PHILIPPINE BIDDING DOCUMENTS

(As Harmonized with Development Partners)

Procurement of INFRASTRUCTURE PROJECTS

Government of the Republic of the Philippines

REHABILITATION OF BURNHAM PARK BAGUIO CITY BENGUET

Sixth Edition
July 2020

Preface

These Philippine Bidding Documents (PBDs) for the procurement of Infrastructure Projects (hereinafter referred to also as the "Works") through Competitive Bidding have been prepared by the Government of the Philippines for use by all branches, agencies, departments, bureaus, offices, or instrumentalities of the government, including government-owned and/or -controlled corporations, government financial institutions, state universities and colleges, local government units, and autonomous regional government. The procedures and practices presented in this document have been developed through broad experience, and are for mandatory use in projects that are financed in whole or in part by the Government of the Philippines or any foreign government/foreign or international financing institution in accordance with the provisions of the 2016 revised Implementing Rules and Regulations (IRR) of Republic Act (RA) No. 9184.

The PBDs are intended as a model for admeasurements (unit prices or unit rates in a bill of quantities) types of contract, which are the most common in Works contracting.

The Bidding Documents shall clearly and adequately define, among others: (i) the objectives, scope, and expected outputs and/or results of the proposed contract; (ii) the eligibility requirements of Bidders; (iii) the expected contract duration; and (iv) the obligations, duties, and/or functions of the winning Bidder.

Care should be taken to check the relevance of the provisions of the PBDs against the requirements of the specific Works to be procured. If duplication of a subject is inevitable in other sections of the document prepared by the Procuring Entity, care must be exercised to avoid contradictions between clauses dealing with the same matter.

Moreover, each section is prepared with notes intended only as information for the Procuring Entity or the person drafting the Bidding Documents. They shall not be included in the final documents. The following general directions should be observed when using the documents:

a. All the documents listed in the Table of Contents are normally required for the procurement of Infrastructure Projects. However, they should be adapted as necessary to the circumstances of the particular Project.

b. Specific details, such as the "*name of the Procuring Entity*" and "*address for bid submission*," should be furnished in the Instructions to Bidders, Bid Data Sheet, and Special Conditions of Contract. The final documents should contain neither blank spaces nor options.

c. This Preface and the footnotes or notes in italics included in the Invitation to Bid, BDS, General Conditions of Contract, Special Conditions of Contract, Specifications, Drawings, and Bill of Quantities are not part of the text of the final document, although they contain instructions that the Procuring Entity should strictly follow.

d. The cover should be modified as required to identify the Bidding Documents as to the names of the Project, Contract, and Procuring Entity, in addition to date of issue.

e. Modifications for specific Procurement Project details should be provided in the Special Conditions of Contract as amendments to the Conditions of Contract. For easy completion, whenever reference has to be made to specific clauses in the Bid Data Sheet or Special Conditions of Contract, these terms shall be printed in bold typeface on Sections I (Instructions to Bidders) and III (General Conditions of Contract), respectively.

f. For guidelines on the use of Bidding Forms and the procurement of Foreign-Assisted Projects, these will be covered by a separate issuance of the Government Procurement Policy Board.

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Glossary of Terms, Abbreviations, and Acronyms

ABC – Approved Budget for the Contract.

ARCC – Allowable Range of Contract Cost.

BAC – Bids and Awards Committee.

Bid – A signed offer or proposal to undertake a contract submitted by a bidder in response to and in consonance with the requirements of the bidding documents. Also referred to as *Proposal* and *Tender*. (2016 revised IRR, Section 5[c])

Bidder – Refers to a contractor, manufacturer, supplier, distributor and/or consultant who submits a bid in response to the requirements of the Bidding Documents. (2016 revised IRR, Section 5[d])

Bidding Documents – The documents issued by the Procuring Entity as the bases for bids, furnishing all information necessary for a prospective bidder to prepare a bid for the Goods, Infrastructure Projects, and/or Consulting Services required by the Procuring Entity. (2016 revised IRR, Section 5[e])

BIR – Bureau of Internal Revenue.

BSP – Bangko Sentral ng Pilipinas.

CDA – Cooperative Development Authority.

Consulting Services – Refer to services for Infrastructure Projects and other types of projects or activities of the GOP requiring adequate external technical and professional expertise that are beyond the capability and/or capacity of the GOP to undertake such as, but not limited to: (i) advisory and review services; (ii) pre-investment or feasibility studies; (iii) design; (iv) construction supervision; (v) management and related services; and (vi) other technical services or special studies. (2016 revised IRR, Section 5[i])

Contract – Refers to the agreement entered into between the Procuring Entity and the Supplier or Manufacturer or Distributor or Service Provider for procurement of Goods and Services; Contractor for Procurement of Infrastructure Projects; or Consultant or Consulting Firm for Procurement of Consulting Services; as the case may be, as recorded in the Contract Form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein.

Contractor – is a natural or juridical entity whose proposal was accepted by the Procuring Entity and to whom the Contract to execute the Work was awarded. Contractor as used in these Bidding Documents may likewise refer to a supplier, distributor, manufacturer, or consultant.

CPI – Consumer Price Index.

DOLE – Department of Labor and Employment.

DTI – Department of Trade and Industry.

Foreign-funded Procurement or Foreign-Assisted Project – Refers to procurement whose funding source is from a foreign government, foreign or international financing institution as specified in the Treaty or International or Executive Agreement. (2016 revised IRR, Section 5[b]).

GFI – Government Financial Institution.

GOCC – Government-owned and/or –controlled corporation.

Goods – Refer to all items, supplies, materials and general support services, except Consulting Services and Infrastructure Projects, which may be needed in the transaction of public businesses or in the pursuit of any government undertaking, project or activity, whether in the nature of equipment, furniture, stationery, materials for construction, or personal property of any kind, including non-personal or contractual services such as the repair and maintenance of equipment and furniture, as well as trucking, hauling, janitorial, security, and related or analogous services, as well as procurement of materials and supplies provided by the Procuring Entity for such services. The term "related" or "analogous services" shall include, but is not limited to, lease or purchase of office space, media advertisements, health maintenance services, and other services essential to the operation of the Procuring Entity. (2016 revised IRR, Section 5[r])

GOP – Government of the Philippines.

Infrastructure Projects – Include the construction, improvement, rehabilitation, demolition, repair, restoration or maintenance of roads and bridges, railways, airports, seaports, communication facilities, civil works components of information technology projects, irrigation, flood control and drainage, water supply, sanitation, sewerage and solid waste management systems, shore protection, energy/power and electrification facilities, national buildings, school buildings, hospital buildings, and other related construction projects of the government. Also referred to as *civil works or works*. (2016 revised IRR, Section 5[u])

LGUs – Local Government Units.

NFCC – Net Financial Contracting Capacity.

NGA – National Government Agency.

PCAB – Philippine Contractors Accreditation Board.

PhilGEPS - Philippine Government Electronic Procurement System.

Procurement Project – refers to a specific or identified procurement covering goods, infrastructure project or consulting services. A Procurement Project shall be described, detailed, and scheduled in the Project Procurement Management Plan prepared by the agency which shall be consolidated in the procuring entity's Annual Procurement Plan. (GPPB Circular No. 06-2019 dated 17 July 2019)

PSA – Philippine Statistics Authority.

SEC – Securities and Exchange Commission.

SLCC – Single Largest Completed Contract.

UN – United Nations.

Section I. Invitation to Bid

Notes on the Invitation to Bid

The Invitation to Bid (IB) provides information that enables potential Bidders to decide whether to participate in the procurement at hand. The IB shall be posted in accordance with Section 21.2 of the 2016 revised IRR of RA No. 9184.

Apart from the essential items listed in the Bidding Documents, the IB should also indicate the following:

a. The date of availability of the Bidding Documents, which shall be from the time the IB is first advertised/posted until the deadline for the submission and receipt of bids;

b. The place where the Bidding Documents may be acquired or the website where it may be downloaded;

c. The deadline for the submission and receipt of bids; and

d. Any important bid evaluation criteria.

The IB should be incorporated into the Bidding Documents. The information contained in the IB must conform to the Bidding Documents and in particular to the relevant information in the Bid Data Sheet.

Republic of the Philippines

Tourism Infrastructure & Enterprise Zone Authority

Invitation to Bid

REHABILITATION OF BURNHAM PARK BAGUIO CITY BENGUET

Project Identification/Invitation to Bid No.**25-08-0002**

1. The Tourism Infrastructure and Enterprise Zone Authority, through the Approved Corporate Budget, intends to apply the sum of **NINETY NINE MILLION NINE HUNDRED SEVENTY EIGHT THOUSAND TWO HUNDRED SIXTY ONE PESOS AND FOUR CENTAVOS ONLY. (P 99,978,261.04)** being the Approved Budget for the Contract (ABC), as payment contract for the **REHABILITATION OF BURNHAM PARK BAGUIO CITY BENGUET,** bids received in excess of the ABC shall be automatically rejected at Bid Opening.

2. The Tourism Infrastructure and Enterprise Zone Authority now invites bids for the above procurement project. Completion of the works is required within One Hundred Eighty (180) calendar days. Bidders should have completed, within five (5) years period from the date of submission and receipt of bids, 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 through open competitive bidding procedures using non-discretionary pass/fail criteria as specified in the Implementing Rules and Regulations (IRR) of Republic Act 9184 (R.A. 9184), otherwise known as the "Government Procurement Reform Act".

4. Bidding is restricted to Filipino citizens/sole proprietorships, partnership, or organizations with at least seventy-five percent (75%) interest or outstanding capital stock belonging to citizens of the Philippines.

5. Interested bidders may obtain further information from the TIEZA BAC Secretariat **(please see contact details below)** and inspect the Bidding Documents on our website and at the posting on the Philippine Government Electronic Procurement Service (PhilGEPS) website.

6. A complete set of bidding documents may be acquired by interested Bidders through the following modes:

   ON-PREMISE:

   The prospective bidders shall accomplish the issued Authority to Accept Payment (ATAP) form for payment at the Treasurer's Office.

   The bidding documents will be issued to the prospective bidder upon settlement of the Order of Payment.

ONLINE:

The Authority to Accept Payment (ATAP) is available at TIEZA's website. Interested bidders can download the ATAP, completely fill out the form and send the scanned copy to the BAC Secretariat's email. An instruction to settle thru bank deposit will be given thereafter.

Bidders who will buy the bidding documents shall deposit the amount in either one of the following TIEZA bank accounts:

Account Name: TIEZA

Development Bank of the Philippines (DBP) Account #: 0405-018676-030 (Makati Branch)

Land Bank of the Philippines (LBP) Account #: 1782-1046-47 (Pasong Tamo Branch) The deposit slip shall be kept and a scanned copy shall be sent to tieza.bacsecretariat@gmail.com.

Please note further that purchase of the bidding documents are available on **August 8, 2025 to August 31, 2025 at 8:00 am to 5:00 pm**, except Fridays, Saturdays, Sundays and Holidays and on **September 1, 2025** from **8:00 to 9:00 a.m**. Please note the payment for the bid documents is a non-refundable fee in the amount of **Fifty Thousand Pesos Only** (**PhP 50,000.00**).

It may also be downloaded free of charge from the website of the Philippine Government Electronic Procurement System (PhilGEPS) and the website of the Procuring Entity, provided that bidders shall pay the applicable fee for the Bidding Documents not later than the submission of their bids. **Bidders must submit to the BAC Secretariat a copy of the official receipt as proof of the purchase of bidding documents on or before 5:00 p.m. on the day of bidding.**

7. The Tourism Infrastructure and Enterprise Zone Authority will hold face to face Pre-Bid Conference on **August 18, 2025** @ 10:00 A.M. at 7th Floor TIEZA TEZ Conference Room Double Dragon Plaza Pasay City

8. Bids (Technical and Financial) in hard copies (one original and two duplicates, sealed in their respective envelopes) enclosed in one outer envelope must be submitted face toface and duly received by the BAC Secretariat at the address below on or before **September 1, 2025 @** 9: 30 A.M. **Proper tabbing of every requirement is encouraged**.

   Bidder shall submit its bid in one (1) outer envelope containing three (3) envelopes (Original, Copy 1, and Copy 2). Each of the three (3) envelopes shall contain two envelopes corresponding to Technical and Financial Proposals. Soft Copy of Financial Proposal in the form of Flash Drive (USB) must be included inside the Original Financial Envelope. Failure to comply with this requirement shall render the bidder disqualified from the bidding.

9. All bids must be accompanied by a bid security in any of the acceptable forms and inthe amount stated in **ITB** Clause 16.

10. Bid opening shall be done face to face on **September 1, 2025 @**10: 00 A.M. at the Legal Conference Room on the 7th Floor, Tower 1 Double Dragon Plaza Double Dragon Meridian Park Macapagal Avenue corner EDSA Extension Bay Area Pasay City. Bids will be opened in the presence of the bidders' representatives who choose to attend theactivity. Late bids shall not be accepted.

11. The Tourism Infrastructure and Enterprise Zone Authority reserves the right to reject any and all bids, declare a failure of bidding or not award the contract in accordance with the applicable provision of the 2016 Revised IRR of R.A. 9184.
For further information, please refer to:
BAC Secretariat
7th Floor, Tower 1 Double Dragon Plaza Double Dragon Meridian Park Macapagal Avenue corner EDSA Extension Bay Area Pasay City
(+632) 249-5986 loc. 713 or 714
bacsecretariat@tieza.gov.ph
http.//www.tieza.gov.ph

12. You may visit the following websites:
For downloading of Bidding Documents:
https://notices.philgeps.gov.ph/stieza.gov.ph
For inquiries/concerns: bacsecretariat@tieza.gov.ph
For purchase of bidding documents: tieza.bacsecretariat@gmail.com

RAQUEL S. DELA CRUZ
Chairperson, Bids and Awards Committee

Section II. Instructions to Bidders

Notes on the Instructions to Bidders

This Section on the Instruction to Bidders (ITB) provides the information necessary for bidders to prepare responsive bids, in accordance with the requirements of the Procuring Entity. It also provides information on bid submission, eligibility check, opening and evaluation of bids, post-qualification, and on the award of contract.

1. Scope of Bid

The Procuring Entity, *[Tourism Infrastructure and Enterprise Zone Authority]* invites Bids for the **REHABILITATION OF BURNHAM PARK BAGUIO CITY BENGUET** with Project Identification Number *[Invitation to Bid no.***25-08-0002**

[Note: The Project Identification Number is assigned by the Procuring Entity based on its own coding scheme and is not the same as the PhilGEPS reference number, which is generated after the posting of the bid opportunity on the PhilGEPS website.]

The Procurement Project (referred to herein as "Project") is for the construction of Works, as described in Section VI (Specifications).

2. Funding Information

2.1. The GOP through the source of funding as indicated below for *[2025]* in the amount of **NINETY NINE MILLION NINE HUNDRED SEVENTY EIGHT THOUSAND TWO HUNDRED SIXTY ONE PESOS AND FOUR CENTAVOS ONLY. (P 99,978,261.04)** The source of funding is:

a. the Corporate Operating Budget.

3. Bidding Requirements

The Bidding for the Project shall be governed by all the provisions of RA No. 9184 and its 2016 revised IRR, including its Generic Procurement Manual and associated policies, rules and regulations as the primary source thereof, while the herein clauses shall serve as the secondary source thereof.

Any amendments made to the IRR and other GPPB issuances shall be applicable only to the ongoing posting, advertisement, or invitation to bid by the BAC through the issuance of a supplemental or bid bulletin.

The Bidder, by the act of submitting its Bid, shall be deemed to have inspected the site, determined the general characteristics of the contracted Works and the conditions for this Project, such as the location and the nature of the 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 and examine all instructions, forms, terms, and project requirements in the Bidding Documents.

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

The Procuring Entity, as well as the Bidders and Contractors, shall observe the highest standard of ethics during the procurement and execution of the contract. They or through an agent shall not engage in corrupt, fraudulent, collusive, coercive, and

obstructive practices defined under Annex "I" of the 2016 revised IRR of RA No. 9184 or other integrity violations in competing for the Project.

5. Eligible Bidders

5.1. Only Bids of Bidders found to be legally, technically, and financially capable will be evaluated.

5.2. 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 PSA's CPI, except under conditions provided for in Section 23.4.2.4 of the 2016 revised IRR of RA No. 9184.

A contract is considered to be "similar" to the contract to be bid if it has the major categories of work stated in the **BDS**.

5.3. 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 Bidding Document prepared for this purpose.

5.4. The Bidders shall comply with the eligibility criteria under Section 23.4.2 of the 2016 IRR of RA No. 9184.

6. Origin of Associated Goods

There is no restriction on the origin of Goods other than those prohibited by a decision of the UN Security Council taken under Chapter VII of the Charter of the UN.

7. Subcontracts

a. Subcontracting is not allowed

8. Pre-Bid Conference

The Procuring Entity will hold face to face Pre-Bid Conference on **August 18, 2025** @ 10:00 A.M.. at its physical address at **7th Floor TIEZA TEZ Conference Room Double Dragon Plaza Pasay City** as indicated in paragraph 6 of the **IB.**

9. Clarification and Amendment of Bidding Documents

Prospective bidders may request for clarification on and/or interpretation of any part of the Bidding Documents. Such requests must be in writing and received by the Procuring Entity, either at its given address or through electronic mail indicated in the **IB**, at least ten (10) calendar days before the deadline set for the submission and receipt of Bids.

10. Documents Comprising the Bid: Eligibility and Technical Components

10.1. The first envelope shall contain the eligibility and technical documents of the Bid as specified in **Section IX. Checklist of Technical and Financial Documents**.

10.2. If the eligibility requirements or statements, the bids, and all other documents for submission to the BAC are in foreign language other than English, it must be accompanied by a translation in English, which 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. For Contracting Parties to the Apostille Convention, only the translated documents shall be authenticated through an apostille pursuant to GPPB Resolution No. 13-2019 dated 23 May 2019. The English translation shall govern, for purposes of interpretation of the bid.

10.3. A valid PCAB License is required, and in case of joint ventures, a valid special PCAB License, and registration for the type and cost of the contract for this Project. Any additional type of Contractor license or permit shall be indicated in the **BDS**.

10.4. A List of Contractor's key personnel (e.g., Project Manager, Project Engineers, Materials Engineers, and Foremen) assigned to the contract to be bid, with their complete qualification and experience data shall be provided. These key personnel must meet the required minimum years of experience set in the **BDS**.

10.5. A 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, must meet the minimum requirements for the contract set in the **BDS**.

11. Documents Comprising the Bid: Financial Component

11.1. The second bid envelope shall contain the financial documents for the Bid as specified in **Section IX. Checklist of Technical and Financial Documents**.

11.2. Any bid exceeding the ABC indicated in paragraph 1 of the **IB** shall not be accepted.

11.3. For Foreign-funded procurement, a ceiling may be applied to bid prices provided the conditions are met under Section 31.2 of the 2016 revised IRR of RA No. 9184.

12. Alternative Bids

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.

13. Bid Prices

All bid prices for the given scope of work in the Project as awarded shall be considered as fixed prices, and therefore not subject to price escalation during contract implementation, except under extraordinary circumstances as determined by the NEDA and approved by the GPPB pursuant to the revised Guidelines for Contract Price Escalation guidelines.

14. Bid and Payment Currencies

14.1. Bid prices may be quoted in the local currency or tradeable currency accepted by the BSP at the discretion of the Bidder. However, for purposes of bid evaluation, Bids denominated in foreign currencies shall be converted to Philippine currency based on the exchange rate as published in the BSP reference rate bulletin on the day of the bid opening.

14.2. *Payment of the contract price shall be made in:*

a. Philippine Pesos.

15. Bid Security

15.1. The Bidder shall submit a Bid Securing Declaration or any form of Bid Security in the amount indicated in the **BDS**, which shall be not less than the percentage of the ABC in accordance with the schedule in the **BDS**.

15.2. The Bid and bid security shall be valid until *[120 Calendar Days]*. Any bid not accompanied by an acceptable bid security shall be rejected by the Procuring Entity as non-responsive.

16. Sealing and Marking of Bids

Each Bidder shall submit one copy of the first and second components of its Bid.

The Procuring Entity may request additional hard copies and/or electronic copies of the Bid. However, failure of the Bidders to comply with the said request shall not be a ground for disqualification.

If the Procuring Entity allows the submission of bids through online submission to the given website or any other electronic means, the Bidder shall submit an electronic copy of its Bid, which must be digitally signed. An electronic copy that cannot be opened or is corrupted shall be considered non-responsive and, thus, automatically disqualified.

17. Deadline for Submission of Bids

The Bidders shall submit on the specified date and time and either at its physical address or through online submission as indicated in paragraph 7 of the **IB.**

18. Opening and Preliminary Examination of Bids

18.1. The BAC shall open the Bids in public at the time, on the date, and at the place specified in paragraph 9 of the **IB**. The Bidders' representatives who are present shall sign a register evidencing their attendance. In case videoconferencing, webcasting or other similar technologies will be used, attendance of participants shall likewise be recorded by the BAC Secretariat.

In case the Bids cannot be opened as scheduled due to justifiable reasons, the rescheduling requirements under Section 29 of the 2016 revised IRR of RA No. 9184 shall prevail.

18.2. The preliminary examination of Bids shall be governed by Section 30 of the 2016 revised IRR of RA No. 9184.

19. Detailed Evaluation and Comparison of Bids

19.1. The Procuring Entity's BAC shall immediately conduct a detailed evaluation of all Bids rated "*passed*" using non-discretionary pass/fail criteria. The BAC shall consider the conditions in the evaluation of Bids under Section 32.2 of 2016 revised IRR of RA No. 9184.

19.2. If the Project allows partial bids, all Bids and combinations of Bids as indicated in the **BDS** 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 Security as required by **ITB** Clause 16 shall be submitted for each contract (lot) separately.

19.3. In all cases, the NFCC computation pursuant to Section 23.4.2.6 of the 2016 revised IRR of RA No. 9184 must be sufficient for the total of the ABCs for all the lots participated in by the prospective Bidder.

20. Post Qualification

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**.

21. Signing of the Contract

The documents required in Section 37.2 of the 2016 revised IRR of RA No. 9184 shall form part of the Contract. Additional Contract documents are indicated in the **BDS**.

Section III. Bid Data Sheet

Notes on the Bid Data Sheet (BDS)

The Bid Data Sheet (BDS) consists of provisions that supplement, amend, or specify in detail, information, or requirements included in the ITB found in Section II, which are specific to each procurement.

This Section is intended to assist the Procuring Entity in providing the specific information in relation to corresponding clauses in the ITB and has to be prepared for each specific procurement.

The Procuring Entity should specify in the BDS information and requirements specific to the circumstances of the Procuring Entity, the processing of the procurement, and the bid evaluation criteria that will apply to the Bids. In preparing the BDS, the following aspects should be checked:

a. Information that specifies and complements provisions of the ITB must be incorporated.

b. Amendments and/or supplements, if any, to provisions of the ITB as necessitated by the circumstances of the specific procurement, must also be incorporated.

