one group of three in-situ density tests shall be carried out for each 500 m of each layer of compacted fill.

Rock

Density requirements will not apply to portions of embankments constructed of materials which cannot be tested in accordance with approved methods.

Embankment materials classified as rock shall be deposited, spread and leveled the full width of the fill with sufficient earth or other fine material so deposited to fill the interstices to produce a dense compact embankment. In addition, one of the rollers, vibrators, or compactors meeting the requirements set forth in Subsection 106.2.1, Compaction Equipment, shall compact the embankment full width with a minimum of three complete passes for each layer of embankment.

104.3.4 Protection of Roadbed During Construction

During the construction of the roadway, the roadbed shall be maintained in such condition that it will be well drained at all times. Side ditches or gutters emptying from cuts to embankments or otherwise shall be so constructed as to avoid damage to embankments by erosion.

104.3.5 Protection of Structure

If embankment can be deposited on one side only of abutments, wing walls, piers or culvert headwalls, care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that it will cause overturning of, or excessive pressure against the structure. When noted on the Plans, the fill adjacent to the end bent of a bridge shall not be placed higher than the bottom of the backfill of the bent until the superstructure is in place. When embankment is to be placed on both sides of a concrete wall or box type structure, operations shall be so conducted that the embankment is always at approximately the same elevation on both sides of the structure.

104.3.6 Rounding and Warping Slopes

Rounding-Except in solid rock, the tops and bottoms of all slopes, including the slopes of drainage ditches, shall be rounded as indicated on the Plans. A layer of earth overlaying rock shall be rounded above the rock as done in earth slopes.

Warping-adjustments in slopes shall be made to avoid injury in standing trees or marring of weathered rock, or to harmonize with existing landscape features, and the transition to such adjusted slopes shall be gradual. At intersections of cuts and fills, slopes shall be adjusted and warped to flow into each other or into the natural ground surfaces without noticeable break.

104.3.7 Finishing Roadbed and Slopes

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

All earth slopes shall be left with roughened surfaces but shall be reasonably uniform, without any noticeable break, and in reasonably close conformity with the Plans or other surfaces indicated on the Plans or as staked by the Engineer, with no variations therefrom readily discernible as viewed from the road.

104.4 Method of Measurement

The quantity of embankment to be paid for shall be the volume of material compacted in place, accepted by the Engineer and formed with material obtained from any source.

Material from excavation per Item 102 which is used in embankment and accepted by the Engineer will be paid under Embankment and such payment will be deemed to include the cost of excavating, hauling, stockpiling and all other costs incidental to the work.

Material for Selected Borrow topping will be measured and paid for under the same conditions specified in the preceding paragraph.

104.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 104.4, 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. The payment shall continue full compensation for placing and compacting 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
104(2)	Embankment from Borrow	Cubic Meter

ITEM 200 – AGGREGATE SUBBASE COURSE

200.1 Description

This item shall consist of furnishing, placing and compacting an aggregate subbase course on a prepared subgrade in accordance with this Specification and the lines, grades and cross-sections shown on the Plans, or as directed by the Engineer.

200.2 Material Requirements

Aggregate for subbase shall consist of hard, durable particles or fragments of crushed stone, crushed slag, or crushed or natural gravel and filler of natural or crushed sand or other finely divided mineral matter. The composite material shall be free from vegetable matter and lumps or balls of clay, and shall be of such nature that it can be compacted readily to form a firm, stable subbase.

The subbase material shall conform to Table 200.1, Grading Requirements

Table 200.1 – Grading Requirements

Sieve Designation		Mass Percent Passing
Standard, mm	Alternate US Standard	
50	2"	100
25	1"	55 – 85
9.5	3/8"	40 – 75
0.075	No. 200	0 - 12

The fraction passing the 0.075 mm (No. 200) sieve shall not be greater than 0.66 (two thirds) of the fraction passing the 0.425 mm (No. 40) sieve.

The fraction passing the 0.425 mm (No. 40) sieve shall have a liquid limit not greater than 35 and plasticity index not greater than 12 as determined by AASHTO T 89 and T 90, respectively.

The coarse portion, retained on a 2.00 mm (No. 10) sieve, shall have a mass percent of wear not exceeding 50 by the Los Angeles Abrasion Tests as determined by AASHTO T 96.

The material shall have a soaked CBR value of not less than 25% as determined by AASHTO T 193. The CBR value shall be obtained at the maximum dry density and determined by AASHTO T 180, Method D.

Construction Requirements

200.3.1 Preparation of Existing Surface

The existing surface shall be graded and finished as provided under Item 105, Subgrade Preparation, before placing the subbase material.

200.3.2 Placing

The aggregate subbase material shall be placed at a uniform mixture on a prepared subgrade in a quantity which will provide the required compacted thickness. When more than one layer is required, each layer shall be shaped and compacted before the

succeeding layer is placed.

The placing of material shall begin at the point designated by the Engineer. Placing shall be from vehicles especially equipped to distribute the material in a continuous uniform layer or windrow. The layer or windrow shall be of such size that when spread and compacted the finished layer be in reasonably close conformity to the nominal thickness shown on the Plans.

When hauling is done over previously placed material, hauling equipment shall be dispersed uniformly over the entire surface of the previously constructed layer, to minimize rutting or uneven compaction.

200.3.3 Spreading and Compacting

When uniformly mixed, the mixture shall be spread to the plan thickness, for compaction.

Where the required thickness is 150 mm or less, the material may be spread and compacted in one layer. Where the required thickness is more than 150 mm, the aggregate subbase shall be spread and compacted in two or more layers of approximately equal thickness, and the maximum compacted thickness of any layer shall not exceed 150 mm. All subsequent layers shall be spread and compacted in a similar manner.

The moisture content of subbase material shall, if necessary, be adjusted prior to compaction by watering with approved sprinklers mounted on trucks or by drying out, as required in order to obtain the required compaction.

Immediately following final spreading and smoothing, each layer shall be compacted to the full width by means of approved compaction equipment. Rolling shall progress gradually from the sides to the center, parallel to the centerline of the road and shall continue until the whole surface has been rolled. Any irregularities or depressions that develop shall be corrected by loosening the material at these places and adding or removing material until surface is smooth and uniform. Along curbs, headers, and walls, and at all places not accessible to the roller, the subbase material shall be compacted thoroughly with approved tampers or compactors.

If the layer of subbase material, or part thereof, does not conform to the required finish, the Contractor shall, at his own expense, make the necessary corrections. Compaction of each layer shall continue until a field density of at least 100 percent of the maximum dry density determined in accordance with AASHTO T 180, Method D has been achieved. In-place density determination shall be made in accordance with AASHTO T 191.

200.3.4 Trial Sections

Before subbase construction is started, the Contractor shall spread and compact trial sections as directed by the Engineer. The purpose of the trial sections is to check the suitability of the materials and the efficiency of the equipment and construction method which is proposed to be used by the Contractor. Therefore, the Contractor must use the same material, equipment and procedures that he proposes to use for the main work. One trial section of about 500 m² shall be made for every type of material and/or construction equipment/procedure proposed for use.

After final compaction of each trial section, the Contractor shall carry out such field density tests and other tests required as directed by the Engineer.

If a trial section shows that the proposed materials, equipment or procedures in the Engineer's opinion are not suitable for subbase, the material shall be removed at the Contractor's expense, and a new trial section shall be constructed.

If the basic conditions regarding the type of material or procedure change during the execution of the work, new trial sections shall be constructed.

200.3.5 Tolerances

Aggregate subbase shall be spread with equipment that will provide a uniform layer which when compacted will conform to the designed level and transverse slopes as shown on the Plans.

The allowable tolerances shall be as specified hereunder:

Permitted variation from design THICKNESS OF LAYER	±20 mm
Permitted variation from design LEVEL OF SURFACE	+10 mm -20 mm
Permitted variation from design SURFACE IRREGULARITY Measured by 3-m straight-edge	20 mm
Permitted variation from design CROSSFALL OR CAMBER	±0.3%
Permitted variation from design LONGITUDINAL GRADE over 25 m in length	±0.1%

200.4 Method of Measurement

Aggregate Subbase Course will be measured by the cubic meter (m³). The quantity to be paid for shall be the design volume compacted in-place as shown on the Plans, and accepted in the completed course. No allowance will be given for materials placed outside the design limits shown on the cross-sections. Trial sections shall not be measured separately but shall be included in the quantity of subbase herein measured.

200.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 200.4, shall be paid for at the contract unit price for Aggregate Subbase Course 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.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
200 (1)	Aggregate Subbase Course	Cubic Meter

ITEM 311 – PORTLAND CEMENT CONCRETE PAVEMENT

311.1 Description

This Item shall consist of pavement of Portland Cement Concrete, with or without reinforcement, constructed on the prepared base in accordance with this Specification and in conformity with lines, grades, thickness and typical cross-section shown on the Plans.

311.2 Material Requirements

311.2.1 Portland Cement

It shall conform to the applicable requirements of Item 700, Hydraulic Cement. Only Type I Portland Cement shall be used unless otherwise provided for in the Special Provisions. Different brands or the same brands from different mills shall not be mixed nor shall they be used alternately unless the mix is approved by the Engineer.

However, the use of Portland Pozzolan Cement Type IP meeting the requirements of AASHTO M 240/ASTM C 695, Specifications for Blended Hydraulic Cement shall be allowed, provided that trial mixes shall be done and that the mixes meet the concrete strength requirements, the AASHTO/ASTM provisions pertinent to the use of Portland Pozzolan Type IP shall be adopted.

Cement which for any reason, has become partially set or which contains lumps of caked cement will be rejected.

Cement salvaged from discarded or used bags shall not be used. Samples of Cement shall be obtained in accordance with AASHTO T 127.

311.2.2 Fine Aggregate

It shall consist of natural sand, stone screenings or other inert materials with similar characteristics, or combinations thereof, having hard, strong and durable particles. Fine aggregate from different sources of supply shall not be mixed or stored in the same pile nor used alternately in the same class of concrete without the approval of the Engineer.

It shall not contain more than three (3) mass percent of material passing the 0.075 mm (No. 200 sieve) by washing nor more than one (1) mass percent each of clay lumps or shale. The use of beach sand will not be allowed without the approval of the Engineer.

If the fine aggregate is subjected to five (5) cycles of the sodium sulfate soundness test, the weighted loss shall not exceed 10 mass percent.

The fine aggregate shall be free from injurious amounts of organic impurities. If subjected to the colorimatic test for organic impurities and a color darker than the standard is produced, it shall be rejected. However, when tested for the effect of organic impurities of strength of mortar by AASHTO T 71, the fine aggregate may be used if the relative strength at 7 and 28 days is not less than 95 mass percent.

The fine aggregate shall be well-graded from coarse to fine and shall conform to Table 311.1

Table 311.1 – Grading Requirements for Fine Aggregate

Sieve Designation	Mass Percent Passing
9.5 mm (3/8 in)	100
4.75 mm (No. 4)	95 – 100
2.36 mm (No. 8)	-
1.18 mm (No. 16)	45 – 80
0.600 mm (No. 30)	-
0.300 mm (No. 50)	5 – 30
0.150 mm (No. 100)	0 – 10

311.2.3 Coarse Aggregate

It shall consist of crushed stone, gravel, blast furnace slag, or other approved inert materials of similar characteristics, or combinations thereof, having hard, strong, durable pieces and free from any adherent coatings.

It shall contain not more than one (1) mass percent of material passing the 0.075 mm (No. 200) sieve, not more than 0.25 mass percent of clay lumps, nor more than 3.5 mass percent of soft fragments.

If the coarse aggregate is subjected to five (5) cycles of the sodium sulfate soundness test, the weighted loss shall not exceed 12 mass percent.

It shall have a mass percent of wear not exceeding 40 when tested by AASHTO T 96.

If the slag is used, its density shall not be less than 1120 kg/m³ (70 lb./cu. ft.). The gradation of the coarse aggregate shall conform to Table 311.2.

Only one grading specification shall be used from any one source.

Table 311.2 – Grading Requirement for Coarse Aggregate

Sieve Designation	Mass Percent Passing
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Standard Mm	Alternate U. S. Standard	Grading A	Grading B	Grading C
75.00	3 in.	100	-	-
63.00	2-1/2 in.	90-100	100	100
50.00	2 in.	-	90-100	95-100
37.5	1-1/2 in.	25-60	35-70	-
25.0	1 in.	-	0-15	35-70
19.0	¾ in.	0-10	-	-
12.5	½ in.	0-5	0-5	10-30
4.75	No. 4	-	-	0-5

311.2.4 Water

Water used in mixing, curing or other designated application shall be reasonably clean and free of oil, salt, acid, alkali, grass or other substances injurious to the finished product. Water will be tested in accordance with and shall meet the requirements of Item 714, Water. Water which is drinkable may be used without test. Where the source of water is shallow, the intake shall be so enclosed as to exclude silt, mud, grass or other foreign materials.

311.2.5 Reinforcing Steel

It shall conform to the requirements of Item 404, Reinforcing Steel. Dowels and tie bars shall conform to the requirements of AASHTO M 31 or M 42, except that rail steel shall not be used for tie bars that are to be bent and restraightened during construction. Tie bars shall be deformed bars. Dowels shall be plain round bars. Before delivery to the site of work, one-half of the length of each dowel shall be painted with one coat of approved lead or tar paint.

The sleeves for dowel bars shall be metal of approved design to cover 50 mm (2 inches), plus or minus 5 mm (1/4 inch) of the dowel, with a closed end, and with a suitable stop to hold the end of the sleeve at least 25 mm (1 inch) from the end of the dowel. Sleeves shall be of such design that they do not collapse during construction.

311.2.6 Joint Fillers

Poured joint fillers shall be mixed asphalt and mineral or rubber filler conforming to the applicable requirements of Item 705, Joint Materials.

Preformed joint filler shall conform to the applicable requirements of Item 705. It shall be punched to admit the dowels where called for in the Plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint.

311.2.7 Admixtures

Air-entraining admixture shall conform to the requirements of AASHTO M 154.

Chemical admixtures, if specified or permitted, shall conform to the requirements of AASHTO M 194.

Fly Ash, if specified or permitted as a mineral admixture and as 20% partial replacement of Portland Cement in concrete mix shall conform to the requirements of ASTM C 618.

Admixture/s should be added only to the concrete mix to produce some desired modifications to the properties of concrete where necessary, but not as partial replacement of cement.

311.2.8 Curing Materials

Curing materials shall conform to the following requirements as specified;

- | | | |
|--------------------------------------|---|--------------|
| a. Burlap cloth | - | AASHTO M 182 |
| b. Liquid membrane forming compounds | - | AASHTO M 148 |
| c. Sheeting (film) materials | - | AASHTO M 171 |

Cotton mats and water-proof paper can be used.

311.2.9 Calcium Chloride/Calcium Nitrate

It shall conform to AASHTO M 144, if specified or permitted by the Engineer, as accelerator.

311.2.10 Storage of Cement and Aggregate

All cement shall be stored, immediately upon delivery at the Site, in weatherproof building which will protect the cement from dampness. The floor shall be raised from the ground. The buildings shall be placed in locations approved by the Engineer. Provisions for storage shall be ample, and the shipments of cement as received shall be separately stored in such a manner as to allow the earliest deliveries to be used first and to provide easy access for identification and inspection of each shipment. Storage buildings shall have capacity for storage of a sufficient quantity of cement to allow sampling at least twelve (12) days before the cement is to be used. Bulk cement, if used, shall be transferred to elevated air tight and weatherproof bins. Stored cement shall meet the test requirements at any time after storage when retest is ordered by the Engineer. At the time of use, all cement shall be free-flowing and free of lumps.

The handling and storing of concrete aggregates shall be such as to prevent segregation or the inclusion of foreign materials. The Engineer may require that aggregates be stored on separate platforms at satisfactory locations.

In order to secure greater uniformity of concrete mix, the Engineer may require that the coarse aggregate be separated into two or more sizes. Different sizes of aggregate shall

be stored in separate bins or in separate stockpiles sufficiently removed from each other to prevent the material at the edges of the piles from becoming intermixed.

311.2.11 Proportioning, Consistency and Strength of Concrete

The Contractor shall prepare the design mix based on the absolute volume method as outlined in the American Concrete Institute (ACI) Standard 211.1, "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete".

It is the intent of this Specification to require at least 364 kg of cement per cubic meter of concrete to meet the minimum strength requirements. The Engineer shall determine from laboratory tests of the materials to be used, the cement content and the proportions of aggregate and water that will produce workable concrete having a slump of between 40 and 75 mm (1-1/2 and 3 inches) if not vibrated or between 10 and 40 mm (1/2 and 1-1/2 inches) if vibrated, and a flexural strength of not less than 3.8 MPa (550 psi) when tested by the third-point method or 4.5 MPa (650 psi) when tested by the mid-point method at fourteen (14) days in accordance with AASHTO T 97 and T 177, respectively; or a compressive strength of 24.1 MPa (3500 psi) for cores taken at fourteen (14) days and tested in accordance with AASHTO T 24.

Slump shall be determined using AASHTO T 119.

The designer shall consider the use of lean concrete (econcrete) mixtures using local materials or specifically modified conventional concrete mixes in base course and in the lower course composite, monolithic concrete pavements using a minimum of 75 mm (3 inches) of conventional concrete as the surface course.

The mix design shall be submitted to the Engineer for approval and shall be accompanied with certified test data from an approved laboratory demonstrating the adequacy of the mix design. A change in the source of materials during the progress of work may necessitate a new design mix.

311.3 Construction Requirements

311.3.1 Quality Control of Concrete

1. General

The Contractor shall be responsible for the quality control of all materials during the handling, blending, and mixing and placement operations.