Bid Data Sheet

ITB Clause	
5.2	For this purpose, contracts similar to the Project refer to contracts which have the same major categories of work, which shall be: *Civil Works*
7.1	*Subcontracting is not allowed.*
10.3	*Preferred Contractors License* *Parks, playground or recreational work– Medium A , Category B*
10.4	The key personnel must meet the required minimum years of experience set below: <u>Key Personnel</u> <u>General Experience</u> <u>Relevant Experience</u> *See attached end-user requirements* *In addition the bidder must certify that the foregoing personnel shall perform work exclusively for the project until completion of the project. Please see the attached Form for the purpose.*
10.5	The minimum major equipment requirements are the following: <u>Equipment</u> <u>Capacity</u> <u>Number of Units</u> *See attached end-user requirements* *In addition the bidder must certify under oath that the equipment shall be exclusively used for the project until completion of the project. Please see attached Form for the purpose*
	Not Applicable
15.1	The bid security shall be in the form of a Bid Securing Declaration or any of the following forms and amounts: a. The amount of not less than **2%** if bid security is in cash, cashier's/manager's check, bank draft/guarantee or irrevocable letter of credit; b. The amount of not less than **5%** if bid security is in Surety Bond.
19.2	Partial bids are allowed, as follows: *[Insert grouping of lots by specifying the items and the quantity for every identified lot.]*
20	*Not Applicable*
21	**Additional contract documents** relevant to the Project as required by existing laws and/or the Procuring Entity, such as construction schedule and S-curve, manpower schedule, construction methods, equipment utilization schedule, and PERT/CPM, and a copy Construction Safety and Health Program **shall be included in the submission of Technical Proposal.**

	Construction Safety and Health Program approved by the Department of Labor and Employment or proof of application with DOLE shall be submitted as part of the contract with winning bidder.

Section IV. General Conditions of Contract

Notes on the General Conditions of Contract

The General Conditions of Contract (GCC) in this Section, read in conjunction with the Special Conditions of Contract in Section V and other documents listed therein, should be a complete document expressing all the rights and obligations of the parties.

Matters governing performance of the Contractor, payments under the contract, or matters affecting the risks, rights, and obligations of the parties under the contract are included in the GCC and Special Conditions of Contract.

Any complementary information, which may be needed, shall be introduced only through the Special Conditions of Contract.

1. Scope of Contract

This Contract shall include all such items, although not specifically mentioned, that can be reasonably inferred as being required for its completion as if such items were expressly mentioned herein. All the provisions of RA No. 9184 and its 2016 revised IRR, including the Generic Procurement Manual, and associated issuances, constitute the primary source for the terms and conditions of the Contract, and thus, applicable in contract implementation. Herein clauses shall serve as the secondary source for the terms and conditions of the Contract.

This is without prejudice to Sections 74.1 and 74.2 of the 2016 revised IRR of RA No. 9184 allowing the GPPB to amend the IRR, which shall be applied to all procurement activities, the advertisement, posting, or invitation of which were issued after the effectivity of the said amendment.

2. Sectional Completion of Works

If sectional completion is specified in the **Special Conditions of Contract (SCC)**, references in the Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date shall apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).

3. Possession of Site

4.1. The Procuring Entity shall give possession of all or parts of the Site to the Contractor based on the schedule of delivery indicated in the **SCC,** which corresponds to 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.

4.2. If possession of a portion is not given by the above date, 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 may be addressed through contract extension provided under Annex "E" of the 2016 revised IRR of RA No. 9184.

4. The Contractor's Obligations

The Contractor shall employ the key personnel named in the Schedule of Key Personnel indicating their designation, in accordance with **ITB** Clause 10.3 and specified in the **BDS**, 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.

5. Performance Security

5.1. 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 successful Bidder shall furnish the performance security in any of the forms prescribed in Section 39 of the 2016 revised IRR.

5.2. The Contractor, by entering into the Contract with the Procuring Entity, acknowledges the right of the Procuring Entity to institute action pursuant to RA No. 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.

6. 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.

7. Warranty

7.1. In case the Contractor fails to undertake the repair works under Section 62.2.2 of the 2016 revised IRR, 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.

7.2. The warranty against Structural Defects/Failures, except that occasioned-on force majeure, shall cover the period from the date of issuance of the Certificate of Final Acceptance by the Procuring Entity. Specific duration of the warranty is found in the **SCC**.

8. 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.

If the Contractor is a joint venture, all partners to the joint venture shall be jointly and severally liable to the Procuring Entity.

9. Termination for Other Causes

Contract termination shall be initiated 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 corrupt, fraudulent, collusive, coercive, and obstructive practices as stated in **ITB** Clause 4.

10. Dayworks

Subject to the guidelines on Variation Order in Annex "E" of the 2016 revised IRR of RA No. 9184, 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.

11. Program of Work

11.1. The Contractor shall submit to the Procuring Entity's Representative for approval the said Program of Work showing the general methods, arrangements, order, and timing for all the activities in the Works. The submissions of the Program of Work are indicated in the **SCC.**

11.2. 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.

12. Instructions, Inspections and Audits

The Contractor shall permit the GOP or the Procuring Entity to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors of the GOP or the Procuring Entity, as may be required.

13. Advance Payment

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**, subject to the requirements in Annex "E" of the 2016 revised IRR of RA No. 9184.

14. Progress Payments

The Contractor may submit a request for payment for Work accomplished. Such requests 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.

15. Operating and Maintenance Manuals

15.1. If required, the Contractor will provide "as built" Drawings and/or operating and maintenance manuals as specified in the **SCC.**

15.2. If the Contractor does not provide the Drawings and/or manuals by the dates stated above, or they do not receive the Procuring Entity's Representative's approval, the Procuring Entity's Representative may withhold the amount stated in the **SCC** from payments due to the Contractor.

Section V. Special Conditions of Contract

Notes on the Special Conditions of Contract

Similar to the BDS, the clauses in this Section are intended to assist the Procuring Entity in providing contract-specific information in relation to corresponding clauses in the GCC found in Section IV.

The Special Conditions of Contract (SCC) complement the GCC, specifying contractual requirements linked to the special circumstances of the Procuring Entity, the Procuring Entity's country, the sector, and the Works procured. In preparing this Section, the following aspects should be checked:

a. Information that complements provisions of the GCC must be incorporated.

b. Amendments and/or supplements to provisions of the GCC as necessitated by the circumstances of the specific purchase, must also be incorporated.

However, no special condition which defeats or negates the general intent and purpose of the provisions of the GCC should be incorporated herein.

Special Conditions of Contract

GCC Clause	
2	*Completion of work shall be within* One Hundred Eighty (180) calendar days
4.1	The Procuring Entity shall give possession of all parts of the Site to the Contractor upon receipt of the Notice to Proceed.
6	The site investigation Report is: Technical Evaluation Report
7.2	*[Select one, delete the other.]* *[In case of permanent structures, such as buildings of types 4 and 5 as classified under the National Building Code of the Philippines and other structures made of steel, iron, or concrete which comply with relevant structural codes (e.g., DPWH Standard Specifications), such as, but not limited to, steel/concrete bridges, flyovers, aircraft movement areas, ports, dams, tunnels, filtration and treatment plants, sewerage systems, power plants, transmission and communication towers, railway system, and other similar permanent structures:] Fifteen (15) years.* *[In case of semi-permanent structures, such as buildings of types 1, 2, and 3 as classified under the National Building Code of the Philippines, concrete/asphalt roads, concrete river control, drainage, irrigation lined canals, river landing, deep wells, rock causeway, pedestrian overpass, and other similar semi-permanent structures:] Five (5) years.* *[In case of other structures, such as bailey and wooden bridges, shallow wells, spring developments, and other similar structures:] Two (2) years.*
10	Dayworks are applicable at the rate shown in the Contractor's original Bid.
11.1	The Contractor shall submit the Program of Work to the Procuring Entity's Representative within ten (10) calendar days after receipt of the Notice of Award.
11.2	The amount to be withheld for late submission of an updated Program of Work is one tenth (1/10) of one percent (1%) per day of delay chargeable against the current progress billing
13	The amount of the advance payment is no more that fifteen percent (15%) of the Contract Price subject to approval by the Authority and compliance with the conditions under RA 9184 and its IRR.
14	No further instructions.
15.1	The date by which operating and maintenance manuals are required is thirty (30) days from the receipt of Notice to Proceed. The date by which "as built" drawings are required is required as part of final payment.
15.2	The amount to be withheld for failing to produce "as built" drawings and/or operating and maintenance manuals by the date required is ten percent (10%) of the Contract Price.

Section VI. Specifications

Notes on Specifications

A set of precise and clear specifications is a prerequisite for Bidders to respond realistically and competitively to the requirements of the Procuring Entity without qualifying or conditioning their Bids. In the context of international competitive bidding, the specifications must be drafted to permit the widest possible competition and, at the same time, present a clear statement of the required standards of workmanship, materials, and performance of the goods and services to be procured. Only if this is done will the objectives of economy, efficiency, and fairness in procurement be realized, responsiveness of Bids be ensured, and the subsequent task of bid evaluation facilitated. The specifications should require that all goods and materials to be incorporated in the Works be new, unused, of the most recent or current models, and incorporate all recent improvements in design and materials unless provided otherwise in the Contract.

Samples of specifications from previous similar projects are useful in this respect. The use of metric units is mandatory. Most specifications are normally written specially by the Procuring Entity or its representative to suit the Works at hand. There is no standard set of Specifications for universal application in all sectors in all regions, but there are established principles and practices, which are reflected in these PBDs.

There are considerable advantages in standardizing General Specifications for repetitive Works in recognized public sectors, such as highways, ports, railways, urban housing, irrigation, and water supply, in the same country or region where similar conditions prevail. The General Specifications should cover all classes of workmanship, materials, and equipment commonly involved in construction, although not necessarily to be used in a particular Works Contract. Deletions or addenda should then adapt the General Specifications to the particular Works.

Care must be taken in drafting specifications to ensure that they are not restrictive. In the specification of standards for goods, materials, and workmanship, recognized international standards should be used as much as possible. Where other particular standards are used, whether national standards or other standards, the specifications should state that goods, materials, and workmanship that meet other authoritative standards, and which ensure substantially equal or higher quality than the standards mentioned, will also be acceptable. The following clause may be inserted in the SCC.

Sample Clause: Equivalency of Standards and Codes

Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards that ensure

a substantially equal or higher quality than the standards and codes specified will be accepted subject to the Procuring Entity's Representative's prior review and written consent. Differences between the standards specified and the proposed alternative standards shall be fully described in writing by the Contractor and submitted to the Procuring Entity's Representative at least twenty-eight (28) days prior to the date when the Contractor desires the Procuring Entity's Representative's consent. In the event the Procuring Entity's Representative determines that such proposed deviations do not ensure substantially equal or higher quality, the Contractor shall comply with the standards specified in the documents.

These notes are intended only as information for the Procuring Entity or the person drafting the Bidding Documents. They should not be included in the final Bidding Documents.

Republic of the Philippines

Tourism Infrastructure & Enterprise Zone Authority

PROJECT SPECIFICATIONS

I. GENERAL CONDITIONS

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

Project : **REHABILITATION OF BURNHAM PARK**
Location : Baguio City, Benguet

A. Scope of Work

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

1. General Requirements
2. Mobilization / Demobilization
3. Site Preparation
4. Control Room
5. Hard Landscaping
6. Sanitary – Plumbing Works
7. Electrical Works
8. Soft Landscaping
9. Retaining Wall

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

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

In the event that there is/are discrepancy/ies found between the detailed estimates and the plans, the latter should prevail to be implemented.

II. GENERAL REQUIREMENT

A. FIELD OFFICE, LABORATORIES AND LIVING QUARTERS

The Contractor shall construct field offices, laboratories and living quarters, including all the necessary air conditioning, electricity, water, drainage and security services for the use of the Engineer and his staff for 24 h a day or provide the same on a rental basis until end of Contract. All offices, laboratories and living quarters shall be ready for occupancy and use by the Engineer immediately for rental basis; or if to be constructed within 3 months upon the commencement

of the Works. Their location and final plan shall require the approval of the Engineer prior to the start of construction.

It is the intent of this Specification to locate the field offices, laboratories and living quarters in Government owned lots so that the use by the Government of these facilities can be maximized even after the completion of the project. In the selection of construction site of the Engineer's Building/s and Recreational Facilities, first priority shall be on DPWH property lots, second is public school lots, third is public health lots, fourth is Local Government Unit (LGU) lots, and then other government property lots. The proximity, access road and cost of development of the proposed site shall be properly evaluated. The construction of building/s and recreational facilities on property other than DPWH-owned shall be covered by an approved Memorandum of Agreement (MOA) between the concerned parties. The Implementing Office shall be allowed to use the other government lots for the construction of the field offices, laboratories and living quarters free of charge until the completion of the project and shall be turned over without cost, effective after completion or acceptance of the project from the Contractor. The transfer/turnover shall be supported by applicable document and shall be a requirement to support the issuance of project Completion Certificate of the Contractor.

If no Government lot is available, and these structures are to be erected on private property, it is the responsibility of the Contractor to make the necessary arrangements for the negotiation with the property owner for the lease/rental of the lot. The field office shall display an appropriate sign that identifies the DPWH facility to the public in locating it. The field offices, laboratories, and living quarters, the improvements thereon, including appurtenances shall be removed or transferred if so required in the Contract upon completion of the project.
All facilities provided by the Contractor shall be within the 5 km radius or preferably near the job site, where necessary and shall conform to the best standard for the required types. On completion of the Contract, the facilities provided by the Contractor including utilities shall revert to the Government including office equipment, apparatus, pieces of furniture, laboratory equipment, etc. unless otherwise specified in the Contract documents.

The Contractor shall be responsible for raising the ground (if necessary), grading and drainage in the vicinity of each facility with suitable access walkways, seeding and sodding of the ground around as directed and approved by the Engineer. Also, the Contractor shall construct a parking area for the compound near the buildings and a satisfactory access road to the parking areas. The whole area of the Engineer's compound shall be fenced with barbed wire (or equivalent) with necessary gates as directed by the Engineer.

B. VEHICLE

The Contractor shall provide within 30 calendar days upon issuance of the Notice to Proceed (NTP), the vehicles listed in the Contract for the exclusive use of the Engineer. The vehicles shall be able to transport personnel or equipment, supplies, products and materials. A provision in the Contract shall be provided that when the project duration exceeds 24 months, the service vehicles being rented shall be turned over to the Government after the 3 completion of the project while the operation and maintenance of the vehicles shall be the responsibility of the Contractor until it is being turned over. For pure rental, in no instance shall the cumulative rental payment exceed the total cost of the vehicle.

All vehicles shall comply in all respects with all relevant Philippine national or local laws statutes and regulations. All vehicles shall carry or be fitted with the accessories as may be prescribed by

laws and have comprehensive insurance. The vehicles on delivery shall be new and shall be driven by a competent, qualified and experienced driver who shall be under the direct order of the Engineer.

The Contractor shall maintain the vehicle in good running condition and shall be supplied with appropriate fuel and lubricants at all times. He shall provide equivalent substitute vehicles during any period when the specified vehicles are taken out of service for maintenance, repair or any other reason. Unless otherwise specified, the vehicle shall at the end of the Contract become the property of the Government.

B.1 Motorized Banca

The motorized banca shall be used for inland waters and limited off-shore and inter-island transportation and shall be made of wood hull with roof. The motorized banca shall have engine capacity not exceeding 30 hp.

C. METHOD OF MEASUREMENT

1. Lump sum shall be used as unit of measurement for the provision of:
   a. Field office building for the Engineer including pieces of furniture, appliances and equipment
   b. Laboratory building for the Engineer including pieces of furniture and appliances, equipment, apparatus and publications
   c. Living Quarters for the Engineer including pieces of furniture and appliances
   d. Survey equipment for the Engineer
   e. Documentary Video

2. The quantities for the provision of rental basis of the field office, laboratory and living quarters for the Engineer shall include Operations and Maintenance and shall be for the time the Engineer occupies the field office, laboratory and living quarters, respectively. The unit of measurement is "month"

3. The quantities for the provision on rental basis of fixtures/furniture, appliances, equipment (including survey equipment), apparatus and publications shall be for the time the Engineer is supplied thereof. The unit of measurement is "month".

4. No separate payment shall be made in respect to consumable materials as this is deemed to be included in the pay item for maintenance of the Engineer's facilities.

5. The quantities for the provision of vehicles for the Engineer shall be the number of each type of vehicle supplied. The unit of measurement is "unit".

6. The quantities for the operation and maintenance of vehicles for the Engineer shall be for the time the Engineer is supplied with each vehicle prior to their finally becoming the property of the Government. The unit of measurement is "vehicle-month".

7. The quantities for the provision on rental basis of the vehicles shall be for the time the Engineer is supplied thereof until the end of Contract. The unit of the measurement is "vehicle-month".

8. The quantities for progress photographs shall be the electronic files, album and/or number of photographs per month selected and provided as progress photographs from the commencement of works until the end of Contract. The unit of measurement is "month".

9. The quantities for the provision of video recording equipment (e.g. drone, digital camera, including digital storage) shall be the number of each type of equipment used. The unit of measurement is "set".

10. The quantities for the provision of progress videos shall include the provision of video record equipment if on a rental basis. The unit of measurement is "month".

11. The quantities for the provision of communication facility/equipment for the Engineer shall include the mobile phones, telephone, internet connection and two-way radio and shall be for the time the Engineer is supplied with such prior to their finally becoming the property of the Government or until end of the Contract. The unit of measurement is "lump sum" or "month".

12. The quantities for operation and maintenance of communication facility/equipment for the Engineer shall be for the time the Engineer is supplied with such prior to their finally becoming the property of the Government or until end of the Contract. The unit of measurement is "month".

D. BASIS OF PAYMENT

The quantities determined as provided above shall be paid for at the appropriate Contract Unit Price, for each of the particular pay items shown in the Bill of Quantities which price and payment shall constitute full compensation for furnishing and maintaining such items.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
	Construction of Living Quarters for the Engineer	Lump Sum
	Provision of Motorized Banca for the	Days

III. PROJECT BILLBOARD / SIGNBOARD

General Requirements

The Contractor shall install two (2) Project Information Signs at/or near the beginning and the end of the project or upon the discretion of the Engineer.

The signs are prescribed separately by the department of Public Works and Highways (DPWH) for government Infrastructure projects to inform the public of the implementation of the project and to advise the road users of the on going construction.

The new billboard design layout, dimension and letter sizes on white background, shall be depicted on a standard billboard measuring 1,220 mm x 2,440 mm using 12.50 mm thick marine plywood or tarpaulin of the same size posted on 5 mm marine plywood. For each building project, the billboard shall be installed in front of the project site. For each road/bridge/flood control project, two billboards shall be installed, one (1) at the beginning and one (1) at the end of the project.

For road projects with a length of 10 km or more, additional billboard shall also be installed at every five (5) km interval. Name(s) and/or picture(s) of any personages should not appear in the billboard.

No other billboards shall be allowed to be installed 100 m before and 100 m after all DPWH projects and in-between the project limits or within the road right-of-way. DPWH contractors shall not be allowed to place names of politicians or carry political billboard on their equipment.

The Contractor shall also install one (1) Billboard as per COA Circular No. 2013-004, Information and Publicity on Programs/Projects/Activities of Government Agencies.

Upon completion of the work, all signs installed shall be removed from the site.

Method of Measurement

All expenses incurred in the furnishing/installation/illumination of the signs shall be paid for each billboard installed.

Basis of Payment

The accepted quantities, measured as provided in Section B.5.2, 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
	Project Billboard/Signboard	Each

IV. OCCUPATIONAL SAFETY AND HEALTH

Description

This Item covers the implementation of construction safety in all stages of project procurement (design, estimate, construction and maintenance), requirements, provisions, and instructions for the guidance of the Engineer.

Construction Safety and Health Program (CSHP)

Every construction project shall have a suitable and approved Construction Safety and Health Program (CSHP) as required in all projects regardless of amount, funding source and mode of

implementation which shall comply with the minimum safety and health requirements as specified in the Occupational Safety and Health Standards.

The required CSHP shall include but not limited to the following:

1. Composition of the Safety and Health personnel responsible for the proper implementation of CSHP.

2. Specific safety policies which shall be undertaken in the construction site, including frequency of and persons responsible for conducting toolbox and gang meetings.

3. Penalties and sanctions for violations of the CSHP.

4. Frequency, content and persons responsible for orienting, instructing and training all workers at the site with regard to the CSHP which they operate.

5. The manner of disposing waste arising from the construction.

Construction Safety and Health Personnel

At the start of the project, the Contractor shall establish construction safety and health committee composed of the following personnel:

1. Project Manager/Project Engineer

The Contractor must provide for a full time Project Manager/Project Engineer, who is tasked to observe, monitor and supervise if the enforcement of CSHP was being followed strictly and correctly.

2. General Safety Engineer/Officer

The General Contractor (under which are a number of subcontractors) must provide for a full time Officer, who shall be assigned as the CSHP to oversee and enforce full time the overall management of the CSHP. Furthermore, deployment of part-time or full-time safety man depending on the number of workers shall be complied in accordance with Rule 1033 of the Occupational Safety and Health Standards (OSHS) and applicable provisions under 26 Section 7.0, Safety Personnel of Department of Labor and Employment (DOLE) Department Order D.O.) 13 Series of 1998.

3. Health Personnel

The Contractor's health personnel may be full time or part time certified first aider, registered nurse, physician and dentist depending on the total number of workers conforms to Section 8.0, Emergency Occupational Health Personnel and Facilities or DOLE D.O. 13, Series of 1998.

4. Safety Practitioner

The Contractor must provide a full time or part time Safety Practitioner, who shall initiate and supervise safety and health training for employees.

Supervision, Control and Monitoring

Overall supervision, control and monitoring of the implementation of CSHP for projects undertaken by administration/contracts shall be under the Implementing Office.

Construction Safety and Health Training

The Construction Safety and Health Seminar (COSH) shall be a 40 h training course as prescribed by the DOLE-Bureau of Working Conditions (BWC). All safety personnel involved in a construction project shall be required to complete such basic training course.

The Contractor shall provide continuing construction safety and health training to all technical personnel under his organization. Continuing training shall be a minimum of 16 h per year for every full-time safety personnel.

Construction Safety and Health Reports

The Contractor shall be required to submit a monthly construction safety and health report to the DOLE Regional Office concerned. The report shall include a monthly summary of all safety and health committee meeting agreements, a summary of all accident investigations/reports and periodic hazards assessment with the corresponding remedial measures/action for each hazard.

In case of any dangerous occurrence or major accident resulting in death or permanent total disability, the concerned employer shall initially notify the DOLE Regional Office within 24 h from occurrence. After the conduct of investigation by the concerned construction safety and health officer, the employer shall report all permanent total disabilities to DOLE Regional Office on or before the 20th of the month following the date of occurrence of accident using the DOLE Employer's Work Accident Illness Report.

Personal Protective Equipment (PPE) and Devices

The Contractor shall furnish his workers with protective equipment for eyes, face, hands and feet, lifeline, safety belt/harness, protective shields and 27 barriers whenever necessary by reason of the hazardous work process or environment, chemical or radiological or other mechanical irritants of hazards capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical agent.

All PPE and Devices shall be in accordance with the requirements of the OSHS and should pass the test conducted and/or standards set by the Occupational Safety and Health Center (OSHC).

For General Construction Work, the required basic PPEs for all workers shall be safety helmet, safety gloves and safety shoes. Specialty PPEs shall be provided to workers in addition to or in lieu of the corresponding basic PPE as the work or activity requires. Workers within the construction project site shall be required to wear the necessary PPE at all times. Moreover, all

other persons who are either authorized or allowed to be at a construction site shall also wear appropriate PPEs.