2. Quality Control Plan

The Contractor shall furnish the Engineer a Quality Control Plan detailing his production control procedures and the type and frequency of sampling and testing to ensure that the concrete produced complies with the Specifications. The Engineer shall be provided free access to recent plant production records, and if requested, informational copies of mix design, materials certifications and sampling and testing reports.

3. Qualification of Workmen

Experienced and qualified personnel shall perform all batching or mixing operation for the concrete mix, and shall be present at the plant and job site to control the concrete productions whenever the plant is in operation. They shall be identified and duties defined as follows:

a. Concrete Batchers. The person performing the batching or mixing operation shall be capable of accurately conducting aggregate surface moisture determination and establishing correct scale weights for concrete materials. He shall be capable of assuring that the proportioned batch weights of materials are in accordance with the mix design.

b. Concrete Technician. The person responsible for concrete production control and sampling and testing for quality control shall be proficient in concrete technology and shall have a sound knowledge of the Specifications as they relate to concrete production. He shall be capable of conducting tests on concrete and concrete materials in accordance with these Specifications. He shall be capable of adjusting concrete mix designs for improving workability and Specification compliance and preparing trial mix designs. He shall be qualified to act as the concrete batcher in the batcher's absence.

4. Quality Control Testing

The Contractor shall perform all sampling, testing and inspection necessary to assure quality control of the component materials and the concrete.

The Contractor shall be responsible for determining the gradation of fine and coarse aggregates and for testing the concrete mixture for slump, air content, water-cement ratio and temperature. He shall conduct his operations so as to produce a mix conforming to the approved mix design.

5. Documentation

The Contractor shall maintain adequate records of all inspections and tests. The records shall indicate the nature and number of observations made, the number and type of deficiencies found, the quantities approved and rejected, and nature of any corrective action taken.

The Engineer may take independent assurance samples at random location for acceptance purposes as he deems necessary.

311.3.2 Equipment

Equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the Engineer as to design, capacity and mechanical condition. The equipment shall be at the jobsite sufficiently ahead of the start of construction operations to be examined thoroughly and approved.

1. Batching Plant and Equipment

a. General. The batching shall include bins, weighing hoppers, and scales for the

fine aggregate and for each size of coarse aggregate. If cement is used in bulk, a bin, a hopper, and separate scale for cement shall be included. The weighing hopper shall be properly sealed and vented to preclude dusting operation. The batch plant shall be equipped with a suitable non-resettable batch counter which will correctly indicate the number of batches proportioned.

- b. Bins and Hoppers. Bins with adequate separate compartments for fine aggregate and for each size of coarse aggregate shall be provided in the batching plant.
- c. Scales. Scales for weighing aggregates and cement shall be of either the beam type or the springless-dial type. They shall be accurate within one-half percent (0.5%) throughout the range of use. Poises shall be designed to be locked in any position and to prevent unauthorized change. Scales shall be inspected and sealed as often as the Engineer may deem necessary to assure their continued accuracy.
- d. Automatic Weighing Devices. Unless otherwise allowed on the Contract, batching plants shall be equipped with automatic weighing devices of an approved type to proportion aggregates and bulk cement.

2. Mixers

- a. General. Concrete may be mixed at the site of construction or at a central plant, or wholly or in part in truck mixers. Each mixer shall have a manufacturer's plate attached in a prominent place showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.
- b. Mixers at Site of Construction. Mixing shall be done in an approved mixer capable of combining the aggregates, cement and water into a thoroughly mixed and uniform mass within the specified mixing period and discharging and distributing the mixture without segregation on the prepared grade. The mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum has been charged and released it at the end of the mixing period. In case of failure of the timing device, the mixer may be used for the balance of the day while it is being repaired, provided that each batch is mixed 90 seconds. The mixer shall be equipped with a suitable nonresettable batch counter which shall correctly indicate the number of the batches mixed.
- c. Truck Mixer and Truck Agitators. Truck mixers used for mixing and hauling concrete, and truck agitators used for hauling central-mixed concrete, shall conform to the requirements of AASHTO M 157.
- d. Non-Agitator Truck. Bodies of non-agitating hauling equipment for concrete shall be smooth, mortar-tight metal containers and shall be capable of discharging the concrete at a satisfactory controlled rate without segregation.

3. Paving and Finishing Equipment

The concrete shall be placed with an approved paver designed to spread, consolidate, screed and float finish the freshly placed concrete in one complete pass of the machine in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous pavement in conformance with the Plans and Specifications.

The finishing machine shall be equipped with at least two (2) oscillating type transverse

screed.

Vibrators shall operate at a frequency of 8,300 to 9,600 impulses per minute under load at a maximum spacing of 60 cm.

4. Concrete Saw

The Contractor shall provide sawing equipment in adequate number of units and power to complete the sawing with a water-cooled diamond edge saw blade or an abrasive wheel to the required dimensions and at the required rate. He shall provide at least one (1) stand-by saw in good working condition and with an ample supply of saw blades.

5. Forms

Forms shall be of steel, of an approved section, and of depth equal to the thickness of the pavement at the edge. The base of the forms shall be of sufficient width to provide necessary stability in all directions. The flange braces must extend outward on the base to not less than $2/3$ the height of the form.

All forms shall be rigidly supported on bed of thoroughly compacted material during the entire operation of placing and finishing the concrete. Forms shall be provided with adequate devices for secure setting so that when in place, they will withstand, without visible spring or settlement, the impact and vibration of the consolidation and finishing or paving equipment.

311.3.3 Preparation of Grade

After the subgrade of base has been placed and compacted to the required density, the areas which will support the paving machine and the grade on which the pavement is to be constructed shall be trimmed to the proper elevation by means of a properly designed machine extending the prepared work areas compacted at least 60 cm beyond each edge of the proposed concrete pavement. If loss of density results from the trimming operations, it shall be restored by additional compaction before concrete is placed. If any traffic is allowed to use the prepared subgrade or base, the surface shall be checked and corrected immediately ahead of the placing concrete.

The subgrade or base shall be uniformly moist when the concrete is placed.

311.3.4 Setting Forms

1. Base Support.

The foundation under the forms shall be hard and true to grade so that the form when set will be firmly in contact for its whole length and at the specified grade. Any roadbed, which at the form line is found below established grade, shall be filled with approved granular materials to grade in lifts of three (3) cm or less, and thoroughly rerolled or tamped. Imperfections or variations above grade shall be corrected by tamping or by cutting as necessary.

2. Form Setting

Forms shall be set sufficiently in advance of the point where concrete is being placed. After the forms have been set to correct grade, the grade shall be thoroughly tamped, mechanically or by hand, at both the inside and outside edges of the base of the forms. The forms shall not deviate from true line by more than one (1) cm at any point.

3. Grade and Alignment

The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete. Testing as to crown and elevation, prior to placing of concrete can be made by means of holding an approved template in a vertical position and moved backward and forward on the forms.

When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

311.3.5 Conditioning of Subgrade or Base Course

When side forms have been securely set to grade, the subgrade or base course shall be brought to proper cross-section. High areas shall be trimmed to proper elevation. Low areas shall be filled and compacted to a condition similar to that of surrounding grade. The finished grade shall be maintained in a smooth and compacted condition until the pavement is placed.

Unless waterproof subgrade or base course cover material is specified, the subgrade or base course shall be uniformly moist when the concrete is placed. If it subsequently becomes too dry, the subgrade or base course shall be sprinkled, but the method of sprinkling shall not be such as to form mud or pools of water.

311.3.6 Handling, Measuring and Batching Materials

The batch plant site, layout, equipment and provisions for transporting material shall be such as to assure a continuous supply of material to the work.

Stockpiles shall be built up in layers of not more than one (1) meter in thickness. Each layer shall be completely in place before beginning the next which shall not be allowed to "cone" down over the next lower layer. Aggregates from different sources and of different grading shall not be stockpiled together.

All washed aggregates and aggregates produced or handled by hydraulic methods, shall be stockpiled or binned for draining at least twelve (12) hours before being batched.

When mixing is done at the side of the work, aggregates shall be transported from the batching plant to the mixer in batch boxes, vehicle bodies, or other containers of adequate capacity and construction to properly carry the volume required. Partitions separating batches shall be adequate and effective to prevent spilling from one compartment to another while in transit or being dumped. When bulk cement is used, the Contractor shall use a suitable method of handling the cement from weighing hopper to transporting container or into the batch itself for transportation to the mixer, with chute, boot or other approved device, to prevent loss of cement, and to provide positive assurance of the actual presence in each batch of the entire cement content specified.

Bulk cement shall be transported to the mixer in tight compartments carrying the full amount of cement required for the batch. However, if allowed in the Special Provisions, it may be transported between the fine and coarse aggregate. When cement is placed in contact with the aggregates, batches may be rejected unless mixed within 1-1/2 hours of such contact. Cement in original shipping packages may be transported on top of the aggregates, each batch containing the number of sacks required by the job mix.

The mixer shall be charged without loss of cement. Batching shall be so conducted as to result in the weight to each material required within a tolerance of one (1) percent for the cement and two (2) percent for aggregates.

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 over than one (1) percent. Unless the water is to be weighed, the water-measuring equipment shall include an auxiliary tank from which the measuring tank shall be equipped with an outside tap and valve to provide checking the setting, unless other means are provided for readily and accurately determining the amount of water in the tank. The volume of the auxiliary tank shall be at least equal to that of the measuring tank.

311.3.7 Mixing Concrete

The concrete may be mixed at the site of the work in a central-mix plant, or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time will be measured from the time all materials, except water, are in the drum. Ready-mixed concrete shall be mixed and delivered in accordance with requirements of AASHTO M 157, except that the minimum required revolutions at the mixing speed for transit-mixed concrete may be reduced to not less than that recommended by the mixer manufacturer. The number of revolutions recommended by the mixer manufacturer shall be indicated on the manufacturer's serial plate attached to the mixer. The Contractor shall furnish test data acceptable to the Engineer verifying that the make and model of the mixer will produce uniform concrete conforming to the provision of AASHTO M 157 at the reduced number of revolutions shown on the serial plate.

When mixed at the site or in a central mixing plant, the mixing time shall not be less than fifty (50) seconds nor more than ninety (90) seconds, unless mixer performance tests prove adequate mixing of the concrete is a shorter time period.

The operation and mixing time for pan, twinshaft and other type of central mixers shall be based on the mixer manufacturer's instructions.

Four (4) seconds shall be added to the specified mixing time if timing starts at the instant the skip reaches its maximum raised positions. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

The mixer shall be operated at the drum speed as shown on the manufacturer's name plate attached on the mixer. Any concrete mixed less than the specified time shall be discarded and disposed of by the Contractor at his expense. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic meter, as shown on the

manufacturer's standard rating plate on the mixer, except that an overload up to ten (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 batches shall be so charged into the drum that a portion of the mixing water shall be entered 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 fifteen (15) seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators or non-agitating truck specified in Subsection 311.3.2, Equipment. The time elapsed from the time water is added to the mix until the concrete is deposited in place at the Site shall not exceed forty-five (45) minutes when the concrete is hauled in non-agitating trucks, nor ninety (90) minutes when hauled in truck mixers or truck agitators, except that in hot weather or under other conditions contributing to quick hardening of the concrete, the maximum allowable time may be reduced by the Engineer.

In exceptional cases and when volumetric measurements are authorized for small project requiring less than 75 cu.m. of concrete 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.

Retempering concrete by adding water or by other means shall not be permitted, except that when concrete is delivered in truck mixers, additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements, if permitted by the Engineer, provided all these operations are performed within forty-five (45) minutes after the initial mixing operation and the water-cement ratio is not exceeded. Concrete that is not within the specified slump limits at the time of placement shall not be used. Admixtures for increasing the workability or for accelerating the setting of the concrete will be permitted only when specifically approved by the Engineer.

311.3.8 Limitation of Mixing

No concrete shall be mixed, placed or finished when natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

During hot weather, the Engineer shall require that steps be taken to prevent the temperature of mixed concrete from exceeding a maximum temperature of 90⁰F (32⁰C)

Concrete not in place within ninety (90) minutes from the time the ingredients were charged into the mixing drum or that has developed an initial set shall not be used. Retempering of concrete or mortar which has partially hardened, that is remixing with

or without additional cement, aggregate, or water, shall not be permitted.

In order that the concrete may be properly protected against the effects of rain before the concrete is sufficiently hardened, the Contractor will be required to have available at all times materials for the protection of the edges and surface of the unhardened concrete.

311.3.9 Placing Concrete

Concrete shall be deposited in such a manner to require minimal rehandling. Unless truck mixers or non-agitating hauling equipment are equipped with means to discharge concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade in such a manner as to prevent segregation. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances.

When concrete is to be placed adjoining a previously constructed lane and mechanical equipment will be operated upon the existing lane, that previously constructed lane shall have attained the strength for fourteen (14) day concrete. If only finishing equipment is carried on the existing lane, paving in adjoining lanes may be permitted after three (3) days.

Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies, by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than fifteen (15) seconds in any one location.

Concrete shall be deposited as near as possible to the expansion and contraction joints without disturbing them, but shall not be dumped from the discharge bucket or hopper into a joint assembly unless the hopper is well centered on the joint assembly. Should any concrete material fall on or be worked into the surface of a complete slab, it shall be removed immediately.

311.3.10 Test Specimens

As work progresses, at least one (1) set consisting of three (3) concrete beam test specimens, 150 mm x 150 mm x 525 mm or 900 mm shall be taken from each 330 m² of pavement, 230 mm depth, or fraction thereof placed each day. Test specimens shall be made under the supervision of the Engineer, and the Contractor shall provide all concrete and other facilities necessary in making the test specimens and shall protect them from damage by construction operations. Cylinder samples shall not be used as substitute for determining the adequacy of the strength of concrete.

The beams shall be made, cured, and tested in accordance with AASHTO T 23 and T 97.

311.3.11 Strike-off of Concrete and Placement of Reinforcement

Following the placing of the concrete, it shall be struck off to conform to the cross-section

shown on the Plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement will be at the elevation shown on the Plans. When reinforced concrete pavement is placed in two (2) layers, the bottom layer shall be struck off and consolidated to such length and depth that the sheet of fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off and screeded. Any portion of the bottom layer of concrete which has been placed more than 30 minutes without being covered with the top layer shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be firmly positioned in advance of concrete placement or it may be placed at the depth shown on the Plans in plastic concrete, after spreading by mechanical or vibratory means.

Reinforcing steel shall be free from dirt, oil, paint, grease, mill scale and loose or thick rust which could impair the bond of the steel with the concrete.

311.3.12 Joints

Joints shall be constructed of the type and dimensions, and at the locations required by the Plans or Special Provisions. All joints shall be protected from the intrusion of injurious foreign material until sealed.

1. Longitudinal Joint

Deformed steel tie bars of specified length, size, spacing and materials shall be placed perpendicular to the longitudinal joints, they shall be placed by approved mechanical equipment or rigidly secured by chair or other approved supports to prevent displacement. Tie bars shall not be painted or coated with asphalt or other materials or enclosed in tubes or sleeves. When shown on the Plans and when adjacent lanes of pavement are constructed separately, steel side forms shall be used which will form a keyway along the construction joint. Tie bars, except those made of rail steel, may be bent at right angles against the form of the first lane constructed and straightened into final position before the concrete of the adjacent lane is placed, or in lieu of bent tie bars, approved two-piece connectors may be used.

Longitudinal formed joints shall consist of a groove or cleft, extending downward from and normal to, the surface of the pavement. These joints shall be effected or formed by an approved mechanically or manually operated device to the dimensions and line indicated on the Plans and while the concrete is in a plastic state. The groove or cleft shall be filled with either a premolded strip or poured material as required.

The longitudinal joints shall be continuous, there shall be no gaps in either transverse or longitudinal joints at the intersection of the joints.

Longitudinal sawed joints shall be cut by means of approved concrete saws to the depth, width and line shown on the Plans. Suitable guide lines or devices shall be used to assure cutting the longitudinal joint on the true line. The longitudinal joint shall be sawed before the end of the curing period or shortly thereafter and before any equipment or vehicles are allowed on the pavement. The sawed area shall be thoroughly cleaned and, if

required, the joint shall immediately be filled with sealer.

Longitudinal pavement insert type joints shall be formed by placing a continuous strip of plastic materials which will not react adversely with the chemical constituent of the concrete.

2. Transverse Expansion Joint

The expansion joint filler shall be continuous from form to form, shaped to subgrade and to the keyway along the form. Preformed joint filler shall be furnished in lengths equal to the pavement width or equal to the width of one lane. Damaged or repaired joint filler shall not be used.

The expansion joint filler shall be held in a vertical position. An approved installing bar, or other device, shall be used if required to secure preformed expansion joint filler at the proper grade and alignment during placing and finishing of the concrete. Finished joint shall not deviate more than 6 mm from a straight line. If joint fillers are assembled in sections, there shall be no offsets between adjacent units. No plugs of concrete shall be permitted anywhere within the expansion space.

3. Transverse Contraction Joint/Weakened Joint

When shown on the Plans, it shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement and shall include load transfer assemblies. The depth of the weakened plane joint should at all times not be less than 50 mm, while the width should not be more than 6 mm.

- a. Transverse Strip Contraction Joint. It shall be formed by installing a parting strip to be left in place as shown on the Plans.
- b. Formed Groove. It shall be made by depressing an approved tool or device into the plastic concrete. The tool or device shall remain in place at least until the concrete has attained its initial set and shall then be removed without disturbing the adjacent concrete, unless the device is designed to remain in the joint.
- c. Sawed Contraction Joint. It shall be created by sawing grooves in the surface of the pavement of not more than 6 mm, depth should at all times not be less than 50 mm, and at the spacing and lines shown on the Plans, with an approved concrete saw. After each joint is sawed, it shall be thoroughly cleaned including the adjacent concrete surface.