Construction workers who are working from unguarded surfaces 6 m or more above water or ground, temporary or permanent floor platform, scaffold or where they are exposed to the possibility of falls hazardous to life or limb, must be provided with safety harnesses and life lines.

Signages and Barricades

Construction Safety Signages and Barricades shall be provided as a precaution and to advice the workers and the general public of the hazards existing in the worksite. Signages shall be posted in prominent positions at strategic location and as far as practicable, be in the language understandable to most of the workers employed. For road projects, it shall be in accordance with the DPWH Road Works Safety Manual.

Facilities

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

1. Adequate supply of safe drinking water.

2. Adequate sanitary and washing facilities.

3. Suitable living accommodation for workers and as may be applicable for their families.

4. Separate sanitary, washing and sleeping facilities for men and women workers.
The services of a full time registered nurse, a full time physician, a dentist and an infirmary or emergency hospital with one (1) bed capacity when the number of employees exceed 300. In addition, there should be one (1) bed capacity for every 100 employees in excess of three hundred (300).

Costing

The cost for the implementation of construction safety and health shall be integrated to the overall project cost under the prescribed pay item. In consideration of the cost involved of providing the necessary safety equipment and manpower for an effective implementation of safety in the workplace, the following shall be used as a guide:
1. Personal Protective Equipment (PPE)

The PPEs shall be provided by the Contractor, and its cost shall be duly quantified and made part of the overall cost of Item B.7, Occupational Safety and Health. The use of PPEs shall conform to Section B.7.7 Personal Protective Equipment and Devices.

2. Clinical Materials and Equipment

Clinical materials and equipment such as medicines, beds and linens, other related accessories shall be to the account of the Contractor implementing the project and shall be in accordance with the Occupational Health Services of OSHS.

3. Signages and Barricades

The quantities and cost of signages and barricades necessary for a specific item of work shall be quantified and made part of that particular pay item of work. For general signages and barricades not included in specific pay item of work but necessary for promoting safety in and around the construction site, the quantities and cost shall be a separate pay item and included in the overall cost of Item B.7, Occupational Safety and Health.

4. Facilities

Facilities such as portable toilets, waste disposal, sanitary and washing facilities, convenient dwellings and office, adequate lighting, and other facilities related to construction safety and health shall be in accordance with OSHS and previously approved guidelines of the Department and shall be quantified and the cost thereof be made a separate pay item under "Facilities for the Engineers" and "Other General Requirements" as required in the DPWH Standard Specifications.

5. Salaries

Labor cost for the medical and safety personnel actually assigned in the field shall be included in the overall cost of Item B.7, Occupational Safety and Health. Manpower cost shall be established based on the cost of labor in the area. Duration of employment shall be based on project duration of the particular project.

6. Safety and Health Training

Cost associated for the provision of basic and continuing construction safety and health training to all safety and technical personnel shall be made part of the indirect/overhead cost of the project.

Safety on Construction during Heavy Equipment Operation

In relation to heavy equipment operation in all construction sites, the following are required in the different phases of the project.

1. Pre-Construction

The Contractor must ensure that appropriate certification is obtained from DOLE duly accredited organizations for the following:

a. All heavy equipment operators assigned at the project site must be tested and certified in accordance with a standard trade test prescribed by Technical Education and Skills Development Authority (TESDA) in coordination with its accredited organization.

b. All heavy equipment must be tested and certified in accordance with the standards prepared by DOLE or its recognized organization prior to commissioning of said equipment.

2. During Construction

The Contractor must ensure that the following conditions are met or complied with:

a. For mobilization or transport of heavy equipment, load restrictions, height and width clearances as imposed by Department for all roads and bridges to be utilized during transport. Moreover, only duly certified operators are allowed to load and unload heavy equipment to low-bed trailer.

b. During erection and set-up of heavy equipment, existing hazards must be avoided. Standard checklist of steps and procedures must be observed. List of necessary equipment, tools and materials must be available and properly utilized.

c. In the interest of accident prevention, duly certified mechanics and operators shall conduct daily routine inspection of all heavy equipment deployed at the site in accordance with standards set by TESDA in coordination with the Association of Construction Equipment Lessors (ASCEL, Inc.). During routine inspection all equipment which do not comply with the minimum safety standards for equipment certification shall be immediately removed from the work site for restoration or repair until they meet said standards or requirements. The Contractor and the equipment owner shall maintain a separate logbook for data on maintenance, repair, tests and inspections for each heavy equipment. Such logbook shall be used as a necessary reference during the conduct of equipment inspection.

3. Post Operation and Post Construction

The procedures for dismantling and demobilization of heavy equipment shall follow the same requirements as listed under provisions of mobilization or transport of heavy equipment and erection and set-up of heavy equipment.

Violations and Penalties

The Contractor if found violating safety rules and regulations shall be meted sanctions depending on the gravity of offense. The amount corresponding to non-compliance shall be deducted from the Contractor's billing.

Method of Measurement

Occupational safety and health program shall be measured by lump sum.

Basis of Payment

The accepted quantities, measured as prescribed in Section B.7.13, Method of Measurement shall be paid for at the Contract Unit Price or for the pay item listed below that is included in the Bill of Quantities. Such payment shall be full compensation for furnishing, maintaining and ensuring against loss of the equipment/tools.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
	Occupational Safety and Health	Lump Sum

V. CONSTRUCTION SURVEY AND STAKING

Description

This Item shall consist of furnishing the necessary equipment and material to survey, stake, calculate, and record data for the control of work in accordance with this Specification and in conformity with the lines, grades and dimensions shown on the Plans or as established by the Engineer.

General

Staking activities shall be included in the construction schedule to be submitted by the Contractor. Dates and sequence of each staking activity shall be included.

The Engineer shall set initial reference lines, horizontal and vertical control points, and shall furnish the data for use in establishing control for the completion of each element of the work. Data relating to horizontal and vertical alignments, theoretical slope stake catch points, and other design data shall be furnished.

The Contractor shall be responsible for the true settling of the works or improvements and for correctness of positions, levels, dimensions and alignment of all parts of the works. He shall provide all necessary instruments, appliances, materials and supplies, and labor in connection therewith. The Contractor shall provide a survey crew supervisor at the project site whenever surveying/staking activity is in progress.

Prior to construction, the Engineer shall be notified of any missing initial reference lines, controls, points, or stakes. The Engineer shall re-establish missing initial reference lines, controls, points, or stakes.

The Contractor for convenient use of Government-furnished data shall perform additional calculations. Immediate notification of apparent errors in the initial staking or in the furnished data shall be provided.

All initial reference and control points shall be preserved. At the start of construction, all destroyed or disturbed initial reference or control points necessary to the work shall be replaced.

Before surveying and staking, the Contractor shall discuss and coordinate the following with the Engineer:

1. Surveying and staking methods
2. Stake marking/concrete monuments
3. Grade control for courses of material
4. Referencing

5. Structure control

The Contractor shall prepare field notes in an approved format. All field notes and supporting documentation shall become the property of the government upon completion of the work. Construction work shall only be started after staking for the affected work is accepted.

The construction survey and staking work may be spot-checked by the Engineer for accuracy, and unacceptable portions of work may be rejected.

Rejected work shall be resurveyed, and work that is not within the tolerances specified in Table B.4.1 shall be corrected. Acceptance of the construction staking shall not relieve the Contractor of responsibility for correcting errors discovered during the work and for bearing all additional costs associated with the error, unless such error is based on incorrect data supplied in writing by the Engineer, in which case, the expense in rectifying the same shall be at the expense of the Government.

In the case of "change" or "changed conditions" which involve any change in stakeout, the Contractor shall coordinate with the Engineer and facilitate the prompt reestablishment of the field control for the altered or adjusted work.

All flagging, lath, stakes, and other staking materials shall be removed and disposed after the project is completed.

Survey and Staking Requirements

All survey, staking, recording of data, and calculations necessary to construct the project from the initial layout to final completion shall be performed. Stakes shall be reset as many times as necessary to construct the work.

VI. MOBILIZATION / DEMOBILIZATION

General Requirements

Mobilization shall mean the transport to the project site of the Contractor's personnel, construction plant and equipment as stipulated in the proposal and Contract of the project while demobilization shall be their subsequent removal from the site after the completion of the project. The Contractor shall secure approval of the Engineer should he opted to demobilize any of the major plant and/or equipment before the completion of the project.

1. Control Points

Established initial horizontal and vertical control points in conflict with construction shall be relocated to areas that will not be disturbed by construction operations. The coordinates and elevations for the relocated points shall be furnished before the initial points are disturbed.

2. Roadway Cross-Sections

Roadway cross-sections shall be taken normal or perpendicular to the centerline. When the centerline horizontal curve radius is less than or equal to 150 m and vertical parabolic curve radius is less than or equal to 100 m, cross- sections shall be taken at a maximum centerline

spacing of 10 m. When the centerline horizontal curve radius is greater than 150 m and vertical parabolic curve radius is greater than 100 m, cross-sections shall be taken at a maximum centerline spacing of 20 m. Additional cross-sections shall be taken at significant breaks in topography and at changes in the typical roadway section including transition change to superelevated sections. Along each cross- section, points shall be measured and recorded at breaks in topography and at changes in typical roadway section including transition change to superelevated

sections and shall be no further apart than 5 m. Points shall be measured and recorded to at least the anticipated slope stake and reference locations. All cross-section distances shall be reduced to horizontal distances from centerline.

3. Slope Stakes and References

Slope stakes and references shall be set on both sides of centerline at the cross-section locations. Slope stakes shall be established in the field as the actual point of intersection of the design roadway slope with the natural ground line. Slope stake references shall be set outside the clearing limits. All reference point and slope stake information shall be included on the reference stakes. When initial references are provided, slope stakes may be set from these points with verification of the slope stake location with field measurements. Slope stakes on any section that do not match with the staking report within the tolerances established in Table B.4.1 shall be recatched. Roadway cross-section data shall be taken between centerline and the new slope stake location. Additional references shall be set even when the initial references are provided.

4. Clearing and Grubbing Limits

Clearing and grubbing limits shall be set on both sides of centerline at roadway cross-section locations, extending 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.

5. Centerline Reestablishment

Centerline shall be reestablished from instrument control points. The maximum spacing between centerline points shall be 10 m when the centerline horizontal curve radius is less than or equal to 150 m and vertical parabolic curve radius is less than or equal to 100 m. When the centerline horizontal curve radius is greater than 150 m and vertical parabolic curve radius is greater than 100 m, the maximum distance between centerline points shall be 20 m.

6. Grade Finishing Stakes

Grade finishing stakes shall be set for grade elevations and horizontal alignment, at the centerline and at each shoulder of roadway cross-section locations. Stakes shall be set at the top of subgrade and the top of each aggregate course.

Where turnouts are constructed, stakes shall be set at the centerline, at each normal shoulder, and at the shoulder of the turnout. In parking areas, hubs shall be set at the center and along the edges of the parking area. Stakes shall be set at all ditches to be paved.

The maximum longitudinal spacing between stakes shall be 10 m when the centerline horizontal curve radius is less than or equal to 150 m and vertical parabolic curve radius is less than or equal to 100 m. When the centerline horizontal curve radius is greater than 150 m and vertical parabolic curve radius is greater than 100 m, the maximum longitudinal spacing between

stakes shall be 20 m. The maximum transverse spacing between stakes shall be 5 m. Brushes or guard stakes shall be used at each stake.

7. Culverts

Culverts shall be staked to fit field conditions. The location of culverts may differ from the plans. The following shall be performed:

a. Survey and record the ground profile along the culvert centerline including inlet and outlet channel profile of at least 10 m and as additionally directed by the Engineer so as to gather all necessary data for the preparation of pipe projection plan.

b. Determine the slope catch points at the inlet and outlet.

c. Set the reference points and record information necessary to determine culvert length and end treatments.

d. Plot into scale the profile along the culvert centerline reflecting the natural ground elevation, invert elevation, the flow line, the roadway section, and the size, length and the degree of elbow of culvert, end treatments, grade and other appurtenances.

e. Plot into scale the cross-section of inlet and outlet channel at not more than 5 m interval.

f. Submit the plotted Pipe Projection Plan for approval of final culvert length, alignment and headwall.

g. When the Pipe Projection Plan has been approved, set drainage culvert structure survey and reference stakes, and stake inlet and outlet to make the structure functional.

8. Bridges

Adequate horizontal and vertical control and reference points shall be set for all bridge structure and superstructure components. The bridge chord or the bridge tangent shall be established and referenced. The centerline of each pier, bent, and abutment shall also be established and referenced.

Set at least three (3) reference points each at downstream and upstream portion. Conduct topographic survey and plot into scale at least 100 meters upstream and downstream from centerline of bridge.

9. Retaining Walls and Other Types of Slope Protection Works

Profile measurements along the face of the proposed wall and 2 m in front of the wall face shall be surveyed and recorded. Cross-sections shall be taken within the limits designated by the Engineer at every 5 m along the length of the wall and all major breaks in terrain. For each cross-section, points shall be measured and recorded every 5 m and at all major breaks in terrain. Adequate references and horizontal and vertical control points shall be set.

10. Borrow and Waste Sites

The work essential for initial layout and measurement of borrow or waste site shall be performed. A referenced baseline, site limits, and clearing limits shall be established. Initial and final cross-sections shall be surveyed and recorded.

11. Permanent Monuments and Markers

All survey and staking necessary to establish permanent monuments and markers shall be performed.

12. Miscellaneous Survey and Staking

All surveying, staking, and recording of data essential for establishing the layout and control of the following shall be performed, as applicable:

a. Approach roads and trails
b. Road Right of Way and Construction limit in accordance with the approved Parcellary Plan.
c. Curb and gutter
d. Guardrail
e. Parking areas
f. Paved waterways and outfall structures
g. Lined canals and other ditches
h. Chutes and Spillways
i. Turf establishment
j. Utilities
k. Signs, delineators, and object markers
l. Pavement markings

Method of Measurement

Construction survey and staking shall be measured by the kilometer.

Bridge survey and staking, and retaining wall survey and staking shall be measured by the lump sum.

Slope, reference, and clearing and grubbing stakes shall be measured by the kilometer.

Centerline establishment shall be measured by the kilometer. Centerline reestablishment shall be measured only one time.

Culvert survey and staking shall be measured by the each.

Grade finishing stakes shall be measured by the kilometer. Subgrade shall be measured one time and each aggregate course shall also be measured one time.

Permanent monuments and markers shall be measured by each unit placed and installed at the proper locations.

Miscellaneous survey and staking shall be measured by the hour of survey work ordered or by the lump sum. For miscellaneous survey and staking paid by the hour, the minimum survey crew size shall be two (2) persons. Time spent in making preparations, travelling to and from the project site, performing calculations, plotting cross sections and other data, processing computer data, and other efforts necessary to successfully accomplish construction survey and staking shall not be measured separately but deemed included as subsidiary for each of the Pay Item.

Basis of Payment

The accepted quantities, measured as provided in Section B.4.3, Method of Measurement 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 surveying, staking, calculating/processing by any means and recording data, for furnishing and placing all materials, and for furnishing all equipment, tools and incidentals necessary to complete the item.

The construction survey and staking lump sum item shall be paid as follows:

1. Twenty five percent (25%) of the lump sum, not to exceed 0.5% of the original contract amount, shall be paid following completion of 10% of the original contract amount.

2. Payment of the remaining portion of the lump sum shall be prorated based on the total work completed.

The bridge survey and staking and the retaining wall survey and staking lump sum items shall be paid on a prorated basis as the applicable work progresses.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
	Construction survey and staking	Kilometer

VII. TEMPORARY FENCE

Description

This work shall consist of furnishing, erecting, moving and removing chain link fencing and metal gates of the size and type shown on top of the temporary concrete barriers, and in sidewalk and roadway areas at the locations, as shown on the Plans or as directed by the Engineer.

Material Requirements

Barbed Wire

Barbed wire shall conform to the requirements of ASTM A121, Class I, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire. The barbed wire shall consist of two (2) strands of 12.5 gauge wire, twisted with two (2) points, 14 gauge barbs spaced 100 mm apart.

Chain Link Fence Fabric

Chain link fence fabric shall be fabricated from ten (10) gauge-galvanized wire conforming to AASHTO M 181, Chain Link Fence, and shall be of the type shown on the Plans. Before ordering the chain link fence fabric, the Contractor shall submit a sample of the material to the Engineer for testing and for approval.

Concrete Post

Concrete posts shall be made of Class A concrete in accordance with Item 900, Structural Concrete. The posts shall be cast to a tapered section as shown on the Plans and shall have a smooth surface finish.

Steel Post

Steel posts shall be of the sections and length as specified or as shown on the Plans. The posts shall be copper bearing steel and shall conform to the requirements of ASTM A702, Standard Specification for Steel Fence Post, Hot Wrought, for the grade specified.

Steel Reinforcement

Steel reinforcement for concrete posts shall be deformed steel bars conforming to the provisions of Item 902, Reinforcing Steel.

Hardware

Nuts, bolts, washers and other associated hardware shall be galvanized after fabrication as specified in ASTM A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

Construction Requirements

The Contractor shall perform such clearing and grubbing as may be necessary to construct the fence to the required grade and alignment.

The Contractor shall install fence posts on the concrete barrier in 38 mm diameter, 300 mm deep drilled or formed holes near each end of each section of the barrier. In addition, if the concrete barrier is furnished in lengths exceeding 3 m, it will be necessary for the Contractor to

provide an additional hole at the center of the section to permit the installation of an intermediate post.

Line posts, corner and end posts on grade, and gate posts shall be installed in accordance with the Plans. Heights of the posts and fencing shall conform to the dimensions shown on the Plans.

At locations where breaks in a run of fencing are required, or at interactions with existing fences, appropriate adjustments in post spacing shall be made to conform to the requirement for the type of closure indicated.

When the Plans require that the posts, braces, or anchors be embedded in concrete, the Contractor shall install temporary guys or braces, as may be required to hold the posts in proper position until such time as the concrete has set sufficiently to hold the posts. Unless otherwise permitted, no materials shall be installed on posts or strain placed on guys or bracing set in concrete until seven days elapsed from the time of placing the concrete.

All posts shall be set vertically and to the required grade and alignment. Cutting off the tops of the posts will be allowed only with the approval of the Engineer and under conditions specified by the Engineer.

The fence fabric of the size and type required shall be firmly attached to the posts and braces in the manner indicated. All fence fabric shall be stretched taut and installed to the required elevations.

The fence shall generally follow the contour of the ground, with the bottom of fence fabric not less than 50 mm nor more than 150 mm from the ground surface. Grading shall be performed where necessary to provide a neat appearance. Line posts shall be spaced equidistantly in the fence line at the spacing shown on the Plans or as directed by the Engineer. The end, corner, and intermediate posts shall be placed at the locations indicated on the Plans or where directed by the Engineer, and shall be braced as shown on the Plans. When chain-link fence is on a long curve, intermediate posts shall be evenly spaced so that the strain of the fence will not bend the line posts.

All end, corner, and intermediate posts shall be set plumb in concrete bases of the depth and diameter shown on the Plans. The Contractor shall have the option of setting the line posts in concrete bases or using methods of driving and anchoring specified by the fence manufacturer and approved by the Engineer.

1. Chain Link Fencing With Top Rail

Posts shall be set so they are equidistant with a maximum of three (3) meters on center.

All top rails shall pass through the base of the post caps and shall form a continuous brace from end to end of each stretch of fence. Top rail lengths shall be joined with sleeve couplings with expansion sleeves provided at 30 m intervals. Top rails shall be securely fastened to end posts by means of approved rail end connectors. Horizontal braces shall be provided at all intermediate posts, midway between the top rail and ground as shown on the Plans.

Diagonal truss rods shall be installed with the horizontal braces as indicated in the Plans.

Fence fabric shall be installed approximately 50 mm above the ground level and securely fastened along the bottom and to all braces, top rails, line and pull posts, at the intervals indicated on the Plans. The fabric shall be secured to all end, corner, and gate posts with stretcher bars fastened to the posts, with stretcher bands spaced at a maximum of 355 mm and in a manner permitting adjustment of the fabric tension.

If the Contractor selects the option of using pieces, roll-formed sections, the fence fabric shall be integrally woven into the fabric loops on the end, corner, pull and gate posts. The fabric shall be attached to the end, corner and line posts as shown on the Plans.

2. Chain Link Fencing With Top Tension Wire

The construction details specified in Chain-Link Fencing with top Rail shall apply with the following modifications:

a. Top tension wire shall be installed as shown on the Plans or as directed by the Engineer.

b. All posts shall be spaced equidistant in the fence line on a maximum of 2.44 m on center, except that a 3 m spacing will be permitted on concrete barriers.

c. Additional pull posts shall be placed at locations indicated on the Plans. Brace assemblies shall be installed at each intermediate post as indicated on the Plans or Standard Sheets.

3. Vinyl Coated Chain-link Fencing on Plastic Coated Frame

The construction details specified on Chain-Link Fencing with Top Rail or Chain- Link Fencing with Top Tension Wire shall apply with the following addition:

If any of the resin-clad material specified under Item that has the protective resin coating is damaged that impairs its effectiveness to prevent corrosion of

the base material, the Contractor shall repair such parts by applying one coat of an approved compound of color to match the original material.

4. Fence Gates

The Contractor shall construct metal fence gates of the type and size as indicated on the Plans, and in the location shown or ordered by the Engineer. Upon removal, fence gates shall become the property of the Contractor and shall be removed from the project site.

Method of Measurement

This work under this Item shall be measured by lump sum of temporary fence installed as measured along the top of the fencing, including gates, center to center of end posts erected in place and accepted.

Basis of Payment

The quantity, as determined in Section B.20.4, Method of Measurement shall be paid for at the Contract Unit Price bid per Lump Sum for temporary chain- link fencing, which shall include the

cost of all materials, labor tools and equipment necessary to satisfactorily install the fencing, and gates and to subsequently remove them. It shall include all necessary clearing, grubbing, excavation and disposal, fill, concrete, anchoring, posts, hardware, fencing, gates, gate posts, locks, bracing, drilling or forming holes in concrete barriers as necessary, repair of material damaged by the Contractor's operations and all other materials.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
	Temporary Fence	lm

VIII. STRUCTURE EXCAVATION

Description

This Item shall consist of the necessary excavation for foundation of bridges, 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 these Specifications and in reasonably close conformity with the Plans or as established by the Engineer.

This Item shall include necessary diverting of live streams, bailing, 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 will be made for classification of different types of material encountered.

Construction Requirements

Clearing and Grubbing

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

Excavation

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

Trenches or foundation pits for structures or structure footings shall be excavated to the lines and grades or elevations shown on the Plans or as staked by the Engineer. They shall be of sufficient size to permit the placing of structures or structure footings of the full width and

length shown. 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.

(2) Structures other than pipe culverts. All rock or other hard foundation materials shall be cleaned of all loose materials, and cut to a firm surface, either level, stepped, or serrated as directed by the Engineer. All seams or crevices shall be cleaned and grouted. All loose and disintegrated rocks and thin strata shall be removed. When the footing is to rest on material other than rock, excavation to final grade shall not be made until just before the footing is to be placed. When the foundation material is soft or mucky or otherwise unsuitable, as determined by the Engineer, the Contractor shall remove the unsuitable material and backfill with approved granular material. This foundation fill shall be placed and compacted in 150 mm layers up to the foundation elevation.