Sawing of the joint shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually 4 to 24 hours. All joints shall be sawed before uncontrolled shrinkage cracking takes place. If necessary, the sawing operations shall be carried on during the day or night, regardless of weather conditions. The sawing of any joint shall be omitted if crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discontinued when a crack develops ahead of the saw. In general, all joints should be sawed in sequence. If extreme conditions exist which make it impractical to prevent erratic cracking by early sawing, the contraction joint groove shall be formed prior to the initial set of concrete as provided above.

4. Transverse Construction Joint

It shall be constructed when there is an interruption of more than 30 minutes in the concreting operations. No transverse joint shall be constructed within 1.50 m of an expansion joint, contraction joint, or plane of weakness. If sufficient concrete has been mixed at the time of interruption to form a slab of at least 1.5 m long, the excess concrete from the last preceding joint shall be removed and disposed off as directed.

5. Load Transfer Device

Dowel, when used, shall be held in position parallel to the surface and center line of the slab by a metal device that is left in the pavement.

The portion of each dowel painted with one coat of lead or tar, in conformance with the requirements of Item 404, Reinforcing Steel, shall be thoroughly coated with approved bituminous materials, e.g., MC-70, or an approved lubricant, to prevent the concrete from binding to that portion of the dowel. The sleeves for dowels shall be metal designed to cover 50 mm plus or minus 5 mm (1/4 inch), of the dowel, with a watertight closed end and with a suitable stop to hold the end of the sleeves at least 25 mm (1 inch) from the end of the dowel.

In lieu of using dowel assemblies at contraction joints, dowel may be placed in the full thickness of pavement by a mechanical device approved by the Engineer.

311.3.13 Final Strike-off (Consolidation and Finishing)

1. Sequence

The sequence of operations shall be the strike-off and consolidation, floating and removal of laitance, straight-edging and final surface finish. Work bridges or other devices necessary to provide access to the pavement surface for the purpose of finishing straight-edging, and make corrections as hereinafter specified, shall be provided by the Contractor.

In general, the addition of water to the surface of the concrete to assist in finishing operations will not be permitted. If the application of water to the surface is permitted, it shall be applied as fog spray by means of an approved spray equipment.

2. Finishing Joints

The concrete adjacent to joints shall be compacted or firmly placed without voids or segregation against the joint material assembly, also under and around all load transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated as required in Subsection 311.3.9, Placing Concrete.

After the concrete has been placed and vibrated adjacent to the joints as required in Subsection 311.3.9, the finishing machine shall be brought forward, operating in a manner to avoid damage or misalignment of joints. If uninterrupted operation of the finishing machine, to over and beyond the joints causes segregation of concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the front screed is approximately 20 cm (8 inches) from the joint. Segregated concrete shall be

removed from in front of and off the joint. The front screed shall be lifted and set directly on top of the joint and the forward motion of the finishing machine resumed. When the second screed is close enough to permit the excess mortar in front of it to flow over the joint, it shall be lifted and carried over the joint. Thereafter, the finishing machine may be run over the joint without lifting the screeds, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

3. Machine Finishing

- a. Non-vibratory Method. The concrete shall be distributed or spread as soon as placed. As soon as the concrete has been placed, it shall be struck off and screeded by an approved finishing machine. The machine shall go over each area of pavement as many times and at such intervals as necessary to give the proper compaction and leave a surface of uniform texture. Excessive operation over a given area shall be avoided. The tops of the forms shall be kept clean by an effective device attached to the machine and the travel of the machine on the forms shall be maintained true without wobbling or other variation tending to affect the precision finish.

During the first pass of the finishing machine, a uniform ridge of concrete shall be maintained ahead of the front screed in its entire length.

- b. Vibratory Method. When vibration is specified, vibrators for full width vibration of concrete paving slabs, shall meet the requirements in Subsection 311.3.2, Equipment. If uniform and satisfactory density of the concrete is not obtained by the vibratory method at joints, along forms, at structures, and throughout the pavement, the Contractor will be required to furnish equipment and method which will produce pavement conforming to the Specifications. All provisions in item (a) above not in conflict with the provisions for the vibratory method shall govern.

4. Hand Finishing

Hand finishing methods may only be used under the following conditions:

- a. In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade.
- b. In narrow widths or areas of irregular dimensions where operations of the mechanical equipment is impractical, hand methods may be used.

Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used. A second screed shall be provided for striking off the bottom layer of concrete if reinforcement is used.

The screed for the surface shall be at least 60 cm (2 feet) longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and constructed either of metal or other suitable material shod with metal.

Consolidation shall be attained by the use of suitable vibrator or other approved equipment.

In operation, the screed shall be moved forward on the forms with a combined longitudinal and transverse shearing motion, moving always in the direction in which the work is progressing and so manipulated that neither end is raised from the side forms during the striking off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross-section, and free from porous areas.

5. Floating

After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated by means of a longitudinal float, either by hand or mechanical method.

- b. Hand Method. The hand-operated longitudinal float shall be not less than 365 cm (12 feet) in length and 15 cm (6 inches) in width, properly stiffened to prevent flexibility and warping. The longitudinal float, operated from foot bridges resting on the side forms and spanning but not touching the concrete, shall be worked with a sawing motion while held in a floating position parallel to the road center line, and moving gradually from one side of the pavement to the other. Movement ahead along the centerline of the pavement shall be in successive advances of not more than one-half the length of the float. Any excess water or soupy material shall be wasted over the side forms on each pass.
- c. Mechanical Method. The mechanical longitudinal float shall be of a design approved by the Engineer, and shall be in good working condition. The tracks from which the float operates shall be accurately adjusted to the required crown. The float shall be accurately adjusted and coordinated with the adjustment of the transverse finishing machine so that a small amount of mortar is carried ahead of the float at all times. The forward screed shall be adjusted so that the float will lap the distance specified by the Engineer on each transverse trip. The float shall pass over each area of pavement at least two times, but excessive operation over a given area will not be permitted. Any excess water or soupy material shall be wasted over the side forms on each pass.
- d. Alternative Mechanical Method. As an alternative, the Contractor may use a machine composed of a cutting and smoothing float or floats suspended from and guided by a rigid frame. The frame shall be carried by four or more visible wheels riding on, and constantly in contact with the side forms. If necessary, following one of the preceding methods of floating, long handled floats having blades not less than 150 cm (5 feet) in length and 15 cm (6 inches) in width may be used to smooth and fill in open-textured areas in the pavement. Long-handled floats shall not be used to float the entire surface of the pavement in lieu of, or supplementing, one of the preceding methods of floating. When strike off and consolidation are done by the hand method and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of the long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance shall be removed from the surface of the pavement by a 3-m straight-edge or more in length. Successive drags shall be lapped one-half the length of the blade.

6. Straight-edge Testing and Surface Correction

After the floating has been completed and the excess water removed, but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a 300 cm long straight-edge. For this purpose, the Contractor shall furnish and use an accurate 300-cm straight-edge swung from handles 100 cm (3 feet) longer than one-half the width of the slab. The straight-edge shall be held in contact with the surface in successive positions parallel to the road center line and the whole area gone over from one side of the slab to the other as necessary. Advances along the road shall be in successive stages of not more than one-half the length of the straight-edge. Any depressions found shall be immediately filled with freshly mixed concrete, struck off, consolidated and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straight-edge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straight-edge and the slab conforms to the required grade and cross-section.

7. Final Finish

If the surface texture is broom finished, it shall apply when the water sheen has practically disappeared. The broom shall be drawn from the center to the edge of the pavement with adjacent strokes slightly overlapping. The brooming operation should be so executed that the corrugations produced in the surface shall be uniform in appearance and not more than 1.5 mm in depth. Brooming shall be completed before the concrete is in such condition that the surface will be unduly roughened by the operation. The surface thus finished shall be free from rough and porous areas, irregularities, and depressions resulting from improper handling of the broom. Brooms shall be of the quality size and construction and be operated so as to produce a surface finish meeting the approval of the Engineer. Subject to satisfactory results being obtained and approval of the Engineer, the Contractor will be permitted to substitute mechanical brooming in lieu of the manual brooming herein described.

If the surface texture is belt finished, when straight-edging is complete and water sheen has practically disappeared and just before the concrete becomes non-plastic, the surface shall be belted with 2-ply canvas belt not less than 20 cm wide and at least 100 cm longer than the pavement width. Hand belts shall have suitable handles to permit controlled, uniform manipulation. The belt shall be operated with short strokes transverse to the center line and with rapid advances parallel to the center line.

If the surface texture is drag finished, a drag shall be used which consists of a seamless strip of damp burlap or cotton fabric, which shall produce a uniform gritty texture after dragging it longitudinally along the full width of pavement. For pavement 5 m or more in width, the drag shall be mounted on a bridge which travels on the forms. The dimensions of the drag shall be such that a strip of burlap or fabric at least 100 cm wide is in contact with the full width of pavement surface while the drag is used. The drag shall consist of not less than 2 layers of burlap with the bottom layer approximately 15 cm wider than the layer. The drag shall be maintained in such condition that the resultant surface is of uniform appearance and reasonably free from grooves over 1.5 mm in depth. Drag shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags be substituted.