When foundation piles are used, the excavation of each pit shall be completed before the piles are driven and any placing of foundation fill shall be done after the piles are driven. After the driving is completed, all loose and displaced materials shall be removed, leaving a smooth, solid bed to receive the footing.

(3) Pipe Culverts. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe.

Where rock, hardpan, or other unyielding material is encountered, it shall be removed below the foundation grade for a depth of at least 300 mm or 4 mm for each 100 mm of fill over the top of pipe, whichever is greater, but not to exceed three-quarters of the vertical inside diameter of the pipe. The width of the excavation shall be at least 300 mm greater than the horizontal outside diameter of the pipe. The excavation below grade shall be backfilled with selected fine compressible material, such as silty clay or loam, and lightly compacted in layers not over 150 mm in uncompacted depth to form a uniform but yielding foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, such unstable soil under the pipe and for a width of at least one diameter on each side of the pipe shall be removed to the depth directed by the Engineer and replaced with approved granular foundation fill material properly compacted to provide adequate support for the pipe, unless other special construction methods are called for on the Plans.

The foundation surface shall provide a firm foundation of uniform density throughout the length of the culvert and, if directed by the Engineer, shall be cambered in the direction parallel to the pipe centerline.

Where pipe culverts are to be placed in trenches excavated in embankments, the excavation of each trench shall be performed after the embankment has been constructed to a plane parallel

to the proposed profile grade and to such height above the bottom of the pipe as shown on the Plans or directed by the Engineer.

Utilization of Excavated Materials

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

Cofferdams

Suitable and practically watertight cofferdams shall be used wherever water-bearing strata are encountered above the elevation of the bottom of the excavation. If requested, the Contractor shall submit drawings showing his proposed method of cofferdam construction, as directed by the Engineer.

Cofferdams or cribs for foundation construction shall in general, be carried well below the bottoms of the footings and shall be well braced and as nearly watertight as practicable. In general, the interior dimensions of cofferdams shall be such as to give sufficient clearance for the construction of forms and the inspection of their exteriors, and to permit pumping outside of the forms. Cofferdams or cribs which are tilted or moved laterally during the process of sinking shall be righted or enlarged so as to provide the necessary clearance.

When conditions are encountered which, as determined by the Engineer, render it impracticable to dewater the foundation before placing the footing, the Engineer may require the construction of a concrete foundation seal of such dimensions as he may consider necessary, and of such thickness as to resist any possible uplift. The concrete for such seal shall be placed as shown on the Plans or directed by the Engineer. The foundation shall then be dewatered and the footing placed. When weighted cribs are employed and the mass is utilized to overcome partially the hydrostatic pressure acting against the bottom of the foundation seal, special anchorage such as dowels or keys shall be provided to transfer the entire mass of the crib to the foundation seal. When a foundation seal is placed under water, the cofferdams shall be vented or ported at low water level as directed.

Cofferdams shall be constructed so as to protect green concrete against damage from sudden rising of the stream and to prevent damage to the foundation by erosion. No timber or bracing shall be left in cofferdams or cribs in such a way as to extend into substructure masonry, without written permission from the Engineer.

Any pumping that may be permitted from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of any portion of the concrete material being carried away. Any pumping required during the placing of concrete, or for a period of at least 24 hours thereafter, shall be done from a suitable sump located outside the concrete forms. Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure.

Unless otherwise provided, cofferdams or cribs, with all sheeting and bracing involved therewith, shall be removed by the Contractor after the completion of the substructure. Removal shall be effected in such manner as not to disturb or mar finished masonry.

Preservation of Channel

Unless otherwise permitted, no excavation shall be made outside of caissons, cribs, cofferdams, or sheet piling, and the natural stream bed adjacent to structure shall not be disturbed without permission from the Engineer. If any excavation or dredging is made at the side of the structure before caissons, cribs, or cofferdams are sunk in place, the Contractor shall, after the foundation base is in place, backfill all such excavations to the original ground surface or stream bed with material satisfactory to the Engineer.

Backfill and Embankment for Structures Other Than Pipe Culverts

Excavated areas around structures shall be backfilled with free draining granular material approved by the Engineer and placed in horizontal layers not over 150 mm in thickness, to the level of the original ground surface. Each layer shall be moistened or dried as required and thoroughly compacted with mechanical tampers.

In placing backfills or embankment, the material shall be placed simultaneously in so far as possible to approximately the same elevation on both sides of an abutment, pier, or wall. If conditions require placing backfill or embankment appreciably higher on one side than on the opposite side, the additional material on the higher side shall not be placed until the masonry has been in place for 14 days, or until tests made by the laboratory under the supervision of the Engineer establishes that the masonry has attained sufficient strength to withstand any pressure created by the methods used and materials placed without damage or strain beyond a safe factor.

Backfill or embankment shall not be placed behind the walls of concrete culverts or abutments or rigid frame structures until the top slab is placed and cured. Backfill and embankment behind abutments held at the top by the superstructure, and behind the sidewalls of culverts, shall be carried up simultaneously behind opposite abutments or sidewalls.

All embankments adjacent to structures shall be constructed in horizontal layers and compacted as prescribed in Subsection 104.3.3 except that mechanical tampers may be used for the required compaction. Special care shall be taken to prevent any wedging action against the structure, and slopes bounding or within the areas to be filled shall be benched or serrated to prevent wedge action. The placing of embankment and the benching of slopes shall continue in such a manner that at all times there will be horizontal berm of thoroughly compacted material for a distance at least equal to the height of the abutment or wall to be backfilled against except insofar as undisturbed material obtrudes upon the area.

Broken rock or coarse sand and gravel shall be provided for a drainage filter at weepholes as shown on the Plans.

Bedding, Backfill, and Embankment for Pipe Culverts

Bedding, Backfill and Embankment for pipe culverts shall be done in accordance with Item 500, Pipe Culverts and Storm Drains.

Method of Measurement

Structure Excavation

The volume of excavation to be paid for will be the number of cubic metres measured in original position of material acceptably excavated in conformity with the Plans or as directed by the Engineer, but in no case, except as noted, will 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 outside the limits of foundation fill as ordered by the Engineer.

(4) The volume included within the staked limits of the roadway excavation, contiguous channel changes, ditches, etc., 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 Item 500 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 individual footings.

Bridge Excavation

The volume of excavation, designated on the Plans or in the Special Provisions as "Bridge Excavation" will be measured as described below and will be kept separate for pay purposes from the excavation for all structures.

The volume of bridge excavation to be paid shall be the vertical 450 mmoutside of and parallel to the neat lines of the footing. The vertical planes shall constitute the vertical faces of the volume for pay quantities regardless of excavation inside or outside of these planes.

Foundation Fill

The volume of foundation fill to be paid for will be the number of cubic metres measured in final position of the special granular material actually provided and placed below the foundation elevation of structures as specified, completed in place and accepted.

Shoring, Cribbing, and Related Work

Shoring, cribbing and related work whenever included as a pay item in Bill of Quantities will be paid for at the lump sum bid price. This work shall include furnishing, constructing, maintaining, and removing any and all shoring, cribbing, cofferdams, caissons, bracing, sheeting, water control, and other operations necessary for the acceptable completion of excavation included in the work of this Section, to a depth of 1.5 m below the lowest elevation shown on the Plans for each separable foundation structure.

Basis of Payment

The accepted quantities, measured as prescribed in Section 103.3, shall be paid for 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 will be paid for as provided in Part K, Measurement and Payment, 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 405, Structural Concrete.

(3) Any roadway or borrow excavation required in excess of the quantity excavated for structures will be measured and paid for as provided under Item 102.

(4) Shoring, cribbing, and related work required for excavation ordered more than 1.5 m below Plan elevation will be paid for in accordance with Part K.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
	Structure Excavation	Cubic Meter

IX. EMBANKMENT

Description

This Item shall consist of the construction of 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.

Material Requirements

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-μm (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

Grading Requirements

Sieve Designation		Mass Percent Passing
Standard, mm	Alternate US Standard	Grading A
63.5	2 1/2"	100
50	2"	65 - 100
25.0	1"	50-85
4.75	No. 4	26-44
0.425	No. 40	16 max
0.075	No. 400	9 max

3. Rock fill material shall be hard, sound and durable material, free from seams, cracks, and other defects tending to destroy its resistance to weather. Specific gravity of rock fill materials shall be above 2.40.

Unsuitable Materials

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.

Construction Requirements

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.

Method 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 ½ 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.

When shoulder excavation is specified, the 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 of as provided in Subsection 802.2.3, Utilization of Excavated Materials. If necessary, the areas shall be compacted before being backfilled.

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, thicker layer maybe placed if 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 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 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.

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 prismoidal 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.

Basis of Payment

The accepted quantities, measured as prescribed in Section 201.4, shall be paid for at the contract unit price for Aggregate Base Course 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
	Embankment from Borrow (Common Soil)	Cubic Meter
	Gravel Fill	Cubic Meter

X. REINFORCING STEEL

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.

Material Requirements

Reinforcing steel shall meet the requirements of Item 710, Reinforcing Steel and Wire Rope.

Construction Requirements

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.

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.

Bending

All reinforcing bars requiring bending shall be cold-bent to the shapes shown on the Plans or as required by the Engineer. Bars shall be bent around a circular pin having the following diameters (D) in relation to the nominal 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.

Placing and Fastening

All steel reinforcement shall be accurately placed in the position shown on the Plans or as 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 300 mm in each directions, in which case, alternate intersections shall be tied. Ties shall be fastened on the inside.

Distance from the forms shall be maintained by means of stays, blocks, ties, hangers, or other approved supports, so that it does not vary from the position indicated on the Plans by more than 6mm. Blocks for holding reinforcement from contact with the forms shall be precast mortar blocks of approved shapes and dimensions. Layers of bars shall be separated by precast mortar blocks or by other equally suitable devices. The use of pebbles, pieces of broken stone or brick, metal pipe and wooden blocks shall not be permitted. Unless otherwise shown on the Plans or 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 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 1.8 m intervals.

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 280(40)	Grade 420(60)	But not less than
Tension	24 bar dia.	36 bar dia.	300mm
Compression	20 bar dia.	24 bar dia.	300mm

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.

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.

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.

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	Reinforcing Steel	Kilogram

XI. STRUCTURAL CONCRETE

Description

Scope

This Item shall consist of furnishing, 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.

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.

Material Requirements

Portland Cement

It shall conform to all the requirements of Subsection 311.2.1.

Fine Aggregate

It shall conform to all the requirements of Subsection 311.2.2.

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 P	Class Seal
63	2-1/2"					
50	2"	100	100			
37.5	1-1/2"	95-100	-			100
25	1"	-	35-70		100	95-100
19.0	¾"	35-70	-	100	-	-
12.5	½"	-	10-30	90-100	-	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.

Reinforcing Steel

It shall conform to the requirements of Item 710, Reinforcing Steel and Wire Rope.

Admixtures

Admixtures shall conform to the requirements of Subsection 311.2.7.

Curing Materials

Curing materials shall conform to the requirements of Subsection 311.2.8.

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. Preformed Fillers, conforming to AASHTO M 213.

Elastomeric Compression Joint Seals

These shall conform to AASHTO M 220.

Elastomeric Bearing Pads

These shall conform to AASHTO M 251 or Item 412 – Elastomeric Bearing Pads.

Storage of Cement and Aggregates

Storage of cement and aggregates shall conform to all the requirements of Subsection 311.2.10.

Sampling and Testing of Structural Concrete

As work progresses, at least one (1) sample consisting of three (3) concrete cylinder test specimens, 150 x 300 mm, 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	T141
Weight per cubic metre and air content (gravi-metric) of concrete	T121
Sieve analysis of fine and coarse aggregates	T27
Slump of Portland Cement Concrete	T119
Specific gravity and absorption of fine aggregate	T84

Tests for strength shall be made in accordance with the following:

Making and curing concrete compressive and flexural tests specimens in the field	T23
Compressive strength of molded concrete Cylinders	T22

Production Requirements

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 m^3 40kg/(bag**)	Maimum Water/ Cement Ratio Kg/kg	Consistency Range in Slump Mm	Designated Size of Coarse Aggregates Square Opening Std. mm	Minumum Compressive Strength of 150x300 mm Concrete Cylinder Speciment at 28 Days MN/m^2
A	364 (9.1 bags)	0.53	50-100	37.5-4.75 (1-1/2" – No. 4)	20.7
B	320 (8 bags)	0.58	50-100	50-4.75 (2" – No. 4)	16.5
C	380 (9.5 bags)	0.55	50-100	12.5-4.75 (1/2" – No. 4)	20.7
P	440 (11 bags)	0.49	100 max.	19.0-4.75 (3/4" – No. 4)	37.7
Seal	380 (9.5 bags)	0.58	100-200	25 – 4.75 (1" – No. 4)	20.7

* The measured cement content shall be within plus or minus 2 mass percent of the design cement content.
** Based on 40 kg/bag

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.

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.

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 inplace 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 1.5 m or less. For mixers having a capacity greater than 1.5m^3, 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 (1) 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 insure 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 (1) mass percent for cement, one and a half (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 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 m^3 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 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 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 32oC, this limit shall be reduced to 15 minutes. The limitation in time between the introduction of the cement to the aggregate and the beginning of the mixing may be waived when, in the judgement of the Engineer, the aggregate is sufficiently free from moisture, so that there will be no harmful effects on the cement.

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

5. Transporting Mixed Concrete

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

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

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

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

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

6. Delivery of Mixed Concrete

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

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 100 mm in diameter or by reinforcing steel, anchors, conduits, weep holes or expansion joint materials.

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
	Structural Concrete, Class A	Cubic Meter

XII. FORMWORKS AND FALSEWORKS

Description

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

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 in between 15% to 20%. Low moisture content means the timber is very dry thus it can absorb moisture from the wet concrete resulting to 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 timber formworks though painting the 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 fiber board.

For metal forms, it is important that the metal used as sheating should be free from rust and nonreactive to concrete or concrete containing calcium oxide. Plywood or 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.

Construction Requirements

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 surfaces 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 shall be 2.5 mm or 3 mm thick or of such thickness that the forms remain true to shape. For timber formworks plywood is used for sheating 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 the 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 4 mm.

The design and construction of the formworks and falseworks shall be the responsibility of the Contractor and for 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.

Fabrication and Erection

Formworks to be used shall conform to ACI 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 designed to withstand concrete pressures without bulging, spreading, or lifting of the forms. The forms shall produce finished surfaces that are free from off-sets, 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 designed 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 concrete columns shall be formed in a way that the 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 at 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 a screed or template. At horizontal construction joints in 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 at other points in order to facilitate cleaning and inspection prior to concrete placement. Unless otherwise shown on the drawings, 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 for exposed surfaces and all steel forms shall be coated with non- staining form release agent which shall be applied just prior to placement of steel reinforcement. After coating with industrial lubricants such as form oil, any surplus form 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 measure shall be taken to ensure acceptable lines and surface to required dimensions and cross 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.

Foundations for Formwork

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.

Safety

Forms must be strong and sound (made of good quality and durable materials) in order to carry the full load and side pressure from 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 Formwork 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.

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 of covering providing adequate air circulation and free from dirt. Store and handle form coating to prevent contamination in accordance with manufacturer's recommendation.

For maintenance of the forms, use stiff brush and clean water for the 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.

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 live 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 StructuralMember	Period of time (days)	Minimum % of Design Strength
Walls, column and vertical sides of beams	1 to 2	70%
Beam soffits (steel formwork props/shoring 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 up to 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 to 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 form 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.

Removal of Forms for Special Structures

In continuous structures, support should not be released in any span until the first and second adjoining spans on each side have reached the specified strength. For prestressed concrete construction, pre-tensioning and post- tensioning of strands, cables or rods can be done with or without side forms of the member in place. Bottom forms and supporting shores or falsework should remain in place until the member is capable of supporting its dead load and anticipated construction loads, as well as any formwork carried by the member. Side forms that remain in place during the transfer of pre-stressing force should be designed to allow for vertical and horizontal movements of the cast member during the prestressing operation. In all cases, the deflections of members due to pre-stressing force and the elastic deformation of forms or falsework should be considered in the design and removal of the forms. For reasons of safety, when using post-tensioned, cast-in-place elevated slabs, the Contractor should be careful to ensure that supporting shores do not fall out due to lifting of the slab during tensioning. For large structures where the dead load of the member remains on the formwork during pre-stressing, displacement of the dead load toward end supports should be considered in the design of the forms and shoring, including sills or other foundation support.

For concrete structures with direct or indirect contact with sea water, sea water or brackish water shall not come in direct contact with concrete prior to the age in days indicated in the Table shown below.

Requirements for the Removal of Formwork for Concrete InContact with Sea Water or Brackish Water	
Water Salinity (ppm dissolved salts) (parts per million or mg/L of dissolved salts)	**Days to Elapse prior to Salt Water Contact (days)**
0 to 10,000	Normal Curing
10,000 to 20,000	15
20,000 to 30,000	25
Over 30,000	30

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.

Method of Measurement

Forms installed for the cast-in-place concrete in accordance to shop drawings and design calculations shall be measured in square meters or when the contract stipulates that the payment for formworks and falseworks will be on lump sum basis, the Pay Item will include all materials and components used for furnishing, fabrication, installation, erection and removal of forms. The quantity to be paid for shall be the square meters of formwork used and accepted by the Engineer or the lump sum bid price in the Contract.

Basis of Payment

The quantity measured as prescribed above shall be paid for at the Contract Unit Price or lump sum 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	Description	Unit of Measurement
	Formworks and Falseworks	Square Meter

XIII. PILING

Description

Scope

This Item shall consist of piling, furnishing, driving, placing, cutting and splicing in accordance with the Plans and this Specification.

Test Piles

The Contractor shall drive the test pile at the location indicated on the Plans and it shall be considered as one of the regular piles. The Contractor shall furnish the test piles of the required dimensions and shall be driven up to refusal. Test piles shall be driven with the same hammer to be used for driving regular piles.

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

Load Tests

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

When load tests are specified, the number and location of piles to be tested will be designated by the Engineer or as indicated on the Plans. Load tests shall be done by methods specified in the Plans. The Contractor shall submit to the Engineer for the approval of the detailed Plans of the loading apparatus he intends to use. The apparatus shall allow the various increments of the load to be placed gradually without vibration to the piles to be tested. If the approved method requires the use of tension or anchor piles, the same shall be of the same type and diameter as the permanent piles and shall be driven in the location of permanent piles when feasible. Piles that are not part of the permanent structure shall be removed or cut-off at least 300 mm below the bottom of the footing or finished elevation of the ground upon completion of the test load. Permanent piles used as anchor piles which are raised during the test load shall be re-driven to the original grade and bearing as specified in the Plans.

Static Pile Testing

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

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

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

Each load increment shall be held for an interval of 2 ½ min. Each succeeding increment shall be as directed by the Engineer or as shown on the Plans and shall be applied immediately after the 2 ½ min interval readings have been made.

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

ground, pumping shall cease. Gross settlement readings, loads and other data shall be recorded immediately after pumping has ceased and again after an interval of 2 ½ min for a total period of 5 min. All loads shall then be removed and the member allowed to recover. Gross settlement readings shall be made immediately after all loads have been removed and at each interval of 2 ½ min for a total period of 5 min.

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

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

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

Dynamic Pile Testing

Pile testing shall be done by Bearing Capacity Test by means of High-Strain Pile Dynamic Test Method, and Pile Integrity Test by means of Cross-Hole Sonic Logging Test (CSL) Method or Low-Strain Pile Dynamic Test Method.

Bearing Capacity Test shall be conducted at locations of piles to be tested as specified in the Plans or designated by the Engineer to determine/check the actual bearing capacity of the completed bored piles against the required ultimate bearing capacity. For buildings, at least 5% of the total number of bored piles shall be tested. The total number of bored piles to be tested in a particular project shall be indicated on the Plans and included in the summary of quantities. Additional tests may be conducted upon recommendation of the Engineer where deemed necessary. The testing of bored pile foundation shall be undertaken on the first completed pile in a particular foundation. Construction of succeeding similar piles may be allowed only after acceptance of the test pile based on the results of bearing capacity test.

Pile Integrity Test shall be conducted on at least 50% of the total number of bored piles at the entire foundation area of the project to verify and check the actual length and the concrete homogeneity, and to locate/evaluate any irregularity in the completed bored piles.

1. Low-Strain Dynamic Method

Pile integrity testing by Low-Strain Dynamic Method shall conform to ASTM D5882, Standard Test Method for Low Strain Impact Integrity Testing of Deep Foundations. It is a so-called Low Strain Method, since it requires the impact of only a small hand-held hammer, and also referred to as a Non-Destructive Test Method.

2. High-Strain Dynamic Testing

Bearing Capacity Testing by High-Strain Dynamic Method using Pile Driving Analyzer (PDA) or equivalent method shall conform to ASTM D4945, Standard Test Method for High-Strain Dynamic Testing of Deep Foundations. High-Strain Dynamic Method shall be applied to confirm the design parameters and capacities assumed for the piles as well as to confirm the normal integrity of testing of the piles. It is considered supplemental to the low-strain and sonic- type integrity testing of the cast-in-place piles. It is a relatively non-destructive quick test and it is intended that the test shaft be left in a condition suitable for use in production. The shaft used for the test shall be instrumented and tested by the testing specialist, as approved by the Engineer, meeting requirements in accordance to ASTM D4945.

3. Cross-Hole Sonic Logging of Bored Holes

Cross-hole Sonic Logging Test (CSL) using Cross-Hole Sonic Analyzer is a downhole variation of the ultrasonic-pulse velocity test. The methodology and equipment shall conform to ASTM D6760, Standard Test Method for Integrity Testing of Concrete Deep Foundations by Ultrasonic Cross-Hole Testing. This test is recommended for bored piles with embedded length of more than 30 m.

By sending ultrasonic pulses through concrete from one probe to another (probes located in parallel tubes), the Cross-hole Sonic Logging (CSL) procedure inspects the drilled shaft structural integrity, and extent and location of defects. Defects indicated by late pulse arrival times and significantly lower amplitude/energy signal shall be immediately reported to the Engineer. For equidistant tubes, uniform concrete yields consistent arrival times with reasonable pulse wave speed and signal strengths. Non-uniformities such as contamination, soft concrete, honeycombing, voids, or intrusions of foreign objects exhibit delayed arrival time with reduced signal strength.

1052.1.4 Timber Pile Bearing Value by Formula

When load tests are called for in the Bill of Quantities and when diesel or other hammers to be calibrated are used, the minimum number of hammer blows per unit of pile penetration needed to obtain the specified bearing value of piles shall be determined by load tests, as provided in Subsections 1052.1.2 and 1052.1.3. In the absence of load tests, the safe bearing value of each timber pile shall be determined by whichever of the following approximate formulas is applicable:

$$\text{For gravity hammer, } P = \frac{1000}{6} \times \frac{WH}{S+25.4}$$

For single-action steam or air hammers, and for diesel hammers having unrestricted rebound of ram,

$$P = \frac{1000}{6} \times \frac{WH}{S+2.54}$$

For double-action steam or air hammers, and diesel hammers having enclosed ram,

$$P = \frac{1000}{6} \times \frac{E}{S+2.54}$$

For diesel or steam hammers on very heavy piles,

$$P = \frac{1000}{6} \times \frac{E}{S+2.54(Wp/W)}$$

Where:

P	=	Safe load per pile in Newton or kg
W	=	Weight of the striking part of the hammer in Newton or kg
H	=	Height of fall of ram in meters
S	=	Average penetration per blow in mm for th e last 5 to 10 blows for gravity hammers and the last 10 to 20 blows for steam hammers
E	=	Hammer energy, N.m or kg.m
Wp	=	Weight of pile

The above formula shall be applicable only when:

1. The hammer has a free fall.
2. The head of the pile is free from broomed or crushed wood fiber or other serious impairment.
3. The penetration is reasonably quick and uniform.
4. There is no measurable bounce after the blow.
5. A follower is not used.

If there is a measurable bounce, twice the height of bounce shall be deducted from H to determine its value in the formula.

The bearing power as determined by the appropriate formula listed in this Subsection, will be considered effective only when it is less than the crushing strength of the pile. Other recognized formulas may be used if fully detailed in the Special Provisions.

When bearing power is determined by a formula, timber piles shall be driven until a computed safe bearing power of each is not less than 18 t.

Concrete and Steel Pile Bearing Values

The bearing values for concrete and steel pile will be determined by the Engineer using the following formulas:

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

$$Ru = \frac{2WH\ (W)}{}$$

$$\frac{(S+K)\,(W+Wp)}{}$$

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

Where:

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

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

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

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

where:

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

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

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

Table 1052.1 Values of C1 for Hiley Formula Temporary Compression Allowance C1 for Pile Head and Cap

Materials towhich blow is applied	Easy Driving: P1 = 3.45 MPa on Pile Butt If no cushion, mm	Medium Driving: P1 = 6.90 MPa on Head or Cap. mm	Hard Driving: P1 = 10.34 MPa on Head or Cap. mm	Very Hard Driving:P1 = 13.88 MPa on Head or Cap. mm
Head of timber pile	1.27	2.54	3.81	5.08
76–100 mm packing inside cap on head of precast concrete piles	1.27 + 1.778b	2.54 + 3.81b	3.81 + 5.588b	5.08 + 7.62b
Concrete Pile	0.635	1.27	1.905	2.54
Steel-covered cap containing wood packing but steel piling at pipe.	1.016	2.032	3.048	4.064
4.76 mm red electrical tuber disk between 2 mm - 10 mm steel plates, for use with severe driving on Monotube pile	0.508	1.016	1.524	2.032
Head of steel piling of pipe	0	0	0	0

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

P1 = Ru/A

Table 1052.2 Values of Efficiency of Hammer, ef

Hammer Type	ef
Drop Hammer released by trigger	1.00
Drop Hammer actuated by rope and friction winch	0.75

McKiernan-Terry Single-acting hammers	0.85
Warrington-Vulcan Single-acting hammers	0.75
Differential-acting hammers	0.75
McKiernan-Terry, Industrial B. Ownhoist, National and Union double-acting hammers	0.85
Diesel Hammers	1.00

Table 1052.3 Values of Coefficient of Restitution, n

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

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

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

Safe Loads

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

Jetted Piles

The safe bearing capacity of jetted piles shall be determined by actual tests or by the appropriate methods and formulas given in the preceding Subsections. No jet shall be used during the test blows.

Micropiles

These are cast-in-place piles with maximum diameter of 300 mm or as indicated on the Plans. They are constructed using high strength small diameter casing, grouted, and installed thread bars. The thread on the bars ensures grout to bond with steel as well as to allow the bar to be cut at any point and joined with a coupler to provide full tension/compression capacity. Typically the casing is advanced to the design depth using a drilling technique. Reinforcing steel in the form of an all-thread bar is typically inserted into the micropile casing, however, deformed bars maybe used when the length are commercially available. Further, deformed reinforcing steel bars are threaded to join using a coupling to obtain the designed length. The casing may extend to the full depth with the reinforcement above the bond zone with the reinforcing bars extending to the full depth. The finished micropile shall resist compression, uplift or tension loads and lateral loads.

Micropiles shall be used as alternatives to conventional piles and as anchors in retaining systems and slopes. Particularly, micropiles are suitable for:

1. Supporting structural loads at sites with restricted access or low headroom.
2. Retrofitting/rehabilitating distressed structures.
3. Underpinning.
4. Excavation and retention systems with restricted access.
5. Seismic retrofit.
6. Expansive soils.

The Contractor shall supply, install and test micropiles including all necessary operation requirements as shown on the Plans or specified herein.

Material Requirements

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

Untreated Timber Piles

Structural timber, lumber and piling shall conform to the applicable requirements of AASHTO M 168, Standard Specification for Wood Products or equivalent specification. No boxed heart pieces of Douglas fir or redwood shall be used in outside stringers, floor beams, caps, posts, sills or rail posts. Boxed heart pieces are defined as timber so sawed that any point in the length of a sawed piece, the pith lies entirely inside the four faces.

Yard lumber shall be of the kind and grade called for on the Plans. Round poles and posts shall be of the kind indicated on the Plans.

The species shall be specified on the Plans. Unless otherwise noted on the Plans or Special Provisions, only the best grade shall be used. It shall be free from loose knots, splits, wormholes, decay, warp, ring separation or any defect which will impair its strength or render it unfit for its intended use. Any species specified on the Plans may be used for untreated timber and if the species is not available, a species of equivalent strength and durability may be used if authorized by the Engineer.

Round piles shall be cut above the ground swell and shall taper from butt to tip. A line drawn from the center of the tip to the center of the butt shall not fall outside of the cross-section of the pile at any point more than 1% of the length of the pile.

In short bends, the distance from the center of the pile to a line stretched from the center of the pile above the bend to the center of the pile below the bend shall not exceed 4% of the length of the bend or a maximum of 65 mm.

Unless otherwise specified, all piles shall be peeled removing all rough bark and at least 80% of the inner bark. Not less than 80% of the surface on any circumference shall be clean wood. No strip of inner bark remaining on the pile shall be more than 20 mm wide and 200 mm long. All knots shall be trimmed close to the body of the pile.
The pile sizes shall conform to the dimensions shown in Table 1052.4.

Table 1052.4 Dimension of Piles

Length of Pile	Diameter (1 meter from the Butt)		Minimum Tip Diameter, mm
	Minimum, mm	Maximum, mm	
Less than 12 meters	300	450	200
12 to 18 meters	320	450	200
More than 18 meters	350	500	150

The diameter of the piles shall be measured in their peeled condition. When the pile is not exactly round, the average of three measurements may be used. For any structure, the butt diameters for the same lengths of pile shall be as uniform as possible.

Square piles shall have the dimensions shown on the Plans.

Treated Timber Piles

Structural timber, lumber and piling to be treated shall conform to the applicable requirements of AASHTO M 168, Standard Specification for Wood Products and AASHTO M 133, Standard Specification for Preservatives and Pressure Treatment Processes for Timber or equivalent specification. The minimum penetration of the preservative into the surface of the timber shall be 20 mm. All piles shall retain the minimum amount of preservative specified in Table 1052.5.

Table 1052.5 Minimum Preservative per Cubic Meter of Wood

Use	Type of Processing	
	Empty Cell Process	Full Cell Process
General Use	195 kg	-
Marine Use	-	320 kg

The Engineer shall inspect the timber prior to the treatment to determine conformance with the Specifications and suitability of conditions for treatment. He shall be permitted free access to the plant in order that temperatures, pressures, quantities and type of treatment materials used may be observed. Samples of the creosote or creosote petroleum mixtures shall be furnished as required for test.

The timber shall be checked to determine penetration of treatment, quantity of free preservative remaining on the timber and any visual evidence that the treatment has been performed in a satisfactory manner. The penetration of treatment shall be determined by boring a sufficient number of well-distributed holes to determine the average penetration. All such holes shall be plugged with plugs approximately 2 mm larger in diameter than the bit used in boring the holes.

If the penetration of preservative is less than the required amount, the entire charge, or such parts thereof shall be retreated. If after treatment the penetration is still insufficient, the treated pieces shall be rejected.

Concrete Piles

Concrete shall conform to the requirements of Item 900, Structural Concrete. Concrete shall be Class "C" unless otherwise specified on the Plans.

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

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

Reinforcing steel shall conform to the requirements of Item 902, Reinforcing Steel. Prestressing reinforcing steel shall be high-tensile steel wire conforming to AASHTO M 204M, Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete.

Steel Shells

1. Shells Driven Without a Mandrel

Unless otherwise shown on the Plans or Special Provisions, shells for cast-in- place concrete piles shall have a minimum diameter of 305 mm at cut-off and a minimum diameter of 203 mm at tip: made from not less than 4.55 mm thick plate stock conforming to ASTM A36M, Standard Specification for Carbon Structural Steel. Shells shall either be spirally or longitudinally welded and shall either be tapered or constant in section. Tips shall be sealed as shown on the Plans.

2. Shells Driven With a Mandrel

The shell shall be of sufficient strength and thickness to withstand driving without injury and to resist harmful distortion and/or buckling due to soil pressure after driven and the mandrel removed. Butt and tip dimension shall be as shown on the Plans or Special Provisions.

Steel Pipes Piles / Steel Pipe Sheet Piles

Filled Steel Pipes (filled with concrete) shall conform to the requirements of ASTM A252, Standard Specification for Welded and Seamless Steel Pipe Piles. Closure Plates for closed piles shall conform to the requirements of ASTM A36M.

Unfilled Tubular Steel Piles shall conform to the requirements of ASTM A252, with chemical requirements meeting ASTM A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless, Grade B. The wall thickness shall not be less than 4.76 mm.

Reinforcing Bar Stud for connection between top slab concrete and steel pipe piles and steel pipe sheet piles shall conform to Item 902, Reinforcing Steel.

The materials for concrete and grout shall conform to Item 900, Structural Concrete. The Concrete shall be Class P as specified in Subsection 900.1.2, Classes and Uses of Concrete of Item 900, Structural Concrete unless otherwise shown on the Plans or specified in the Special Provisions. The grout shall consist of Portland cement, water and an expansive admixture approved by the Engineer.

Steel H-Piles

Steel H-Piles shall be rolled steel sections of the weight and shape shown on the Plans. They shall be structural steel meeting the requirements of ASTM A36M provided that, where the Special Provisions called for copper-bearing structural steel, the steel shall not contain less than 0.2% nor more than 0.35% of copper, except that steel manufactured by the acid bessemer process shall not be used.

Steel Sheet Piles

Steel sheet piles shall meet the requirements of AASHTO M 202 (ASTM A328), Standard Specification for Steel Sheet Piling or ASTM A572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel. The joints shall be practically water-tight when the piles are in place.

Polyvinyl Chloride (PVC) Sheet Piles

PVC sheet piles shall meet the requirements of ASTM D638, Standard Test Method for Tensile Properties of Plastics, ASTM D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials, ASTM D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics, and ASTM D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position. The joints shall be practically water-tight when the piles are in place.

Pile Shoes

Pile shoes shall be as called for on the Plans. Steel pile shoes shall be fabricated from cast steel conforming to ASTM A148, Standard Specification for Steel Castings, High Strength, for Structural Purpose.

When shoes are required by soil conditions, piles shall conform to the approved steel shoes to ensure a firm uniform contact and prevent local stress concentrations.

Splices

Full length piles shall be used when practicable; but if splices cannot be avoided, piles or shells for cast-in-place piles may be spliced in accordance with the requirements of the Plans. Piles shall not be spliced except with the approval of the Engineer.

Paint

Paint shall conform to Item 1032, Painting, Varnishing and Other Related Works.

Mortar for Steel Pipe Piles/Steel Pipe Sheet Piles

Mortar shall consist of sand, cement, and water conforming to the requirements given under Item 1710, Riprap and Grouted Riprap, mixed in the proportion of one-part cement to three-parts sand by volume, and sufficient water to obtain the required consistency.

Slurry

The mineral slurry shall be premixed thoroughly with clean fresh water and adequate time allotted for hydration prior to introduction into the shaft excavation. Adequate slurry tanks shall be required when specified. No excavated slurry pits shall be allowed when slurry tanks are required on the project without written permission of the Engineer. Adequate desanding equipment shall be required when specified. Steps shall be taken as necessary to prevent the slurry from "setting up" in the shaft excavation, such as agitation, circulation, and adjusting the properties of the slurry.

Control tests using suitable apparatus shall be carried out by the Contractor on the mineral slurry to determine density, viscosity, and pH. An acceptable range of values for those physical properties is shown in Table 1052.6.

Table 1052.6 Range of Values (At 20°C)

Property Units	Time of Slurry Introduction	Time of Concreting (In Hole)	Test Method
Density (KN/m3)	10.10 to 10.86	10.10 to 11.79	Density Balance
Viscosity (s/L)	28 to 45	28 to 45	Marsh Cone
pH	8 to 11	8 to 11	pH Paper or Meter

Note:
a. Increase density values by 0.314 KN/m3 in salt water.

b. If desanding is required; sand content shall not exceed 4% (by volume) at any point in the shaft excavation as determined by the American Petroleum Institute sand content test.

Tests to determine density, viscosity and pH values shall be done during the shaft excavation to establish a consistent working pattern.

Construction Requirements

Location and Site Preparation

Piles shall be driven where indicated on the Plans or as directed by the Engineer.

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

Determination of Pile Length

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

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

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

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

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

The bottom of piles shall be embedded at least three times the diameter (3D) into hard strata with an N-Value of at least 40 capable of developing the required ultimate bearing capacity, if the above condition cannot be met during construction, the designer shall be notified for adjustment of pile length if necessary.

The Contractor shall be responsible for obtaining the correct pile length and bearing capacity according to the agreed criteria indicated in this Specification.

Pile Driving

All piles shall be driven as shown on the Plans. Piles shall be driven within an allowed variation of 20 mm per meter of pile length from the vertical or batter as shown on the Plans. The maximum allowable variation at the butt end of the pile shall be 75 mm in any direction from

the location shown on the Plans. Each pile, after driving, shall be within 150 mm from the theoretical location underneath the pile cap or underneath the superstructure in case of pile bents. All piles pushed up by the driving of adjacent piles or any other cause shall be re-driven.

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

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

The plant and equipment furnished for steam hammers shall have sufficient capacity to maintain, under working condition, the pressure at the hammer specified by the manufacturer. The boiler or pressure tank shall be equipped with an accurate pressure gauge and another gauge shall be supplied at the hammer intake to determine the drop in pressure between the gauges. When diesel hammers or any other types requiring calibration are used, they shall be calibrated with test piling and/or test loads in accordance with Subsection 1052.1.2, Test Piles.

Water jets shall be used only when permitted in writing by the Engineer. When water jets are allowed, the number of jets and the nozzle volume and pressure shall be sufficient to clear the material adjacent to the pile. The ultimate pile capacity shall be determined from the results of driving after the jets have been withdrawn. The pump shall have sufficient capacity to deliver a pressure equivalent to at least 690 KPa for two 19 mm diameter jet nozzles. The jets shall be shut off before the required penetration is reached and the piles shall be driven solely by hammers to final penetration as required by the Engineer.

Piles shall be supported in line and position with leads while being driven. Pile driving leads shall be constructed in such a manner as to afford freedom of movement of the hammer, and shall be held in position by workers or steel braces to ensure rigid lateral support to the pile during driving. The leads shall be of sufficient length to make the use of a follower unnecessary and shall be so designed as to permit proper placing of batter piles. The driving of the piles with followers shall be avoided if practicable and shall be done only under written permission from the Engineer.

The method used in driving piles shall not subject them to excessive and undue abuse producing crushing and spalling of the concrete, injurious splitting, splintering and brooming of the wood or deformation of the steel. Manipulation of piles to force them into proper position if considered by the Engineer too excessive will not be permitted.

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

Full length piles shall be used where practicable. Splicing of piles when permitted, shall be in accordance with the provisions of Subsection 1052.3.7 and 1052.3.9. All piles shall be continuously driven unless otherwise allowed by the Engineer.

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

Timber Piles

Piles shall be strapped with three (3) metal straps: one about 450 mm from the butt, one about 600 mm from the butt, and the third, about 300 mm from the tip. Additional straps shall be provided at about 4.5 m on centers between tip and butt. Strapping shall encircle the pile once and be tensioned as tightly as possible. Straps shall be 38 mm wide, 0.8 mm thick, cold rolled, fully heat treated, high tensile strapping, painted and waxed. Treated piles shall be strapped after treatment.

Point protection shall be considered for all timber piles. Where timber piles must penetrate dump fill, or may encounter obstructions or be driven to hard strata, point protection shall be used. A boot that encompasses and utilizes the entire end area of the pile is preferred.

Timber Pile Bents

Piles for any one (1) bent shall be carefully selected as to size, to avoid undue bending or distortion of the sway bracing. Care shall be exercised in the distribution of piles of various sizes to obtain uniform strength and rigidity in the bents of any given structure. Cut offs shall be made accurately to ensure full being between caps and piles of bents.

1052.3.6 Precast/Prestressed Concrete Piles

Precast concrete piles shall be of the design shown on the Plans. The method of prestressing to be used shall be optional with the Contractor subject to all requirements hereinafter specified.

The Contractor, prior to casting any members to be prestressed, shall submit to the Engineer for approval complete details of the methods, materials and equipment he proposes to use in the prestressing operations. Such details shall outline the method and sequence of stressing, complete specifications and details of the prestressing, steel and anchoring devices proposed for use, anchoring stresses, type of enclosures and all other data pertaining to the prestressing operations, including the proposed arrangement of the prestressing units in the members, pressure grouting materials and equipment.

The piles shall be caste separately and concrete in each pile shall be placed continuously. The completed piles shall be free from stone pockets, honeycombs, or other defects, and shall be straight and true to the form specified. The forms shall be true to line and built of metal, plywood or dressed lumber. A 25 mm chamfer strip shall be used in all corners. Form shall be water-tight and shall not be removed until at least 24 h after the concrete is placed.

Piles shall be cured and finished in accordance with Subsection 900.3.13, Curing Concrete of Item 900, Structural Concrete.

Cylinder specimens shall be made and tested in accordance with Item 900, Structural Concrete. Piles shall not be moved until the tests indicate that the concrete has attained a compressive

strength of at least 80% of the design 28- day compressive strength and they shall not be transported or driven until the design 28-day compressive strength has been attained.

If testing equipment is not available, as in isolated areas, piles shall not be moved until after 14 days after casting and shall not be transported or driven prior to 28 days after casting. If high early strength cement is used, piles shall not be moved, transported or driven prior to 7 days after casting.

When concrete piles are lifted or moved, they shall be supported at the points shown on the Plans; if not shown, they shall be supported at the quarter points.

Cast-in-place Concrete Piles

1. Drilled Holes

All holes for concrete piles shall be drilled dry to tip elevation as shown on the Plans. Suitable casings shall be furnished and placed when required to prevent cave-in before concrete is placed.

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

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

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

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

2. Steel Shells and Pipes

The inside of shells and pipes shall be cleaned and all loose materials removed before concrete is placed. The concrete shall be placed in one continuous operation from tip to cut-off elevation and shall be carried on in such a manner as to avoid segregation.

The top 3 m of concrete filled shells, or to the depth of any reinforcing cage, whichever is greater, shall be consolidated by acceptable vibratory equipment.

Pipes shall be of the diameter shown on the Plans. The pipe wall thickness shall not be less than that shown on the Plans but in no case less than 5 mm. The pipe, including end closures, shall be of sufficient strength to be driven by the specified methods without distortion.

Closure plates and connecting welds shall not project more than 12.5 mm beyond the perimeter of the pile tips.

No shell or pipe shall be filled with concrete until all adjacent shells, pipes, or piles within a radius of 1.5 m or 4 ½ times the average pile diameter, whichever is greater, have been driven to the required resistance.

After a shell or pipe has been filled with concrete, no shell, pipe or pile shall be driven within 6 m thereof until at least seven (7) days have elapsed.

3. Drilled Shafts

Drilled shafts shall be deep foundations formed by boring a cylindrical hole into soil and/or rock and filling the hole with concrete. Drilled shafts are also commonly referred to as caissons, bored piles or drilled piers.

Drilled shafts, like driven piles, transfer structural loads to bearing stratum well below the base of the structure by passing soils having insufficient strength to carry the design loads.

Drilled shafts shall be classified according to their primary mechanism for deriving load resistance either as floating shafts (i.e., shafts transferring load primarily by side resistance), or end-bearing shafts (i.e., shafts transferring load primarily by tip resistance). Occasionally, the bases of shafts shall be enlarged (i.e., belled or underreamed) to improve the load capacity of end bearing shafts on less than desirable soils, or to increase the uplift resistance of floating shafts.

Effects of ground and ground water conditions on shaft construction operations shall be considered and delineated, when necessary. Because shafts derive their capacity from side and tip resistance which are a function of the condition of the materials in direct contact with the shaft, it is important that the construction procedures be consistent with the material conditions assumed in the design. Softening, loosening or other changes in soil and rock conditions caused by the construction method could result in a reduction in shaft capacity and an increase in shaft displacement. Therefore, evaluation of the effects of shaft construction procedure on load capacity shall be considered an inherent aspect of the design.

Drilled shafts shall be normally sized in 15.24 cm diameter increments with a minimum diameter of 45.72 cm. The diameter of a shaft socketed into rock shall be a minimum of 15.24 cm larger than the socket diameter. If a shaft must be inspected by the entry of a person, the shaft diameter shall not be less than 76.20 cm.

Drilled shafts constructed in dry, non-caving soils can usually be excavated without lateral support of the hole. Other ground conditions where caving, squeezing or sloughing soils are present require installation of a steel casing or use of a slurry for support of the hole. Such conditions and techniques may result in loosening of soil around the shaft, or altering of frictional resistance between the concrete shafts and surrounding soil.

The center-to-center spacing between shafts is normally restricted to a minimum of 3B to minimize the effects of interaction between adjacent shafts during construction or in service. However, larger spacing may be required where drilling operations are difficult or where construction must be completed in very short time frames.

Particular attention shall be given to the potential for deposition of loose or wet material in the bottom of the hole, or the buildup of a cake of soft material around the shaft perimeter prior to concrete placement. Adequate cleaning and inspection of rock sockets shall always be performed to assure good contact between the rock and shaft concrete. If good contact along the shaft cannot be confirmed, it may be necessary to assume that all load is transferred to the tip. If the deposition of soft or loose material in the bottom of the hole is expected, the shaft may have to be designed to carry the entire design load through side resistance.

A number of methods can be used to prevent cave-in during the drilling of holes and the placement of concrete. It is preferred that drilled shafts be constructed in stable non-sloughing soil without excessive ground water. If impossible, consider the following three different construction methods:

a. The construction of the pile or shaft in a wet condition while the walls of the excavation are stabilized by hydrostatic pressure of water or a mineral slurry until the concrete is placed by tremie methods for the full length of the pile. This method consist of using water or mineral slurry to maintain stability of the hole perimeter while advancing the excavation to final depth, placing the reinforcing cage and concreting the shaft.

Mineral slurry used in the drilling process shall have both a mineral grain size that will remain in suspension and sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system. The percentage and specific gravity of the material used to make the suspension shall be sufficient to maintain the stability of the excavation and to allow proper concrete placement. The level of the slurry shall be maintained at a height sufficient to prevent cave-in of the hole.
Prior to placing shaft concrete, slurry samples shall be taken from the bottom and at intervals not exceeding 3.05 m for the full height of slurry. Any heavily contaminated slurry that has accumulated at the bottom of the shaft shall be eliminated. The mineral slurry shall be within Specification requirements immediately before shaft concrete placement.