Regardless of the method used for final finish, the hardened surface of pavement shall have a coefficient of friction of 0.25 or more. Completed pavement that is found to have a coefficient of friction less than 0.25 shall be ground or scored by the Contractor at his expense to provide the required coefficient of friction.

8. Edging at Forms and Joints

After the final finish, but before the concrete has taken its initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, formed joints, transverse construction joints, and emergency construction joints, shall be worked with an approved tool and rounded to the radius required by the Plans. A well – defined and continuous radius shall be produced and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting the tool during the use.

At all joints, any tool marks appearing on the slab adjacent to the joints shall be eliminated by brooming the surface. In doing this, the rounding of the corner of the slab shall not be disturbed. All concrete on top of the joint filler shall be completely removed.

All joints shall be tested with a straight-edge before the concrete has set and correction made if one edge of the joint is higher than the other.

311.3.14 Surface Test

As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 3-m straight-edge or other specified device. Areas showing high spots of more than 3 mm but not exceeding 12 mm in 3 m shall be marked and immediately ground down with an approved grinding tool to an elevation where the area or spot will not show surface deviations in excess of 3 mm when tested with 3 m straight-edge. Where the departure from correct cross-section exceeds 12 mm, the pavement shall be removed and replaced by and at the expense of the Contractor.

Any area or section so removed shall be not less than 1.5 m in length and not less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 1.5 m in length, shall also be removed and replaced.

311.3.15 Curing

Immediately after the finishing operations have been completed and the concrete has sufficiently set, the entire surface of the newly placed concrete shall be cured in accordance with either one of the methods described herein. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or the lack of water to adequately take care of both curing and other requirements, shall be a cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than ½ hour between stages of curing or during the curing period.

In all congested places, concrete works should be designed so that the designed strength is attained.

1. Cotton of Burlap Mats

The surface of the pavement shall be entirely covered with mats. The mats used shall be of such length (or width) that as laid they will extend at least twice the thickness of the pavement beyond the edges of the slab. The mat shall be placed so that the entire surface and the edges of the slab are completely covered. Prior to being placed, the mats shall be saturated thoroughly with water. The mat shall be so placed and weighted down so as to cause them to remain in intimate contact with the covered surface. The mat shall be maintained fully wetted and in position for 72 hours after the concrete has been placed unless otherwise specified.

2. Waterproof Paper

The top surface and sides of the pavement shall be entirely covered with waterproof paper, the units shall be lapped at least 45 cm. The paper shall be so placed and weighted down so as to cause it to remain in intimate contact with the surface covered. The paper shall have such dimension but each unit as laid will extend beyond the edges of the slab at least twice the thickness of the pavement, or at pavement width and 60 cm strips of paper for the edges. If laid longitudinally, paper not manufactured in sizes which will provide this width shall be securely sewed or cemented together, the joints being securely sealed in such a manner that they do not open up or separate during the curing period. Unless otherwise specified, the covering shall be maintained in place for 72 hours after the concrete has been placed. The surface of the pavement shall be thoroughly wetted prior to the placing of the paper.

3. Straw Curing

When this type of curing is used, the pavement shall be cured initially with burlap or cotton mats, until after final set of the concrete or, in any case, for 12 hours after placing the concrete. As soon as the mats are removed, the surface and sides of the pavement shall be thoroughly wetted and covered with at least 20 cm of straw or hay, thickness of which is to be measured after wetting. If the straw or hay covering becomes displaced during the curing period, it shall be replaced to the original depth and saturated. It shall be kept thoroughly saturated with water for 72 hours and thoroughly wetted down during the morning of the fourth day, and the cover shall remain in place until the concrete has attained the required strength.

4. Impervious Membrane Method

The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place, or if the pavement is cured initially with jute or cotton mats, it may be applied upon removal of the mass. The curing compound shall not be applied during rain.

Curing compound shall be applied under pressure at the rate 4 L to not more than 14 m² by mechanical sprayers. The spraying equipment shall be equipped with a wind guard. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by effective mechanical means. Hand spraying of odd widths

or shapes and concrete surface exposed by the removal of forms will be permitted. Curing compound shall not be applied to the inside faces of joints to be sealed, but approved means shall be used to ensure proper curing at least 72 hours and to prevent the intrusion of foreign material into the joint before sealing has been completed. The curing compound shall be of such character that the film will harden within 30 minutes after application. Should the film be damaged from any cause within the 72-hour curing period, the damaged portions shall be repaired immediately with additional compound.

5. White Polyethylene Sheet

The top surface and sides of the pavement shall be entirely covered with polyethylene sheeting. The units used shall be lapped at least 45 cm. The sheeting shall be so placed and weighted down so as to cause it to remain in intimate contact with the surface covered. The sheeting as prepared for use shall have such dimension that each unit as laid will extend beyond the edges of the slab at least twice the thickness of the pavement. Unless otherwise specified, the covering shall be maintained in place for 72 hours after the concrete has been placed.

311.3.16 Removal of Forms

After forms for concrete shall remain in place undisturbed for not less than twenty-four (24) hours after concrete pouring. In the removal of forms, crowbars should be used in pulling out nails and pins. Care should be taken so as not to break the edges of the pavement. In case portions of the concrete are spalled, they shall be immediately repaired with fresh mortar mixed in the proportion of one part of Portland Cement and two parts fine aggregates. Major honeycomb areas will be considered as defective work and shall be removed and replaced at the expense of the Contractor. Any area or section so removed shall not be less than the distance between weakened plane joint nor less than the full width of the lane involved.

311.3.17 Sealing Joints

Joints shall be sealed with asphalt sealant soon after completion of the curing period and before the pavement is opened to traffic, including the Contractor's equipment. Just prior to sealing, each joint shall be thoroughly cleaned of all foreign materials including membrane curing compound and the joint faces shall be clean and surface dry when the seal is applied.

The sealing material shall be applied to each joint opening to conform to the details shown on the Plans or as directed by the Engineer. Material for seal applied hot shall be stirred during heating so that localized overheating does not occur. The pouring shall be done in such a manner that the material will not be spilled on the exposed surfaces of the concrete. The use of sand or similar material as a cover for the seal will not be permitted.

Preformed elastomeric gaskets for sealing joints shall be of the cross-sectional dimensions shown on the Plans. Seals shall be installed by suitable tools, without elongation and secured in place with an approved lubricant adhesive which shall cover both sides of the concrete joints. The seals shall be installed in a compressive condition and shall at time of placement be below the level of the pavement surface by approximately 6 mm.

The seals shall be in one piece for the full width of each transverse joint.

311.3.18 Protection of Pavement

The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by his own employees and agents. This shall include watchmen to direct traffic and the erection of and maintenance of warning signs, lights, pavement bridges or crossovers, etc. The Plans or Special Provisions will indicate the location and type of device or facility required to protect the work and provide adequately for traffic.

All boreholes after thickness and/or strength determinations of newly constructed asphalt and concrete pavements shall be immediately filled/restored with the prescribed concrete/asphalt mix after completion of the drilling works.

Any damage to the pavement, occurring prior to final acceptance, shall be repaired or the pavement be replaced.

311.3.19 Concrete Pavement – Slip Form Method

If the Contract calls for the construction of pavement without the use of fixed forms, the following provisions shall apply:

1. Grade

After the grade or base has been placed and compacted to the required density, the areas which will support the paving machine shall be cut to the proper elevation by means of a properly designed machine. The grade on which the pavement is to be constructed shall then be brought to the proper profile by means of a properly designed machine. If the density of the base is disturbed by the grading operation, it shall be corrected by additional compaction before concrete is placed. The grade should be constructed sufficiently in advance of the placing of the concrete. If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately before the placing of concrete.

2. Placing Concrete

The concrete shall be placed with an approved slip-form paver designed to spread, consolidate, screed and float-finish the freshly placed concrete in one complete pass of the machine in such a manner that a minimum of hand finish will be necessary to provide a dense and homogenous pavement in conformance with the Plans and Specifications. The machine shall vibrate the concrete for the full width and depth of the strip of pavement being placed. Such vibration shall be accompanied with vibrating tubes or arms working in the concrete or with a vibrating screed or pan operating on the surface of the concrete. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The forms shall trail behind the paver for such a distance that no appreciable slumping of the concrete will occur, and that necessary final finishing can be accomplished while the concrete is still within the forms. Any edge slump of the pavement, exclusive of edge rounding, in excess of 6 mm shall be corrected before the concrete has hardened. The concrete shall be held at a uniform consistency, having a slump of not more than 40 mm (1-12/ inches). The slip form paver shall be operated with

as nearly as possible a continuous forward movement and that all operations of mixing, delivering and spreading concrete shall be coordinated so as to provide uniform progress with stopping and starting of the paver held to a minimum. If, for any reason, it is necessary to stop the forward movement of the paver the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

3. Finishing

The surface smoothness and texture shall meet the requirements of Subsections 311.3.13 and 311.3.14.