Excavation Inspection

The Contractor shall provide equipment for checking the dimensions and alignment of each shaft excavation. The Contractor under the direction of the Engineer shall determine the dimensions and alignment of the drilled shaft. Final shaft depth shall be measured prior to concrete pouring.

The base of the shaft excavation may be cleaned using a cleaning bucket followed by airlifting clean-up method. Reverse circulation techniques may also be used to clean the base of the shaft.

The shaft excavation shall be cleaned so that a minimum of 50% of the base will have less than 12.5 mm of sediment and at no place on the base more than 37.5 mm of sediment. The Engineer will determine shaft cleanliness.

b. The use of steel casing which is installed during drilling operations to hold the hole open and usually withdrawn during concrete placement.

Casing, if used in operation, shall be metal, smooth, clean, watertight, and of ample strength to withstand both handling and driving stresses and the pressure of both concrete and the surrounding earth materials. The outside diameter of casing shall not be less than the specified size of the shaft. It shall conform to ASTM A709, Standard Specification for Structural Steel for Bridges, Grade 36 unless otherwise specified.

Temporary casings shall be removed while the concrete remains workable. Generally the removal of temporary casing shall not be started until concrete placement in the shaft is at or above ground surface. Movement of casing by rotating, exerting downward pressure and tapping to facilitate extraction or extraction with a vibratory hammer shall be permitted. Casing

extraction shall be at a slow, uniform rate with the pull in line with the shaft axis.

A sufficient head of concrete shall be maintained above the bottom of the casing to overcome the hydrostatic pressure of water or drilling fluid outside of the casing.

c. The use of a permanent casing which is left in place within the portion of the pile which is in unstable material.

A permanent casing is applied as protection from the presence of surface water during drilling and as support later for the installation of the rebar cage and as a concrete form in drilling under water.

Standard weight pipe shall be furnished unless otherwise shown on the Plans.

Reinforcing Steel Cage Construction and Placement

The reinforcing steel cage consisting of the steel shown on the Plans plus cage stiffener bars, spacers, centralizers and any other necessary appurtenances shall be completely assembled and placed as a unit immediately after the shaft excavation is inspected and accepted prior to shaft concrete placement.

Where the reinforcing cage length is too long for placement as a single unit, the cage may be placed in separate units such that appropriate means of splicing the longitudinal steel is provided for. The Contractor shall submit his Plans for such splices to the Engineer for approval.

The reinforcing steel in the hole shall be tied and supported so that the reinforcing steel will remain within allowable tolerances until the concrete will support the reinforcing steel. When concrete is placed by suitable tubes, temporary hold-down devices shall be used to prevent uplifting of the steel cage during concrete placement. Concrete spacers or other approved noncorrosive spacing devices shall be used at sufficient intervals not exceeding 1.50 m along the shaft to insure concentric location of the cage within the shaft excavation. When the size of the longitudinal reinforcing steel exceeds 25 mm, such spacing shall not exceed 3 m.

Concrete Placement, Curing and Protection

Concrete shall be placed as soon as possible after reinforcing steel cage placement. Concrete placement shall be continuous in the shaft to the top elevation of the shaft. Placement shall continue after the shaft is full until good quality concrete is evident at the top of the shaft. Concrete shall be placed through a suitable tube.
For piles less than 2.5 m in diameter, the elapsed time from the beginning of concrete placement in the shaft to the completion of placement shall not exceed 2 h. For piles 2.50 m and greater in diameter, the concrete placing rate shall not be less than 9 m of pile height per each 2-hour period. The concrete mix shall be of such design that the concrete remains in a workable plastic state throughout the 2-hour placement limit.

When the top of pile elevation is above ground, the portion of the pile above ground shall be formed with a removable form or permanent casing when specified.

The upper 1.5 m of concrete shall be vibrated or rodded to a depth of 1.5 m below the ground surface except where soft uncased soil or slurry remaining in the excavation will possibly mix with the concrete.

After placement, the temporarily exposed surfaces of the shaft concrete shall be cured in accordance with the provision in Subsection 900.3.13, Curing Concrete Item 900, Structural Concrete.

For at least 48 h after pile concrete has been placed, no construction operations that would cause soil movement adjacent to the shaft, other than mild vibration, shall be conducted.

Construction Tolerances:

The following tolerances shall be maintained in constructing drilled shaft:

1. The drilled shaft shall be within 15.24 cm of the plan position in the horizontal plane at the plan elevation for the top of the shaft.

2. The vertical alignment of the shaft excavation shall not vary from the plan alignment by more than 20.83 mm/m of depth.

3. After all the shaft concrete is placed, the top of the reinforcing steel cage shall be no more than 15.24 cm above and no more than 7.62 cm below plan position.

4. When casing is used, its outside diameter shall not be less than the shaft diameter shown on the Plans. When casing is not used, the minimum diameter of the drilled shaft shall be the diameter shown on the Plans for diameters 60.96 cm or less, and not more than 2.54 cm less than the diameter shown on the Plans for diameters greater than 60.96 cm.

5. The bearing area of bells shall be excavated to the plan bearing area as a minimum. All other plan dimensions shown for the bells may be varied, when approved, to accommodate the equipment used.

6. The top elevation of the shaft shall be within 2.54 cm of the plan top of shaft elevation.

7. The bottom of the shaft excavation shall be normal to the axis of the shaft within 62.5 mm/m of shaft diameter.

8. Drilled shaft excavations constructed in such a manner that the concrete shaft cannot be completed within the required tolerances are unacceptable.

Steel Pipe Piles /Steel Pipe Sheet Piles

Steel Pipe Piles and Steel Pipe Sheet Piles (SPPs/SPSPs) shall be driven to the elevation shown on the Plans/Drawings. Where, due to subsurface conditions, it is impractical to drive the piles to design depth, the piles may be stopped at a higher elevation with the written permission of the Engineer. Where, due to subsurface conditions, it is necessary to drive the piles to below the design depth, for normal and low headroom working or other site conditions, the piles may be spliced in accordance with Subsection 1052.3.12(3), Splicing. Where obstacles to driving exist and the Engineer decides that the obstacles may be removed, the Contractor shall extract the piles, remove the obstacles in an approved manner and re-drive the piles.

Steel H-Pile

Steel H-Pile shall consist of structural steel shapes of the sections indicated on the Plans.

When placed in the leads, the pile shall not exceed the camber and sweep permitted by allowable mill tolerance. Piles bent or otherwise damaged shall be rejected.

The loading, transporting, unloading, storing and handling of steel H-pile shall be conducted so that the metal will be kept clean and free from damage.

Unfilled Tubular Steel Piles

The minimum wall thickness shall be as indicated in the following table:

Table 1052.7 Minimum Wall Thickness of Unfilled Tubular Steel Piles

Outside Diameter	Less than 355 mm	355 mm and over
Minimum wall thickness	6.5 mm	9.5 mm

Cutting shoes for piles driven open end may be inside or outside of the pipe. They may be high carbon structural steel with a machined ledged for pile bearing or cast steel with a ledge, designed for attachment with a simple weld.

PVC Sheet Piles

All PVC sheet piles shall be driven as shown on the Plans. If it is determined that the soil conditions warrant a mandrel, then holes shall be drilled in the appropriate locations to bolt the sheets to the top of the mandrel. Drive the initial sheet piles with the male lock leading, since the female lock fill up with soil and hinder driving if used as the leading edge. Make certain that the initial sheets are properly positioned, square and plumb, as it will influence the orientation of subsequent sheets. Also ensure that the sheets are placed up against the pile guide as they

are positioned for driving. The sheets shall be driven as close to plumb as possible. Deviation in plumbness in any direction shall not be more than three (3) degrees.

Splicing

Splicing when permitted shall be made as shown on the Plans and in accordance with this Subsection.

1. Precast Concrete Piles

a. By using prefabricated joints mounted in the forms and cast together with the piles sections and joined together as specified by the manufacturer and approved by the Engineer. The joints shall be of the design and type as specified or shown on the Plans.

By cutting away the concrete at the end of the pile, leaving the reinforcing steel exposed for a length of 40 times bar diameters for corrugated or deformed bars and 60 times bar diameters for plain bars. The final cut of the concrete shall be perpendicular to the axis of the pile. Reinforcement of the same size as that used in the pile shall be spliced to the projecting steel in accordance with Item 902, Reinforcing Steel, and the necessary splice box shall be placed, care being taken to prevent leakage along the pile.

b. By any other method shown on the Plans or approved by the Engineer, curing and finishing of extensions shall be the same as in the original pile.

2. Prestressed Piles

Splicing of prestressed precast piles will generally not be permitted, but when permitted, it shall be made in accordance with (1) above, but only after driving has been completed. Reinforcement bars shall be included in the pile head for splicing to the extension bars. No additional driving shall be permitted. The Contractor, at his option, may submit alternative plans of splicing for consideration by the Engineer.

3. Steel Piles, Shells or Pipes

If the length of the steel pile, shell or pipe driven is insufficient to obtain the specified bearing capacity, an extension of the same cross-section shall be spliced to it. Unless otherwise shown on the Plans, splices shall be made by butt-welding the entire cross-sections to form an integral pile using the electric arc method. The sections connected shall be properly aligned so that the axis of the pile shall be straight. Bent and/or damaged piles shall be rejected.

Cutting Off and Capping Piles

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

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

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

When the cut off elevation for a precast pile or for the steel shell or pile for a cast in place concrete pile is below the elevation of the bottom of the pile cap, the pile may be built-up from the butt of the pile to the elevation of the bottom of the cap by means of reinforced concrete extension constructed in accordance with Subsection 1052.3.12 or as approved by the Engineer.

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

Defective Piles

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

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

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

3. The pile shall be spliced or built-up or as otherwise provided herein on the underside of the footing lowered to the properly embedded pile. Manipulation of piles to force them into proper position, considered by the Engineer to be excessive, shall not be permitted.

A precast concrete pile shall be considered defective if it has a visible crack, extending around the four (4) sides of the pile, or any defect which, in the opinion of the Engineer, affects the strength or life of the pile.

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

Protecting Untreated Timber Trestle Piles

The sawed surface of the heads of untreated piles shall be thoroughly brush- coated with two (2) applications of hot creosote oil or other approved preservative.

Protecting Treated Timber Trestle Piles

All cuts and abrasions in treated timber piles shall be protected by a preservative approved by the Engineer.

Painting Steel Piles

Unless otherwise provided, when required steel piles extend above the ground surface or water surface, they shall be protected by paint as specified for cleaning and painting metal surfaces in accordance with Item 1047, Metal Structures. This protection shall extend from the elevation shown on the Plans to the top of the exposed steel.

Pile Records

The Contractor shall keep records of all piles driven or installed. A copy of the record shall be given to the Engineer within 2 days after each pile is driven. The record form to be used shall be approved by the Engineer. The pile records shall not be limited to the following:

Driven Piles	Cast-In-Place Piles
1. Pile type and dimension 2. Date of casting and concrete quality (for concrete piles) 3. Date of driving 4. Driving equipment: type, weight & efficiency of hammer, etc. 5. Description of cushion on pile head 6. Depth driven and tip elevation 7. Final set for the last 20 blows (for every (ten) 10 piles and when the Engineer so requires the penetration along the whole depth driven shall be recorded) 8. For gravity and single-acting hammers: the height of drop 9. For double acting-hammers - the frequency of blows 10. Details of any interruption in driving 11. Level of pile top immediately after driving and the level when all piles in the group are driven 12. Details of re-driving	1. Date of boring or driving (For steel shell) & casting 2. Date of test 3. Pile identification number, elevation and location 4. Pile type and nominal dimension 5. Length of finished pile and tip elevation 6. Details of penetration during boring or driving of steel shell (driving records as for drivenpiles) 7. Test load achieved 8. Concrete quality and consistency 9. Time interval between boring ordriving and concreting 10. Volume of concrete placed inconcrete 11. Installation logs with supportingdata 12. Instrumentation types and locations 13. Load cell calibrations and instrument calibrations 14. Load vs Displacement graph, plotting load transfer along the length of the pile using instrumentation data 15. The skin friction/adhesion pressure and end bearing shaft bearing pressure at 12 mm displacement of the pile during testing

Micropiles

Drilling Operations

1. Boring near recently Cast Piles

The maximum allowable deviation of center point location for Micropile shall be 40 mm and a verticality of 1:50. Piles shall not be bored next to other piles which have recently been cast within 24 h and contain unset grout.

2. Stability of Drill Holes

The Contractor shall be responsible in providing materials, labour and plant, to maintain the stability of the sides of boreholes during Micropile installation and successful completion of the piles. The Contractor shall submit his proposed methods for boring operations.

Considering the existing ground water, the sides of all borehole shall be kept intact and no loose material shall be permitted to fall into the bottom of the boreholes. The Contractor's boring equipment shall be capable in sinking a steel casing to support the sides of all boring.

If the sides of boreholes are unstable, temporary steel casing shall be driven until the stable stratum is reached. The borehole shall be filled with drilling fluid to a level sufficiently to stabilize the boreholes.

Depth of anchorage shall be as shown on the Plans.

Drill holes shall not be exposed longer than is necessary and shall be covered at all times when work is not in progress. Pile shall be casted within 24 h unless otherwise approved by the Engineer.

In case of a rapid loss of drilling fluid from the borehole excavation causing instability of borehole, the Contractor shall install temporary casing prior to resumption of boring at that location at the expense of the Contractor.

3. Stability of Borehole by Temporary Casing Method

Where the use of temporary casing is required to maintain the stability of a borehole, the bottom of casing shall be kept at a minimum of 1 m below the unstable strata to prevent the caving-in of soil and the formation of cavities in the surrounding ground.

Temporary casings shall be thin-walled mild steel. The dimensions and quality of the casing shall be adequate to withstand pressures to which they will be subjected. The casings shall have an internal diameter not less than the specified pile diameter. The joints of casings shall be watertight.

Grouting Operations

The Contractor shall provide details of the method and equipment to be used in grout mixing. Further information such as grouting pressure, grouting procedure, grouting equipment and technique employed in grouting underwater shall also be furnished for approval.

Grout shall be mixed on site and shall be free from segregation, clumping and bleeding. Grout shall be pumped into its final position in one continuous operation as soon as possible and in no case more than half an hour after mixing.

Micropile shall be grouted in one continuous process. If there is significant loss of grout, the Contractor may choose to carry out pre-grouting in stages as necessary to prevent further loss of grout for the construction of micropile. Method statement for pre-grouting including details of equipment, materials and procedures shall be reviewed and approved by the Engineer. If after the process of pre-grouting and re-drilling of the hole is required, the Contractor shall bear the cost and time of the pre-grouting and re-drilling.

Construction of Pile Heads

When lengthening is required, the pile reinforcement unit shall be connected on site to the details shown on the Plans. Other means of jointing reinforcement shall be to the approval of the Engineer. Pile heads shall be constructed to the details as shown on the Plans.

Standard Load Tests

Load test of two (2) times the working loads shall be carried out on piles designated by the Engineers and in accordance with ASTM D 1143, Standard Test Methods for Deep Foundations Under Static Axial Compressive Load. The Contractor shall submit detailed proposal of the load tests to the Engineer for approval prior to commencement on site. Upon completion of the test, the Contractor shall submit to the Engineer complete results including graphs showing load and settlement versus time, and settlement versus load.

The format of the test report shall be approved by the Engineer which shall contain the following:

1. Pile designation, date completed, weather condition, pile length, pile size, volume of grout intake, time of drilling at intervals not greater than 4 m and time to grout the pile
2. Designation of the apparatus used for testing, loading system and procedure for measuring settlement
3. Field data
4. Time vs Settlement Curve
5. Load vs Settlement Curve
6. Remarks containing unusual event or data and movement of piles
7. Calibration certificates of dial gauges and pressure gauges
8. The format of record shall be approved by the Engineer

Damaged or Displaced Piles

Should the deviation exceed the tolerance provided in the specification, the Contractor shall submit his remedial proposal subject to approval of the Engineer. The faulty pile shall be replaced by additional piles as necessary in position as determined by the Engineer at the expense of the Contractor.

Where piles have not been positioned within the specified limits, no method of forcible correction shall be permitted.

Piling Records

Complete piling records shall be kept by the Contractor during piling works. The Contractor shall submit the following in duplicate copy to the Engineer.

1. Records of all piles as the work proceeds.
2. Upon completion, a record of the work as carried out and as-built drawing.

The format of the record shall be approved by the Engineer and shall contain the following where applicable:

1. Reference number and position of pile
2. Type and dimension
3. Date of boring and nature of strata where each pile is bored
4. Details of the equipment used
5.Ground level and base of excavation level
6. Total penetration
7. Length and position of cavity/cavities in each pile
8. Penetration in rock
9. Time of drilling at intervals not exceeding 5 m
10. Details of all splicing or jointing operations, locations of sleeves, etc.
11. Details of grouting operation for tremie grouting and time tables
12. Weather
13. Top level of pile immediately after completion
14. Errors in position and inclination
15. Amount of grout and the pressure used
16. Size and position of boulder/s in each pile
17. Detailed drilling speed (m/min)
18. Description of drilled material

Method of Measurement

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

Steel, Precast Concrete Piles, Micropile, and Timber Piles

1. Piles Furnished

The quantity to be paid for shall be the sum of the lengths in meters of the piles of the several types and lengths ordered in writing by the Engineer, furnished in compliance with this Specifications and stockpiled in good condition at the project site by the Contractor and

accepted by the Engineer. The length to be paid for shall include test and tension piles ordered by the Engineer, but not those furnished by the Contractor at his option. No allowance shall be made for piles, including test piles, furnished by the Contractor to replace piles previously accepted by the Engineer that are subsequently lost or damaged while in stockpile, or during handling or driving, and are ordered by the Engineer to be removed from the site of work.

In case extensions of piles are necessary, the extension length shall be included in the length of pile furnished, except for cut off lengths used for extensions and already measured for payment.

2. Piles Driven

The quantity to be paid for shall be the sum of the lengths in meters of the piles driven in the completed work measured from the pile tip elevation to the bottom of pile caps, footings or bottom of concrete superstructure in the case of pile bents. Measurement shall not include additional piles or test piles driven that may be necessary to suit the Contractor's method of construction and were driven at his option.

Unless otherwise provided for, preboring, jetting or other methods used for facilitating pile driving operations shall not be measured directly but will be considered subsidiary to Pay Items.

Steel Pipes/Steel Pipe Piles and Steel Pipe Sheet Piles (SPPs/SPSPs)

The quantity to be paid for shall be the sum of actual lengths in meters of the steel pipes/ Steel Pipe Piles and Steel Pipe Sheet Piles (SPPs/SPSPs) left in- place in the completed and accepted work. Measurements shall be by linear meter of installed as Permanent Works as the approved working Plans/drawings and measurement from the design pile tip elevation or higher elevation allowed by the Engineer to the design top level after cut off complete in place and accepted work.

Measurement shall not include additional piles, rejected piles or test piles installed that may be necessary to suit the Contractor's method of construction and installed at his option. All necessary methods of installation and pre-boring, jetting or other methods used for facilitating pile driving operations shall not be measured directly but shall be considered subsidiary to Pay Items.

Steel Pipe Piles and Steel Pipe Sheet Piles (SPPs/SPSPs) to be installed as Temporary Works for the purpose of forming cofferdams or as temporary supports to bridges or staging etc. shall be measured as a Lump Sum and included in the Item B.24 General Scaffolding and Shoring (including Cofferdamming) in Part B. Other General Requirements and strictly in accordance with the requirements, Standard Specifications and Special Specifications included in Part 2- Works Requirements.

Cast-In-Place Concrete Piles

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

PVC Sheet Piles

The quantity to be paid for shall be the sum of actual lengths in meters of the PVC sheet piles furnished and driven in the completed and accepted work measured from the pile tip elevation to the bottom of pile caps. Measurement shall not include additional PVC sheet piles or test piles driven that may be necessary to suit the Contractor's method of construction and were driven at his option.

Pile Shoes

The quantity to be paid for, including test pile shoes, shall be the number of pile shoes driven shown on the Plans or as ordered in writing by the Engineer, furnished by the Contractor in accordance with this Specification and accepted by the Engineer. Pile shoes furnished by the Contractor at his option or to replace those that are lost or damaged in stockpile or handling shall not be measured for payment.

Load Tests

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

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

Splices

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

Permanent Casing

The quantity of permanent casing to be paid for shall be the number of kilograms or meter installed in place and accepted.

Basis of Payment

The accepted quantities, measured as prescribed in Section 1052.4, Method of Measurement shall be paid for at the contract unit price for each of the particular item listed below that is included in the Bill of Quantities, which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment tools and incidentals as well as temporary works, staging areas or craneway necessary to complete the work prescribed in this Item.

Payment shall be made under:

Pay Item	Description	Unit of Measurement
1052 (6)	Structural Steel Sheet Piles, furnished	Meter
1052 (12)	Structural Steel Sheet Piles, driven	Meter
1052 (22)	Load Tests	Each
1052 (28)a	Micro Piles, 0.20	Meter

XXIII. CARPENTRY AND JOINERY WORKS

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.

Material Requirement

Lumber

Lumber of the different species herein specified for the various parts of the structure shall be well-seasoned, sawn straight, sundried or kiln dried and free from defects such as loose unsound knots, pitch pockets, sapwood, cracks and other imperfections impairing its strength, durability and appearance. Jambs, transoms, mullions, headers, sills, frames, and wood base shall be air dried and well-seasoned for at least 2 months before use.

Grades of Lumber and Usage

1. Stress grade is seasoned, close-grained and high quality lumber of the specified specie free from defects and suitable for sustaining heavy loads. Stress grade lumber shall be used for wooden structural member subject to heavy loads, and for sub-floor framing embedded or in contact with concrete or masonry.

2. Select grade lumber of the specified specie is generally of high quality, of good appearance, without imperfections, and suitable for use without waste due to defects and suitable also for natural finish.

3. Select grade lumber shall be used for flooring, sidings, facia and base boards, trims, mouldings, millwork, railings, stairs, cabinet work, shelvings, doors, windows and frames of openings.

4. Common grade lumber has minimum tight medium knot not larger than 25 mm in diameter, with minimal imperfections, without sapwood, without decay, insect holes, and suitable for use with some waste due to minor defects and suitable also for paint finish.

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

Lumber Species and Usage

Unless otherwise specified on the Plans, the following lumber species shall be used as indicated:

1. Yacal (stress grade) for structural member such as post, girders, girts, sleepers door and window frames set or in contact with concrete or masonry.

2. Guijo (select grade) for door and window frames set in wooden framework, for stairs, for roof framing supporting ceramic or cement tiles, for floor joists and other wooden structural parts.

3. Apitong (common grade) for roof framing supporting light roofing materials such as galvanized iron, aluminum, for wall framing, ceiling joists, hangers and nailers.

4. Tanguile (select grade) for door and windows, facia and base boards, trims, mouldings, millwork, railings, stairs, cabinet work, shelvings, flooring siding, ceiling joist, studs, roof framing and nailers.

5. Narra (select grade) for stair railings, flooring boards, wall panels base boards, trims, mouldings, cabinet work, millwork, doors and windows when indicated as such in the Plans.

6. Dao (selected grade) for stair railings, flooring boards, wall panels base boards, trims, mouldings, cabinet work, millwork, doors and windows when indicated as such on the Plans.

Moisture Content

Except otherwise specified, lumber shall be sun-dried, or kiln-dried. At time of installation, the maximum moisture content, expressed as a percentage of the oven-dry wood, shall be as follows:

Rough Carpentry and Framing:
a. Framing lumber 50.80 mm and less in thickness: 19%
b. Framing lumber over 50.80 mm thick: 25%

Interior millwork, finish and trim: 17%

Substitution in Lumber Species

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

Plyboard

Plyboard shall be good grade and made of laminated wood strips of uniform width and thickness bounded together with water resistant resin glue. The laminated core shall be finished both faces with select grade Tanguile or red Lauan veneers not less than 2 mm thick similarly

bonded to the core. The plyboard of not less than 19 mm thick shall be free from defect such as split in veneer, buckling or warping.

Plywood

Plywood shall conform to the requirements of PNS ISO 12465:2017 Plywood – Specifications. Thickness of single layer laminae shall not be less than 2 mm. The laminae shall be superimposed in layers with grains crossing at right angles in successive layers to produce stiffness. The face veneers shall be rotary cut from selected grade timber. The laminae and face veneers shall be bonded with water resistant resin glue, hot pressed and pressure treated.

Two (2) types of plywood based on bonding quality:

1. **Type I (Exterior/Marine Plywood)**

This is intended for ceiling exposed to moisture such as at toilets and eaves, partitions and doors (toilet and bath) and ceiling to be finished with acrytex.

2. **Type II (Interior/Ordinary Plywood)**

This is intended for interior ceiling, doors and partitions shall be of 6 mm thick tanguile plywood, grade "A", three (3) – ply with high water resistant.

Sample for testing shall comply with the applicable requirements of PNS ISO 12466-1:2016 Plywood – Bonding Quality – Part 1: Test Methods and PNS ISO 12466-2:2016 Plywood – Bonding Quality – Part 2: Requirements.

Lawanit

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

Materials Other than Lumber

Plastic Sheet

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

Glue

Glue shall be from water resistant resins which, upon hardening, shall not dissolve nor lose its bond or holding power even when soaked with water for extended period.

Glue in powder form be in sealed container and shall be without evidence of lumping or deterioration in quality.

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 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 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.

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.

Gypsum Board

It shall comply with the applicable requirements of Item 1041, Gypsum Board.

Pre-painted Metal Panel

It shall comply with the applicable requirements of Item 1014, Prepainted Metal Sheets.

Aluminum Metal Cladding

Aluminum for metal cladding shall comply with the applicable requirements of Item 1039, Aluminum Cladding.

Polyvinyl Chloride (PVC)

Polyvinyl Chloride (PVC) shall be made from 100% virgin PVC and Class A fire rating in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

Moulding

Mouldings may be made of steel, wood, PVC, concrete and precast concrete or as indicated on the Plans. It shall match the surface where it shall be built.

Sizes, dimensions, colors, finishes, locations and design details shall be specified on the approved Plans and in accordance with the manufacturer's recommendation.

Modular Partition

Materials for modular partition shall be in accordance with the manufacturer's recommendation and approved by the Engineer.

Sizes, dimensions, color, finishes, descriptions, locations and framing details of modular partition shall be indicated on the approved Plans.

Construction Requirements

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.

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 orderly stack at least 150 mm above ground and sheltered place where it will be of least obstruction to the work.

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.

Rough Carpentry

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

1. Framing shall be stress grade or common grade lumber of the specie specified under Subsection 1003.2.1.2, Lumber Species and Usage.

2. Rough carpentry shall be done true to lines, levels and dimensions. It shall be squared, aligned, plumbed and well fitted at joints.

3. Trusses and other roof framing shall be assembled, fitted and set to exact location and slope indicated on the Plans.

4. Fasteners, connectors and anchors of appropriate type and number shall be provided and fitted where necessary.

5. 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.

6. Timber framing in contact with concrete masonry shall be treated with termite-proofing solution and after drying coated with bituminous paint.

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.

4. Plyboard shall be as specified under Subsection 1003.2.2 unless otherwise indicated on the Plans.

5. Plywood shall be specified under Subsection 1003.2.3.

6. Exposed edges of plywood or plywood for cabinets shall be provided with select grade hardwood strips, rabbeted as necessary, glued in place and secured with finishing nails. To prevent splitting, hardwood for trims shall be drilled before fastening with nails or screws.

7. Fabricated woodwork shall be done preferably at the shop. It shall be done true to details and profiles indicated on the Plans. Where set against concrete or masonry, woodwork shall be installed when curing is completed.

8. Exposed wood surfaces shall be free from disfiguring defects such as raised grains, stains, uneven planning, sanding, tool marks and scratches. Exposed surfaces shall be machine or hand sanded to an even smooth surface, readyto finish.

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 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 wood studs without sheathing. Install building paper over studs prior to installing siding.

Over wood and wood-composite sheathing. Fasten siding through sheathing into studs. For sheathing of 25 mm thickness or less, nail through sheathing into studs using correspondingly longer nails.

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 panel at each stud insuring that at least three (3) screw threads penetrate thestuds.

After installation, seal all joints. Seal around all penetrations.

For finish painting, follow manufacturer's recommendation timeline for painting primed and unprimed products. Paint all exposed cut edges.

Gypsum Board

Installation requirements shall conform to the applicable requirements of Item 1041, Gypsum Board.

Aluminum Metal Cladding

Installation requirements shall conform to the applicable requirements of Item 1039, Aluminum Cladding.

Prepainted Metal Panel

It shall comply with the applicable requirements of Item 1014, Prepainted Metal Sheets.

Moulding

Moulding color finishes shall match the wall or the surface where it will be installed. Cutting details of molding and its installation shall be in accordance with the manufacturer's instructions and detailed drawings approved by the Engineer.

Modular Partition

Installation requirements shall be in accordance with the manufacturer's instructions and detailed drawings approved by the Engineer.

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 standard, specifications and as accepted by the Engineer.

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	Description	Unit of Measurement
	Ceiling, 4.5mm, Metal Frame, Fiber Cement Board	Square Meter

XXIV. WOODEN DOORS AND WINDOW

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 in accordance with the Plans and this Specification and applicable Specifications of Item 1003, Carpentry and Joinery Works.

Material Requirements

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 species indicated on the Plans and/or specified under Item 1003, Carpentry and Joinery Works.

Plywood

Plywood for veneer of solid core and hollow core flush doors shall be 3-ply, rotary cut, 6 mm 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.

Adhesive

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

Glass

Glass for window panes shall be 3 mm thick and/or 6 mm thick, tinted, tempered, stained, clear, among others, unless otherwise shown on the Plans or indicated in the Schedule of Doors and Windows. The type of glass used shall conform to the applicable requirements of Item 1012, Glass and Glazing.

Capiz Shells

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

Hardware

Hardware shall be as specified under Item 1004, Hardware.

Construction Requirements

Fabrication

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

1. Flush Type Hollow Core Doors

Flush type hollow core doors shall be adequately framed with stiles and top and bottom rails having a minimum thickness of 44 mm and width of 75 mm. Two (2) intermediate rails at least 44 mm wide shall be provided for stiffness.

The stiles and the top and bottom rails shall be rabbeted at least 10 mm wide to receive the 6 mm thick plywood veneer. A lock block shall be provided at each stile, long enough to connect to the two (2) intermediate rails and at least 75 mm wide for mounting the lockset.

The plywood veneer shall be glued and nailed to the framing with 25 mm long finishing nails space at not more than 150 mm on centers.

2. Flush Type Solid Core Doors

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

3. Panel Doors

Rails with a 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 and rails to receive panels shall be 6.5 mm wide and 20 mm deep. Integral mouldings formed on both faces of stiles and rails framing the panels shall be true to shape and well defined. Intersections of mouldings 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.

4. Window Sashes with Glass Panes or Wood Panels

Window sashes shall be fabricated in conformity with the design, size and type of installation shown on the Plans. Unless otherwise shown on the

Plans, stiles and rails shall be Tanguile with minimum thickness of 30 mm and width of 70 mm. Jointing of stiles and rails shall be mortise and tenon secured with glue and bamboo pin. Stiles and rails shall be rabbeted at the exterior face for mounting glass panes or wood panels. Integral mouldings formed as frames for panes or panels shall be true to shape, sharply defined and mitered at joints. Separate mouldings of the same design shall be provided for fixing glass panes and wood panel from the outside.

5. Window Sashes with Capiz Shells

Stiles and rails shall be of the same sizes specified under Subsection 1010.3.1(4), Window Sashes with Glass Panes or Wood Panels, and assembled with mortise and tenon joint. Unless otherwise indicated on the Plans, lattices for framing Capiz shall be tanguile, 8 mm thick and 15 mm wide, spaced at not more than 60 mm on centers bothways. Grooves 2 mm wide and 5 mm shall be made at sides of lattices to receive the preformed Capiz shells.

The lattices shall be assembled with half lap joints at their intersections and the assembled lattices containing the Capiz shells shall be framed into the stiles and rails.

Selected Capiz shells shall be washed to remove dirt and blemishes and dried under the sun for bleaching effect. Capiz shells shall be cut square to required sizes with sharp bench cutter to produce non-serrated and non- peeling edges.

6. Sliding Type Window Sashes

Stiles of sliding type window sashes shall be framed to the top and bottom rails with mortise and tenon joints. Tenons shall be formed on the stiles. Joints shall be tightly fitted, glued and locked with bamboo pins. Top and bottom rails shall be 10 mm wider than the stiles. Top rails shall be rabbeted to form a tongue flush with the outer face, with width of 8 mm and height of 10 mm. The stiles and rails shall be rabbeted as specified under Subsection 1010.3.1(4), Window Sashes with Glass Panes or Wood Panels to receive glass panes or wood panels.

7. Awning Type Window Sashes

Tenons of rails shall be fitted into the mortises formed on the stiles and the joints glued and locked. The stiles and rails shall be rabbeted as specified under Subsection 1010.3.1(4), Window Sashes with Glass Panes or Wood Panels for mounting of glass panes. Series of sashes to be installed vertically shall have their meeting rails rabbeted for half lapping when in closed position.

8. Casement Type Window Sashes

Rails of casement type window sashes shall be fitted to stiles with mortise and tenon joint. Tenons shall be formed in the rails. Meeting rails shall be rabbeted to provide for half lapping when in closed position. The stiles and rails shall be rabbeted as specified under Subsection 1010.3.1(4), Window Sashes with Glass Panes or Wood Panels for mounting of glass panes or wood panels.

9. Door and Window Frames

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

Installation

1. 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 provided with two (2) 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 2,100 mm and width of not more than 900 mm shall be hung with four (4) loose- pin butt hinges, 100 mm x 100 mm. Swing out exterior doors shall be hung with four (4) fast-pin butt hinges. Two (2) hinges shall be fitted 150 mm from top and bottom edge of door. The other two (2) 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. Sliding Doors

   Overhead tracks, standard, locally manufactured as per Plans shall be installed level and mounting bracket secured in place with lag screws supplied with the set. Bracket shall be spaced 1,000 mm on centers. Hangers, two (2) each per door leaf, shall be perfitted and bolted to the door rail. For panel doors, the hangers shall be centered on the door stiles. For flush doors, the hangers shall be centered 100 mm from the edges of the door. If there is no adequate space for installing the door with its attached rollers, through either end of the track the perfitted hangers shall be disassembled for connection to the rollers.

   After installation on the track, set the door plumb and in alignment by means of the adjustment mechanism integrated with the roller assembly.

4. 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.

5. Sliding Type Window Sashes

Sashes shall be trimmed to fit height of opening. A clearance of 2 mm shall be provided between the tongue's base at the top rail and the bottom of the window head. The same clearance shall be provided between the sash tongue and the groove at the window head. Paraffin wax shall be applied to contacts of sliding surfaces. The bottom rails shall be fitted with standard brass guided spaced 75 mm from both ends of the rail, mounted flush with the inner face and secured with three (3) brass screws each guide.

6. Casement Type Window Sashes

Sashes shall be trimmed to fit size of opening, with provision for half lapping of meeting stiles. Right side sash shall lap onto the left side sash. Sashes shall be fitted with two (2) brass-plated narrow hinges, 50 mm x 75 mm, spaced 150 mm from top and bottom of stiles. In lieu of hinges, sashes maybe hung with cadmium-plated steel casement adjusters 200 mm long, subject to prior approval of the Engineer. The top and bottom rails of casement type window sashes shall be milled to provide for the installation of adjusters.

7. Awning Type Window Sashes

Installation of awning type sashes shall be by means of casement adjusters specified under Subsection 1010.3.2 (6), Casement Type Window Sashes.

Method of Measurement

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

Doors and windows shall be measured based on the number of square meters or lump sum including its hardware involved in the completed and accepted installation.

Payment per square meter or in lumpsum 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.

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	Description	Unit of Measurement
	Doors (Wood Panel)	Square Meter

XXV. ALUMINUM GLASS WINDOW

Description

This Item shall consist of furnishing all aluminum glass window materials, labor, tools and equipment required in undertaking the proper installation in accordance with the Plans and this Specification.

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 B211, Aluminum and Aluminum-Alloy Rolled or Cold Finished 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, etc. Hardware for fixing and locking device 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.

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 operation 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 strip 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.

Window Sash

Window panel shall be jointed at corners with 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.

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.

Casement Window

Casement window type shall be provided with two (2) hinges fabricated from extruded aluminum alloy. They shall open on stay arms having adjustable sliding friction shoes to control window panel operations. Locking device shall be one arm action handle for manual operations complete with strike plate.

Awning Window

The perimeter frame of the awning window type can be supplied with nailing fins. Awning window units to be installed in prepared openings in accordance with the manufacturer's recommendations and installation drawings. Frames must be securely fastened, set plumb and level without twisting, bowing or distortion.

Fixed Type

Fixed type window members including any mullions, shall be made of aluminum. Secondary members such as friction tabs, shoes, and weather stripping guides, shall also be made of aluminum or a compatible material. The tilt housing and latch units shall be mechanically anchored to the sash rails. The latches shall be spring loaded and afford positive lock into the jamb profile. In a tilted position, the sash shall be removable to the interior.

Shop Finish

Exposed aluminum surfaces shall be electrolyte hand coats such as anodize, satin, powder coated, among others.

Protection

All aluminum parts shall be protected adequately to ensure against damage during transit and construction phase.

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 Engineer. Aluminum shall be thoroughly cleaned with aluminum and glass cleaning solution and then wipes surface using clean cloth rugs. No abrasive cleaning materials shall be permitted in cleaning surface.

Method of Measurement

Aluminum glass window fully equipped with fixing accessories and locking devices shall be measured in lump sum or square meters actually installed in- place and accepted to the satisfaction of the Engineer.

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 shall be made under:

Pay Item	Description	Unit of Measurement
	Aluminum Glass Windows, Fixed Type	Square Meter

XXVI. CERAMIC AND GRANITE TILES

Description

This item shall consist of furnishing and installing ceramic and granite tiles materials including cementitious/adhesive materials, tools and equipment including labor required in the proper installation of floor, wall and countertop as shown on the Plans and in accordance with this Specification.

Material Requirements

Ceramic Tiles

Ceramic Tiles are thin slabs made from clays and/or other organic raw materials, 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.

Glazed Tiles and Trims

Glazed tiles and trims shall have an impervious face of ceramic materials fused onto the body of the tiles. The glazed surface may be clear white or colored depending on the color scheme approved by the Engineer. Standard glazes may be bright (glossy), semi-matte (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.

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.

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 and others that are necessary for edging or making a transition between intersecting planes.

Granite Tiles

Granite tiles shall conform to the applicable requirements of ASTM C615M, Standard Specification for Granite Dimension Stone, for material characteristics, physical requirements, and sampling for selection of granite.

All granite shall be sound, durable, and free of spalls, cracks, open seams, pits, or other defects, which may impair its structural integrity or function. Color or other visual characteristics indigenous to the particular material and adequately demonstrated in the sampling or mock-up phases will be accepted provided they do not compromise the structural or durability capabilities of the material. Texture and finish shall be within the range of samples approved by the Engineer. Table 1018.2 shows the required test methods for granite tiles.

Finishes of Granite Tiles:

1. Polish – Highly reflective, mirror gloss finish; shows full color depth andcrystal structure of the stone.

2. Hone – Smooth, satin surface without reflection; shows full color

of thestone.

3. Thermal – Slip-resistant, rough-textured surface.

4. Sandblast – Highly slip resistant; slightly rough textured surface.

Synthetic Granite Tiles

Synthetic granite tiles are manufactured solid surface that are made of man- made materials most often acrylic, polyester resins, marble dust and other pigment, all blended and heated together.

All synthetic granite tiles shall be sound, durable, and free of spalls, cracks, open seams, pits, or other defects, which may impair its structural integrity or function. Texture, finish and color shall be within the range of samples approved by the Engineer.

Accessories

Tile accessories such as round edge ceramic tiles, cove tiles, step treads and nosing to stairs, landings, and thresholds, skirting, sills, copings, and bath vents, shall match the composition, color and finish of the surrounding tiles.

Mortar Materials

Portland Cement

Portland Cement shall comply with the applicable requirements of AASHTO M 85, Standard Specification for Portland Cement (ASTM C150M).

Sand

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

Lime

It shall be hydrated lime with free unhydrated oxide and magnesium oxide content not to exceed 8% by weight.

Grouting Materials

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.

An 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 1/5 part lime may be added.

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 of 3.18 mm width or greater.

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 ofbacking shall be scratched in an approved manner, when completely set toform key. The surface of the backing shall be well wetted before the tilingis applied and same shall be cured for 5 days before tiling starts. Tiles shallbe 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 orwaxy 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:

    c. For tiles with all edges shorter than 380 mm, the 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.

    d. 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 substrates 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.

General Installation

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 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. 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 tile 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 work shall be extended into recesses and under equipment and fixtures in the spaces 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 and drilling of tile shall be

performed without damaging visible surfaces. Edges of tile 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 grid 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 beprovided 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 of 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 areas such as bathrooms, washing area, kitchens, pantries and mechanical rooms 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.

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 edges of glazed wall tiling shall be formed with angle 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.

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 splashes 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.

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.

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 tile shall be polished with soft cloth.

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.

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-ups 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.

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 a dry location and protect from contamination, dampness, or overheating.

Method of Measurement

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

Basis of Payment

The quantities measured as prescribed in Section 1018.4, Method of Measurement shall be based on the Unit Bid or Contract Unit Price which price and payment 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	Description	Unit of Measurement
	Glazed tiles and Trims	Square Meter
	Unglazed tiles	Square Meter
	Granite Tiles	Square Meter
	Synthetic Granite Tiles	Square Meter
	Glazed Tiles	Square Meter

XXVII. PAINTING, VARNISHING AND OTHER RELATED WORKS

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.

Material Requirements

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 forexterior and interior use)	Properly preparedplaster, 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, flat)	PNS 464	Specification for Roof paint (water-based, flat)	Paintable roofing materials
Roof paint (Portland Cement)	PNS 465	Specification for Roof paint (Portland Cement)	Paintable roofing materials

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.

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.

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.

Silicon Water Repellant

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

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.

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.

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.

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.

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.

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.

Glazing Putty

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

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.

Schedule

Exterior

EXTERIOR	
1. Plain cement plastered finish to be painted	-Three (3) coats acrylic base masonry paint
2. Concrete exposed aggregate and/or tool finish	- One (1) coat water repellant
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 repellant

INTERIOR	
1. Plain cement plastered finish to be painted	- Two (2) coats acrylic base masonry paint
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, allow to dry then 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.

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.

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 of imperfections in plaster shall be filled with patching compound and smoothed off to match adjoining surfaces.

Concrete and masonry surfaces shall be coated with concrete neutralizer and allowed to dry before any painting primer coat is applied. When surface is dried, apply 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 withproper 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 hotor 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.

Application

Paints when applied by brush shall become non-fluid, thick enough to lay down as adequate film of wet paint. Brush marks shall 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 change the required properties of the paint.

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.

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.

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, orstains on adjacent surfaces shall be removed and the entire job left clean andacceptable to the Engineer.

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.

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.

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.

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.

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.

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	Description	Unit of Measurement
	Painting Works, Masonry/Concrete	Square Meter
	Painting Works, Wood	Square Meter
	Painting Works, Steel	Square Meter
	Varnishing	Square Meter
	Sea-mist Finish	Square Meter
	Ducco Finish	Square Meter
	Texture Finish	Square Meter

XXVIII. PEBBLE WASHOUT FINISH

Description

This Item shall consist of furnishing all materials, labor, tools and equipment required in undertaking the proper application of pebble washout finish as shown on the Plans and in accordance with this Specification.

Material Requirements

Pebble

Unless otherwise specified on the Plans or Special Provisions, pebbles shall be well graded stones sized ranging from 2 mm to 4.76 mm rounded species like Luna Stones, Boracay, among others. Pebbles shall be free from impurities and hazardous materials.

Cement

It shall conform to Subsection 900.2.1, Portland Cement of Item 900, Structural Concrete. It can be gray or white species depending on the tone or color scheme approved.

Colored Cement

Colored cement shall be powder type pigmented used to obtain the desired shade and color finish.

Fine Aggregates

Fine Aggregates shall conform to the applicable requirements of Subsection 900.2.2.1, Fine Aggregates of Item 900, Structural Concrete.

Water

Water shall conform to the applicable requirements of Subsection 900.2.3, Water of Item 900, Structural Concrete.

Construction Requirements

All pebble washout finish shall be done by men experienced and qualified to do this particular type of trade. Samples of each applied finish of different shades measuring 300 mm x 300 mm shall be submitted to the Engineer for approval. The approved samples shall then be kept for future reference.

Surface Preparation

Surface to receive pebble washout finish shall be clean of all projection, dust, loose particles and foreign matters. It shall be thoroughly wetted with clean water before

application of scratch coat mortar. When surface has sufficiently set scratch with hard broom.

Mixture

Unless otherwise specified on the Plans or Special Provisions, pebble washout finish mix shall consist of one (1) part Portland Cement, 1 ½ sand and three (3) parts pebble measured by volume. Mixtures shall be in approved containers to ensure that the specified materials are controlled and accurately measured. Mixtures measured by shovel or shovel counts will not be permitted. Unless specified otherwise pebble washout mix shall be in the proportion by volume in approved mixing machines or mortar boxes. The aggregates introduced and mixed in such a manner that the materials will be uniformly distributed throughout the mass. A sufficient amount of water shall be added gradually and the mass further mixed until a mortar plasticity necessary for the purpose intended is obtained. Mortar boxes, pans, etc. where mixtures are mixed shall be keep clean and free from debris or dried mortar.

Application

1. Before any application work is started, the Contractor shall establish all wood mold for vertical and horizontal groove lines after the scratch coat has seasoned for 7 days in the case of masonry wall or concrete columns, beams, parapets, among others.

2. In the case of finish flooring application and the like the slope of drainage shall be properly provided and design pattern properly placed. The proposed under bed shall be done to a level of 16 mm below the finish floor line to accommodate the pebble washout mix.

3. The prepared surfaces to receive the pebble washout mix shall be kept damp for at least 4 h before the application work is commenced.

4. Pebble washout finish mix shall be applied with pressure to obtain solid adhesion to the prepared surface.

5. The applied surface shall be firm, even and monolithically applied, then allowed to set initially.

6. When the applied surface has initially set to withstand the removal of the cement paste spray evenly by spray apparatus to washout and cement paste on the outer surface so that the pebbles are partly exposed or by means of paint brush and water, or by means of spray washing down the cement paste leaving the pebbles partially exposed in their natural texture appearance.