4. Curing

Unless otherwise specified, curing shall be done in accordance with one of the methods included in Subsection 311.3.15. The curing media shall be applied at the appropriate time and shall be applied uniformly and completely to all surfaces and edges of the pavement.

5. Joints

All joints shall be constructed in accordance with Subsection 311.3.12.

6. Protection Against Rain

In order that the concrete may be properly protected against rain before the concrete is sufficiently hardened, the Contractor will be required to have at all times materials for the protection of the edges and surface of the unhardened concrete. Such protective materials shall consist of standard metal forms or wood planks having a nominal thickness of not less than 50 mm (2 inches) and a nominal width of not less than the thickness of the pavement at its edge for the protection of the pavement edges, and covering material such as burlap or cotton mats, curing paper or plastic sheeting materials for the protection of the surface of the pavement. When rain appears imminent, all paving operations shall stop and all available personnel shall begin placing forms against the sides of the pavement and covering the surface of the unhardened concrete with the protective covering.

311.3.22 Acceptance of Concrete

The strength level of the concrete will be considered satisfactory if the averages of all sets of three (3) consecutive strength test results equal or exceed the specified strength, f'_c and no individual strength test result is deficient by more than 15% of the specified strength, f'_c . A set shall consist of a minimum of three (3) concrete beam specimens.

Concrete deemed to be not acceptable using the above criteria may be rejected unless the Contractor can provide evidence, by means of core tests, that the quality of concrete represented by failed test results is acceptable in place. At least three (3) representative cores shall be taken from each member or area of concrete in place that is considered deficient. The location of cores shall be determined by the Engineer so that there will be at least impairment of strength of the structure. The obtaining and testing of drilled cores

shall be in accordance with AASHTO T 24.

Concrete in the area represented by the cores will be considered adequate if the average strength of the cores is equal to at least 85% of, and if no single core is less than 75% of, the specified strength, f_c' .

If the strength of control specimens does not meet the requirements of this Subsection, and it is not feasible or not advisable to obtain cores from the structure due to structural considerations, payment of the concrete will be made at an adjusted price due to strength deficiency of concrete specimens as specified hereunder:

Deficiency in Strength of Concrete Specimens, Percent (%)	Percent (%) of Contract Price Allowed
Less than 5	100
5 to less than 10	80
10 to less than 15	70
15 to less than 20	60
20 to less than 25	50
25 or more	0

311.3.23 Opening to Traffic

The Engineer will decide when the pavement may be opened to traffic. The road will not be opened to traffic until test specimens molded and cured in accordance with AASHTO T 23 have attained the minimum strength requirements in Subsection 311.2.11.

If such tests are not conducted prior to the specified age the pavement shall not be operated to traffic until 14 days after the concrete was placed.

Before opening to traffic, the pavement shall be cleaned and joint sealing completed.

Tolerance and Pavement thickness

1. General

The thickness of the pavement will be determined by measurement of cores from the completed pavement in accordance with AASHTO T 148.

The completed pavement shall be accepted on a lot basis. A lot shall be considered as 1000 linear meters of pavement when a single traffic lane is poured or 500 linear meters when two lanes are poured concurrently. The last unit in each slab constitutes a lot in itself when its length is at least $\frac{1}{2}$ of the normal lot length. If the length of the last unit is shorter than $\frac{1}{2}$ of the normal lot length, it shall be included in the previous lot.

Other areas such as intersections, entrances, crossovers, ramp, etc., will be grouped

together to form a lot. Small irregular areas may be included with other unit areas to form a lot.

Each lot will be divided into five (5) equal segments and one core will be obtained from each segment in accordance with AASHTO T 24.

2. Pavement Thickness

It is the intent of this Specification that the pavement has a uniform thickness as called for on the Plans for the average of each lot as defined. After the pavement has met all surface smoothness requirements, cores for thickness measurements will be taken.

In calculating the average thickness of the pavement, individual measurements which are in excess of the specified thickness by more than 5 mm will be considered as the specified thickness plus 5 mm and measurements which are less than the specified thickness by more than 25 mm shall not be included in the average. When the average thickness for the lot is deficient, the contract unit price will be adjusted for thickness in accordance with paragraph (3 below).

Individual areas within a segment found deficient in thickness by more than 25 mm shall be evaluated by the Engineer, and if in his judgment, the deficient areas warrant removal, they shall be removed and replaced by the Contractor with pavement of the specified thickness at his entire expense. However, if the evaluation of the Engineer is that the deficient area should not be removed and replaced, such area will not be paid.

When the measurement of any core is less than the specified thickness by more than 25 mm, the actual thickness of the pavement in this area will be determined by taking additional cores at no less than 5 m intervals parallel to the center line in each direction from the affected location until a core is found in each direction, which is not deficient in thickness by more than 25 mm. The area of slab for which no payment will be made shall be the product of the paving width multiplied by the distance along the centerline of the road between transverse sections found not deficient in thickness by more than 25 mm. The thickness of the remainder of the segment to be used to get the average thickness of each lot shall be determined by taking the average thickness of additional cores which are not deficient by more than 25 mm.

3. Adjustment for Thickness

When the average thickness of the pavement per lot is deficient, payment for the lot shall be adjusted as follows:

Deficiency in the Average Thickness per lot (mm)	Percent (%) of Contract Price Per Lot
0 - 5	100% payment
6 - 10	95% payment
11 - 15	85% payment

16 – 20	70% payment
21 – 25	50% payment
More than 25	Remove and replace/ No payment

No acceptance and final payment shall be made on completed pavement unless core test for thickness determination is conducted, except for Barangay Roads where the implementing office is allowed to waive such test.

311.4 Method of Measurement

The area to be paid for under this Item shall be the number of square meters (m²) of concrete pavement placed and accepted in the completed pavement. The width for measurements will be the width from outside edge to outside edge of completed pavement as placed in accordance with the Plans or as otherwise required by the Engineer in writing. The length will be measured horizontally along the centerline of each roadway or ramp. Any curb and gutter placed shall not be included in the area of concrete pavement measured.

311.5 Basis of Payment

The accepted quantity, measured as prescribed in Section 311.4, shall be paid for at the contract unit price for Portland Cement Concrete Pavement, which price and payment shall be full compensation for preparation of roadbed and finishing of shoulders, unless otherwise provided by the Special Provisions, furnishing all materials, for mixing, placing, finishing and curing all concrete, for furnishing and placing all joint materials, for sawing weakened plane joints, for fitting the prefabricated center metal joint, for facilitating and controlling traffic, and for furnishing all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
311 (1)b	Portland Cement Concrete Pavement (200mm thick)	Square meter

ITEM 404 - REINFORCING STEEL

404.1 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.

404.2 Material Requirements

Reinforcing steel shall meet the requirements of item 710, Reinforcing Steel and Wire Rope.

404.3 Construction Requirements

404.3.1 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.

404.3.2 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.

404.3.3 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.

404.4 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 direction, 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.

404.5 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 60min. 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.

404.6 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.

404.7 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.

404.8 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
404 (1)a	Reinforcing Steel	Kilogram

ITEM 405 – STRUCTURAL CONCRETE

405.1 Description

405.1.1 Scope

This Item shall consist of furnishing, bending, placing and finishing concrete in all structures except pavements in accordance with this Specification and conforming to the lines, grades, and dimensions 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.

405.1.2 Classes and Uses of Concrete

Five classes of concrete are provided for in this Item, namely: A, B, C, P and Seal. Each class shall be used in that part of the structure as called for on the Plans.

The classes of concrete will generally be used as follows:

Class A – All superstructures and heavily reinforced substructures. The important parts of the structure included are slabs, beams, girders, columns, arch ribs, box culverts, reinforced abutments, retaining walls, and reinforced footings.

Class B – Footings, pedestals, massive pier shafts, pipe bedding, and gravity walls, unreinforced or with only a small amount of reinforcement.

Class C – Thin reinforced sections, railings, precast R.C. piles and cribbing and for filler in steel grid floors.

Class P – Prestressed concrete structures and members.

Seal – Concrete deposited in water.

405.2 Material Requirements

405.2.1 Portland Cement

It shall conform to all the requirements of Subsection 311.2.1.

405.2.2 Fine Aggregate

It shall conform to all the requirements of Subsection 311.2.2.

405.2.3 Coarse Aggregate

It shall conform all the requirements of Subsection 311.2.3 except that gradation shall conform to Table 405.1.

Table 405.1 – Grading Requirements for Coarse Aggregate

Sieve Designation		Mass Percent Passing				
Standard Mm	Alternate US Standard	Class A	Class B	Class C	Class D	Class Seal
63	2-1/2"		100			
50	2"	100	95-100			
37.5	1-1/2"	95-100	-			
25	1"	-	35-70			95-100
19.0	3/4"	35-70	-	100	100	-
12.5	1/2"	-	10-30	90-100	95-100	25-60
9.5	3/8"	10-30	-	40-70	20-55	-
4.75	No.4	0-5	0-5	0-15*	0-10*	0-10*

* The measured cement content shall be within plus (+) or minus (-) 2 mass percent of the design cement content.

405.2.4 Water

It shall conform to the requirements of Subsection 311.2.4

405.2.5 Reinforcing Steel

It shall conform to the requirements of Item 710, Reinforcing Steel and Wire Rope.

405.2.6 Admixtures

Admixtures shall conform to the requirements of Subsection 311.2.7

405.2.7 Curing Materials

Curing materials shall conform to the requirements of Subsection 311.2.8.

405.2.8 Expansion Joint Materials

Expansion joint materials shall be:

1. Preformed Sponge Rubber and Cork, conforming to AASHTO M 153.
2. Hot-Poured Elastic Type, conforming to AASHTO M 173.

3. Prefomed Fillers, conforming to AASHTO M 213.

405.2.9 Elastomeric Compression Joint Seals

These shall conform to AASHTO M 220.

405.2.10 Elastomeric Bearing Pads

These shall conform to AASHTO M 251 or Item 412 – Elastomeric Bearing

405.2.11 Storage of Cement and Aggregates

Storage of cement and aggregates shall conform to all the requirements of Subsection 311.2.10.

405.3 Sampling and Testing of Structural Concrete

As work progresses, at least one (1) sample consisting of three (3) concrete cylinder test specimens, 150 x 300mm (6 x 12 inches), shall be taken from each seventy-five (75) cubic meters of each class of concrete or fraction thereof placed each day.

Compliance with the requirements of this Section shall be determined in accordance with the following standard methods of AASHTO:

Sampling of fresh concrete	T 141
Weight per cubic metre and air content (gravi-metric) of concrete	T 121
Sieve analysis of fine and coarse aggregates	T 27
Slump of Portland Cement Concrete	T 119
Specific gravity and absorption of fine aggregate	T 84

Tests for strength shall be made in accordance with the following:

Making and curing concrete compressive and flexural tests specimens in the field	T 23
Compressive strength of molded concrete Cylinders	T 22

405.4 Production Requirements

405.4.1 Proportioning and Strength of Structural Concrete

The concrete materials shall be proportioned in accordance with the requirements for each class of concrete as specified in Table 405.2, using the absolute volume method as outlined in the American Concrete Institute (ACI) Standard 211.1. “Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete”. Other methods of proportioning may be employed in the mix design with prior approval of the Engineer. The mix shall either be designed or approved by the Engineer. A change in the source of materials during the progress of work may necessitate a new mix design.

The strength requirements for each class of concrete shall be as specified in Table 405.2.

Table 405.2 - Composition and Strength of Concrete for Use in Structures

Class of Concrete	Minimum Cement Content per	Maximum Water/	Consistency Range in	Designated Size of Coarse Aggregate	Minimum Compressive Strength of
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	m3 kg (bag**)	Cement Ratio kg/kg	Slump mm (inch)	Square Opening Std. mm	150mmx300mm Concrete Cylinder Specimen at 28 days MN/m2 (psi)
A	360 (9.1 bags)	0.53	50-100 (2-4)	37.5 - 4.75 (1-1/2" - No. 4)	20.7 (3000)
B	320 (8 bags)	0.58	50-100 (2-4)	50-4.75 (2"-No.4)	16.5 (2400)
C	380 (9.5 bags)	0.55	50-100 (2-4)	12.5 - 4.75 (1/2" - No. 4)	20.7 (3000)
P	440 (11 bags)	0.49	100 max (4)	19.0 - 4.75 (3/4"-No.4)	37.7 (5000)
Seal	380 (9.5 bags)	0.58	100-200 (4-8)	25-4.75 (1" - No.4)	20.7 (3000)

* The measured cement content shall be within plus or minus 2 mass percent of the design cement content.

** Based on 40 kg/bag

405.4.2 Consistency

Concrete shall have a consistency such that it will be workable in the required position. It shall be of such a consistency that it will flow around reinforcing steel but individual particles of the coarse aggregate when isolated shall show a coating of 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 in mixing and transporting. The quantity 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.

405.4.3 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 than 12 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 two (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.

405.4.4 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 otherwise 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 32 °C, 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 judgment 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 30°C, 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.

405.5 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 pipe less than 100mm (4 inches) in diameter or by reinforcing steel, anchors, conduits, weep holes or expansion joint materials.

405.6 Basis of Payment

The accepted quantities, measured as prescribed in Section 405.5, 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
405 (1)	Structural Concrete	Cubic Meter

ITEM 1046 - MASONRY WORKS

Refer to Item 1046, I. Construction of Provincial Warehouse. Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1046 (2)a1	CHB Non- Load-Bearing (including Reinforcing Steel), 100mm	Square Meter

ITEM 1027 - CEMENT PLASTER FINISH

Refer to Item 1027, I. Construction of Provincial Warehouse. Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1027 (1)	Cement Plaster Finish	Square Meter

ITEM 1001 - STORM DRAINAGE AND SEWERAGE SYSTEM

Refer to Item 1001, I. Construction of Provincial Warehouse. Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1001(5)b	Catch Basin, CHB	Each
1001(9)	Storm Drainage and Downspouts	Lump Sum

HAND TOOLS

Brand new hand tools will be turned over by the contractor during completion of the project for the operation and maintenance of the **Construction of Provincial Warehouse with Multi-Purpose Drying Pavement in Bugallon**. These hand tools will be considered as indirect cost and not as pay item.

1. Hammer (2 pieces)

Key Specifications/Special Features:

- Material: drop forged cast steel
- With wooden handle
- Bleached and laser cured wooden shaft
- Polished head
- Size: 27mm
- Over-all length: 15 inches

2. Shovel (4 pieces) - Heavy duty, lightweight, one-piece shovel scoop ideal for material handling and industrial applications.

Key Specifications/Special Features:

- Stainless steel blade and heat treatment
- Mirror polished
- D-shaped PP handle
- Total size: 41-3/4 inches
- Cubic feet: 1.78 feet
- Length: 38 inches

3. Wheelbarrow (1 piece) – 10.5kg. Wheelbarrow with 78L Water Capacity and 5cbf Sand Capacity

Key Specifications/Special Features:

- Load: 160kg
- Weight: 10.5kg
- Water capacity: 78L
- Sand capacity: 5cbf
- Wheel: 13 x 3 inches

4. Brush Cutter (2 pieces) – 43cc Gasoline Brush Cutter, used for cutting Shrub and Grass with Metal Blade

Key Specifications/Special Features:

- Engine: two-stroke, air-cooled single cylinder
- Displacement: 43cc
- Maximum power: 1.64kW/7,500rpm
- Fuel tank capacity: 1,000mL
- Working shaft length: 1,650mm
- Mass without cutter and empty tanks: 7.5kg
- Cutter type: mental blade
- Diversified blade cutter and belt can be chosen
- EPA emission configuration is available
- GS/CE approvals
- Anti-vibration, fast-idle control
- Fully adjustable, automatic chain oiling pump
- Adjustable open handle

5. Aluminum Ladder (1 piece)

Key Specifications/Special Features:

- Type: Folding Ladder (Double Side)
- Material: 1.4mm-2mm super thick aluminum
- Bearing Weight: 300 kg
- Length: 16 ft / 4.7 m
- V height: 7.5 ft / 2.3 m
- Number of steps: 4 x 4

6. Portable Welding Machine (1 piece)

Key Specifications/Special Features:

- Power Voltage: 220V
- Output Current: 300a/350a/400a
- Current Range: 20-400 Amperes
- Enclosure Class: IP21
- Insulation Class: F
- With Air Cool function

7. Portable Drilling Machine (1 piece)

Key Specifications/Special Features:

- Type: Cordless Drill/ Driver
- Chuck : 13mm
- Voltage: 20V
- Capacity: 2.0Ah
- Chemistry: Li-Ion
- Power Output: 340 W
- Max Torque: 26/65Nm
- Led Light: Yes
- Max Drilling (Steel): 13 mm

- Max Drilling (Wood): 30 mm
- Max Drilling (Masonry): 13 mm
- No Load Speed : 0 - 500 / 1750 min-1
- Impact Rate : 0 - 8500 / 29750 min-1

8. Grinder (1 piece)

Key Specifications/Special Features:

- Type: Angle Grinder
- Voltage: 96V
- No Load Speed: 9,000 rpm
- Disc Diameter: 100mm (4")
- Spindle Thread: M14
- Switch Type: Slider
- Battery Capacity: 5.0Ah

Section VII. Drawings

CONSTRUCTION OF PROVINCIAL WAREHOUSE WITH MULTI-PURPOSE DRYING PAVEMENT IN BUGALLON

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Plumbing Plan

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Project Billboard

Section VIII. Bill of Quantities

*Please follow the link : https://bit.ly/bugallon_warehouse_BOQ
for downloadable and editable Bill of Quantities.*

Section IX. Bidding Forms

*Please follow the link: <https://bit.ly/prdpbiddingforms>
for downloadable and editable templates.*