Workmanship

1. Pebble washout finish shall be leveled, plumbed, squared true within a tolerance of 3 mm in 3 m without caves cracks, blisters, pits crazing, discoloration, projections, or other imperfections.

2. Special care shall be taken to prevent sagging and consequent drooping of applications.

3. There shall be no invisible junction marks in the finish surface where 1 day work adjoins another.

4. Where required or directed by the Engineer, vertical and horizontal groove joints shall be provided.

Curing and Protection

1. When the pebble washout surface has finally set, the surface shall be kept wet or moist for at least 6 days.

2. After all other work have been completed the pebble washout finish surfaces shall be saturated with diluted hydrochloric acid and cleaned with steel brush. The ratio of diluted hydrochloric acid shall be one (1) part Hydrochloric acid is to 10 to 20 parts water.

3. The clean surface shall be allowed to dry before a coat of silicon water repellant or a sealer as specified in the contract shall be applied to protect the natural physical appearance of the pebble washout finish.

Method of Measurement

Pebble washout finish shall be measured in square meters for work actually completed and accepted by the Engineer.

Basis of Payment

The work done under this Item as provided in the Bill of Quantities shall be paid for at the contract unit bid which price and payments constitute full compensation including labor, materials, tools, equipment and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item	Description	Unit of Measurement
	Pebble Washout	Square Meter

XXIX. CONDUITS, BOXES AND FITTINGS

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.

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.

Rigid Metal Conduit (RMC)

A threadable raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed with its integral or associated coupling and appropriate fittings.

RMC shall be made of steel with protective coatings, aluminum, red brass or stainless steel.

Markings in each length of RMC shall be clearly and durably identified in 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. Nonferrous conduit of corrosion-resistant material shall have suitable markings.
The standard length of RMC shall be 3,000 mm, including an attached coupling, and each end shall be threaded. Longer or shorter lengths with or without coupling and threaded or unthreaded shall be permitted.

RMC shall have a minimum size of metric designator 16 (trade size ½) and a maximum size of metric designator 155 (trade size 6).

Intermediate Metal Conduit (IMC)

A steel threadable raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed with its integral or associated coupling and appropriate fittings.

IMC shall be made of either steel with protective coatings or stainless steel.

Markings in each length of IMC shall be clearly and durably marked at least every 1,500 mm with the letters IMC. Each length shall be marked as required

in Subsection 1.10.1.21 of Article 1.10, Requirements for Electrical Installations of PEC, Part I.

The standard length of IMC shall be 3,000 mm, including an attached coupling, and each end shall be threaded. Longer or shorter lengths with or without coupling and threaded or unthreaded shall be permitted.

IMC shall have a minimum size of metric designator 16 (trade size ½) and a maximum size of metric designator 103 (trade size 4).

Flexible Metal Conduit (FMC)

A raceway of circular cross section made of helically wound, formed, interlocked metal strip.

Sizes of FMC shall comply with the requirements of subsection 3.48.2.11, Size of Article 3.48, Flexible Metal Conduit: Type FMC of PEC, Part I.

Electrical Metallic Tubing (EMT)

An unthreaded thin-wall raceway of circular cross section designed for the physical protection and routing of conductors and cables and for use as an equipment grounding conductor when installed utilizing appropriate fittings. EMT is generally made of steel (ferrous) with protective coatings or aluminum (nonferrous).

EMT 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.

EMT shall have a minimum size of metric designator 16 (trade size ½) and a maximum size of metric designator 103 (trade size 4).

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 ½) and a maximum size of metric designator 155 (trade size 6).

Liquid tight Flexible Nonmetallic Conduit (LFNC)

A raceway of circular cross section of various types as follows:

1. A smooth seamless inner core and cover bonded together and having one or more reinforcement layers between the core and covers, designated as Type LFNC-A.

2. A smooth inner surface with integral reinforcement within the conduit wall, designated as Type LFNC-B.

3. A corrugated internal and external surface without integral reinforcement within the conduit wall, designated as LFNC-C.

LFNC-B as a prewired manufactured assembly shall be provided in continuous lengths capable of being shipped in a coil, reel, or carton without damage.

LFNC shall be marked at least in every 600 mm in accordance with Subsection 1.10.1.21 (A) of Article 1.10, Requirements for Electrical Installations of PEC, Part I. The marking shall include a type designation and the trade size. Conduit that is intended for outdoor use or direct burial shall be marked.

The type, size and quantity of conductors used in prewired manufactured assemblies shall be identified by means of a printed tag or label attached to each end of the manufactured assembly and either the carton, coil or reel. The enclosed conductors shall be marked in accordance with Subsection 3.10.3.17, Markings of Article 3.10, Conductors for General Wiring of PEC, Part I.

Sizes of LFNC shall comply with the requirements of subsection 3.56.2.11, Size of Article 3.56, Liquidtight Flexible Nonmetallic Conduit: Type LFNC of PEC, Part I.

Weatherhead

Weatherhead is installed at the point of connection to service-drop connectors to protect the service raceways and service cables from exposure to weather or rain.

Weatherhead material shall be of the same material as conduit where it will be connected.

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.

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.

Rigid Metal Conduit (RMC) 1100.3.1.1 Uses Permitted

1. Atmospheric Conditions and Occupancies

a. Galvanized Steel and Stainless Steel RMC. Galvanized steel and stainless steel RMC shall be permitted under all atmospheric conditions and occupancies.

b. Red Brass RMC. Red brass RMC shall be permitted to be installed for direct embedment and swimming pool applications.

c. Aluminum RMC. Aluminum RMC shall be permitted to be installed where approved for the environment. Rigid aluminum conduit encased in concrete or in direct contact with the earth shall be provided with approved supplementary corrosion protection.

d. Ferrous Raceways and Fittings. Ferrous raceways and fittings protected from corrosion solely by enamel shall be permitted only indoors and in occupancies not subject to severe corrosive influences.

2. Corrosive Environments

a. Galvanized Steel, Stainless Steel and Red Brass RMC, Elbows, Couplings and Fittings. Galvanized steel, stainless steel and red brass RMC, elbows, couplings and fittings shall be permitted to be installed in concrete, in direct contact with the earth, or in areas subject to severe corrosive influences where protected by corrosion protection approved for the condition.

b. Supplementary Protection of Aluminum RMC. Aluminum RMC shall be provided with approved supplementary corrosion protection where encased in concrete or in direct contact with the earth.

3. Cinder Fill

Galvanized steel, stainless steel and red brass RMC shall be permitted to be installed in or under cinder fill where subject to permanent moisture where protected on all sides by a layer of noncinder concrete not less than 50 mm thick; where the conduit is not less than 450 mm under the fill; or where protected by corrosion protection and judged suitable for the condition.

4. Wet Locations

All supports, bolts, straps, screws, and so forth, shall be of corrosion-resistant materials or protected by corrosion-resistant materials exposed to moisture.

Dissimilar Metals

Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Aluminum fittings and enclosures shall be permitted to be used with galvanized steel RMC, and galvanized steel fittings and enclosures shall be permitted to be used with aluminum RMC where not subject to severe corrosive influences. Stainless steel RMC shall only be used with stainless steel fittings and approved accessories, outlet boxes, and enclosures.

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

Number of Conductors and/or Cables	Cross-sectional Area (%)
1	53
2	31
Over 2	40

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 1. The number of cables shall not exceed the allowable percentage fill specified in Table 1100.1.

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 TubingSize	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 (360 degrees total) between pull points, for example, conduit bodies and boxes.

Reaming and Threading

All cut ends shall be reamed or otherwise finished to remove rough edges. Where conduit is threaded in the field, a standard cutting die with a one (1) in 16 taper (62.5 mm per meter) shall be used.

Securing and Supporting

RMC shall be installed as a complete system in accordance with 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 securely fastened in place and supported in accordance with the following:

1. Securely Fastened. RMC shall be secured in accordance with the following:

    a. RMC shall be securely fastened within 0.90 m of each outlet box, junction box, device box, cabinet, conduit body, or other conduit termination.

    b. Fastening shall be permitted to be increased to a distance of 1.50 m where structural members do not readily permit fastening within 0.90 m.

    c. Where approved, conduit shall not be required to be securely fastened within 0.90 m of the service head for above-the-roof termination of a mast.

2. Supports. RMC shall be supported in accordance with one of the following:

    a. Conduit shall be supported at intervals not exceeding 3.0 m.

    b. The distance between supports for straight runs of conduit shall be permitted in accordance with Table 1100.3, provided the conduit is made up with threaded couplings, and such supports prevent transmission of stresses to termination where conduit is deflected between supports.

Table 1100.3 Supports for Rigid Metal Conduit

Conduit size		Maximum Distance Between Rigid Metal Conduit Supports
Metric Designator	Trade Size	(m)
16 - 21	1/2 - 3/4	3.0
27	1	3.6
35 - 41	1 ¼ - 1 ¼	4.2
53 - 63	2 - 2 ½	4.8
73 and larger	3 and larger	6.0

c. Exposed vertical risers from industrial machinery or fixed equipment shall be permitted to be supported at intervals not exceeding 6.0 m if the conduit is made up with threaded couplings, the conduit is supported and securely fastened at the top and bottom of the riser and no other means of intermediate support are readily available.

d. Horizontal runs of RMC supported by openings through framing members at intervals not exceeding 3.0 m and securely fastened within 0.90 m of termination points shall be permitted.

Couplings and Connectors

Threadless couplings and connectors used with conduit shall be made tight. Where embedded in masonry or concrete, they shall be the concrete tight type. Where installed in wet locations, they shall comply with Subsection 3.14.2.1, Damp or Wet Locations of Article 3.14, Outlet, Device, Pull Junction Boxes; Conduit Bodies; Fittings; and Handholes Enclosures of PEC, Part I. Threadless couplings and connectors shall not be used on threaded conduit ends unless listed for the purpose.

Running threads shall not be used on conduit for connection at couplings.

Locknut and Bushings

Where a conduit enters a box, fitting, or other enclosure, a locknut and bushing shall be provided to protect the wire from abrasion unless the design of the box, fitting, or enclosure is such as to afford equivalent protection.

Intermediate Metal Conduit (IMC)

Uses Permitted
1. All Atmospheric Conditions and Occupancies

Use of IMC shall be permitted under all atmospheric conditions and occupancies.

2. Corrosion Environments

IMC, elbows, couplings and fittings shall be permitted to be installed in concrete, in direct contact with the earth, or in areas subject to severe corrosive influences where protected by corrosion protection approved for the condition.

3. Cinder fill

IMC shall be permitted to be installed in or under cinder fill where subject to permanent moisture where protected on all sides by a layer of noncinder concrete not less than 50 mm thick; where the conduit is less than 450 mm under the fill; or where protected by corrosion protection approved for the condition.

4. Wet locations

All supports, bolts, straps, screws, and so forth, shall be of corrosion-resistant materials or protected against corrosion by corrosion-resistant materials.

Dissimilar Metals

Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action.

Aluminum fittings and enclosures shall be permitted to be used with galvanized steel IMC where not subject to severe corrosive influences. Stainless steel IMC shall only be used with stainless steel fittings and approved accessories, outlet boxes, and enclosures.

Number of Conductors

It shall comply with the requirements of Subsection 1100.3.1.3, Number of Conductors.

Bends

It shall comply with the requirements of Subsection 1100.3.1.4, Bends.

Reaming and Threading

It shall comply with the requirements of Subsection 1100.3.1.5, Reaming and Threading.

Securing and Supporting

It shall comply with the requirements of Subsection 1100.3.1.6, Securing and Supporting.

Couplings and Connectors

It shall comply with the requirements of Subsection 1100.3.1.7, Couplings and Connectors.

Bushings

It shall comply with the requirements of Subsection 1100.3.1.8, Locknut and Bushings.

Flexible Metal Conduit

Uses Permitted

FMC shall be permitted to be used in exposed and concealed locations.

1100.3.3.2 Uses Not Permitted

FMC shall not be used in the following:

1. In wet locations.

2. In hoistways, other than as permitted in Subsection 6.20.3.1(A) (1), Hoistways and Pits of Article 6.20, Elevators, Dumbwaiters, Escalators, Moving Walks, Platforms Lifts of PEC, Part I.

3. In storage battery rooms.

4. In any hazardous (classified) location except as permitted by other articles in the PEC, Part I.

5. Where exposed to materials having a deteriorating effect on the installed conductors, such as oil or gasoline.

6. Underground or embedded in poured concrete or aggregate.

7. Where subject to severely physical damage.

Number of Conductors

The number of conductors shall not exceed that permitted by the percentage fill specified in Table 1100.1 or as permitted in Table 3.48.2.13, Maximum Number of Insulated Conductors in Metric Designator 12 (Trade Size) Flexible Metal Conduit of Article 3.48, Flexible Metal Conduit: Type FMC of PEC, Part I or for metric designator 12 (trade size 3/8).

Cable shall be permitted to be installed where such use is not prohibited by the respective cable articles of PEC, Part I. The numbers of cables shall not exceed the allowable percentage fill specified in Table 1100.1.

Bends

Bends in conduit shall be made so that the conduit is not damaged and the internal diameter of the conduit is not effectively reduced. Bends shall be permitted to be made manually without auxiliary equipment. The radius of the curve to the centerline of any bend shall not be less than as shown in Table 1100.2 using the column "Other Bends".

There shall not be more than the equivalent of four (4) quarter bends (360 degrees total) between pull points, for example, conduit bodies and boxes.

Trimming

All cut ends shall be trimmed and smoothened.

Securing and Supporting

FMC shall be secured and supported in accordance with the requirements of Subsection 3.48.2.21, Securing and Supporting of Article 3.48, Flexible Metal Conduit: Type FMC of PEC, Part I.

Couplings and Connectors

Angle connectors shall not be used for concealed raceway installations.

Electrical Metallic Tubing (EMT)

Uses Permitted

1. Exposed and Concealed. The use of EMT shall be permitted for both exposed and concealed work for the following:

a. In concrete, in direct contact with the earth or in areas subject to severe corrosive influences where installed in accordance with Subsection 1100.3.4.1 (b).

b. In dry, damp and wet locations.

c. In any hazardous (classified) location as permitted by other articles in the PEC, Part 1.

2. Corrosive Environments

a. Galvanized Steel and Stainless Steel EMT, Elbows and Fittings. Galvanized steel and stainless steel EMT, elbows and fittings shall be permitted to be installed in concrete, in direct contact with the earth, or in areas subject to severe corrosive influences where protected by corrosion protection and approved as suitable for the condition.

b. Supplementary Protection of Aluminum EMT. Aluminum EMT shall be provided with approved supplementary corrosion protection where encased in concrete or in direct contact with the earth.

3. Cinder Fill

Galvanized steel and stainless steel EMT shall be permitted to be installed in cinder concrete or cinder fill where subject to permanent moisture where protected on all sides by a layer of noncinder concrete not less than 50 mm thick or when the tubing is installed at 450 mm under the fill.

4. Wet Locations

It shall comply with the requirements of Subsection 1100.3.1.1 (4), Wet Locations.

Uses Not Permitted

EMT shall not be used under the following conditions:

1. Where subject to severe physical damage.
2. Where protected from corrosion solely by enamel.

Number of Conductors.

It shall comply with the requirements of Subsection 1100.3.1.3, Number of Conductors.

Bends

It shall comply the requirements of Subsection 1100.3.1.4, Bends.

Reaming and Threading

All cut ends of EMT shall be reamed or otherwise finished to remove rough edges.

EMT shall not be threaded.

Securing and Supporting

EMT shall be securely fastened in place at least every 3.0 m. In addition, each EMT run between termination points shall be securely fastened within 0.90 m of each outlet box, junction box, device box, cabinet, conduit body, or other tubing termination except to the following conditions:

1.Fastening of unbroken lengths shall be permitted to be increased to a distance of 1.5 m where structural members do not readily permit fastening within 0.90 m.

2. For concealed work in finished buildings or prefinished wall panels where such securing is impracticable, unbroken lengths (without coupling) of EMT shall be permitted to be fished.

3. Horizontal runs of EMT supported by openings through framing members at intervals not greater than 3.0 m and securely fastened within 0.90 m of termination points shall be permitted.

Couplings and Connectors

Couplings and connectors used with EMT shall be made up tight when embedded in masonry or concrete. Where installed in wet locations, they shall comply with Subsection 3.14.2.1, Damp or Wet Locations of Article 3.14, Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures of PEC, Part I.

Rigid Polyvinyl Chloride Conduit

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 in 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 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 Equipment of Article 1.10, Requirements for Electrical Installations and Subsection 3.14.2.2(C)(2), Conduit Bodies of Article 3.14, Outlet, Device, 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.

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.

Number of Conductors

It shall comply with the requirements of Subsection 1100.3.1.3, Number of Conductors.

Bends

It shall comply the requirements of Subsection 1100.3.1.4, Bends.

Trimming

All cut ends shall be trimmed and smoothened.

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	1¼ - 2	1.5
63 - 78	22½ - 3	1.8
91 - 129	3½ - 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 x

10-5mm/mm/° 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 enclosures designs 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.

1100.3.6 Liquid tight Flexible Nonmetallic Conduit (LFNC)

1100.3.6.1 Uses Permitted

LFNC shall be permitted to be used in exposed or concealed locations for the following purposes:

1. Where flexibility is required for installation, operation or maintenance.

2. Where protection of the contained conductors is required from vapors, liquids or solids.

3. For outdoor locations where listed and marked as suitable for the purpose.

4. For direct embedment where listed and marked for the purpose.

5. Type LFNC-B shall be permitted to be installed in lengths longer than 1.8 m where secured in accordance Subsection 1100.3.6.7, Securing and Supporting.

6. Type LFNC-B as a listed manufactured prewired assembly, metric designator 16 through 27 (trade size ½ through 1) conduit.

7. For encasement in concrete where listed for direct embedment and install in accordance with Subsection 1100.3.6.8, Couplings and Connectors.

1100.3.6.2 Uses Not Permitted

LFNC shall not be used as follows:

1. Where subject to severe physical damage.

2. Where any combination of ambient and conductor temperatures is in excess of that for which the LFNC is approved.
3. In lengths longer than 1.8 m, except as permitted by Subsection 1100.3.6.1
(5) or where a longer length is approved as essential for a required degree of flexibility.

4. In any hazardous (classified) location, except as permitted by other articles in PEC, Part I.
1100.3.6.3 Number of Conductors

It shall comply with the requirements of Subsection 1100.3.1.3, Number of Conductors.

1100.3.6.4 Bends

It shall comply with the requirements of Subsection 1100.3.3.4, Bends.

1100.3.6.5 Trimming

All cut ends of conduit shall be permitted inside and outside to remove rough edges.

1100.3.6.6 Securing and Supporting

LFNC shall be securely fastened and supported in accordance with Subsection 3.56.2.21, Securing and Supporting of Article 3.56, Liquidtight Flexible Nonmetallic Conduit: Type LFNC of PEC, Part I.

1100.3.6.7 Couplings and Connectors

Only fittings listed for use with LFNC shall be used. Angle connectors shall not be used for concealed raceway installations. Straight LFNC fittings are permitted for direct burial or encasement in concrete.

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.

1100.5 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	Description	Unit of Measurement
	Conduits, Boxes & Fittings (Conduit Works/Conduit Rough-In)	Lump Sum

XXIV. 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 1

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 mm2 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 1 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 mm2 aluminum or copper-clad aluminum. Insulated conductors of sizes 2.0 mm2 (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 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 2 (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 for 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 or 20
30	30
40	40 or 50
50	50

Metal faceplates for receptacles 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 if formed or reinforced to provide adequate mechanical strength.

1101.3 Construction Requirements

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 all circuit conductors within 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 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 grip 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 is met:

1. The switch is mounted with metal screws to a metal box or to a nonmetallic box with integral means for grounding devices.

2. An equipment grounding conductor or equipment bonding jumper is 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 those 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 an equipment-grounding conductor 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 FEP, 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 lump 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 wiring devices labor cost and all the incidental expenses necessary to complete the work.

Payment shall be made under:

Pay Item	Description	Unit of Measurement
	Wires and Wiring Devices	Lump Sum

XXV. LIGHTING FIXTURES

1103.1 Description

This Item shall consist of furnishing all lighting 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 1.5 mm^2 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 surroundings. 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
Lamp Type	**Rated Power Ranges (watts)**	**Efficacy Ranges (lumens/watt)**
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 a 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. Fixtures 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, lampholders, 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 on GI poles of 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 mm^2 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 200 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 152 mm 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 these 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 CFTR26W/GX24Q/835. Compact fluorescent lamps in nominal 39 and 40 watt 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 4,100 K 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. Doubleended 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 Ballasts

1103.2.4.1 Ballasts 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. Ballasts 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 ballast shall be of the lead-peak auto-transformer type for 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, M110, M130, M139 and M140 rated lamps shall be electronic-type.

1103.3 Construction 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 approved rust inhibiting prime coat before application of finish.

3. Fixtures in Indoor Sports, 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 the lamp 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 area of the 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 Show 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, hangers, ballasts, voltage rating, and other miscellaneous appurtenances to properly coordinate with 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 member(s) and fixture(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 electric 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, measured 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	Description	Unit of Measurement
	Lighting Fixtures	Lump Sum

Prepared by:

ENGR. RENE LENARD M. BUENAVENTURA
Sr. Project Planning and Development Officer

ENGR. JERRY ESPIÑA
Electrical Works – Estimator/Designer

Checked by:

ENGR. NOEL P. YAMBAO
Manager, PMD

Noted:

ENGR. JEOFFREY B. MACALALAD
Manager, PEPD

Section VII. Drawings

[Insert here a list of Drawings. The actual Drawings, including site plans, should be attached to this section, or annexed in a separate folder.]

Section VIII. Bill of Quantities

Notes on the Bill of Quantities

Objectives

The objectives of the Bill of Quantities are:

a. to provide sufficient information on the quantities of Works to be performed to enable Bids to be prepared efficiently and accurately; and

b. when a Contract has been entered into, to provide a priced Bill of Quantities for use in the periodic valuation of Works executed.

In order to attain these objectives, Works should be itemized in the Bill of Quantities in sufficient detail to distinguish between the different classes of Works, or between Works of the same nature carried out in different locations or in other circumstances which may give rise to different considerations of cost. Consistent with these requirements, the layout and content of the Bill of Quantities should be as simple and brief as possible.

Daywork Schedule

A Daywork Schedule should be included only if the probability of unforeseen work, outside the items included in the Bill of Quantities, is high. To facilitate checking by the Entity of the realism of rates quoted by the Bidders, the Daywork Schedule should normally comprise the following:

a. A list of the various classes of labor, materials, and Constructional Plant for which basic daywork rates or prices are to be inserted by the Bidder, together with a statement of the conditions under which the Contractor will be paid for work executed on a daywork basis.

b. Nominal quantities for each item of Daywork, to be priced by each Bidder at Daywork rates as Bid. The rate to be entered by the Bidder against each basic Daywork item should include the Contractor's profit, overheads, supervision, and other charges.

Provisional Sums

A general provision for physical contingencies (quantity overruns) may be made by including a provisional sum in the Summary Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a provisional sum in the Summary Bill of Quantities. The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises. Where such provisional sums or contingency allowances are used, the SCC should state the manner in which they will be used, and under whose authority (usually the Procuring Entity's Representative's).

The estimated cost of specialized work to be carried out, or of special goods to be supplied, by other contractors should be indicated in the relevant part of the Bill of Quantities as a particular provisional sum with an appropriate brief description. A separate procurement procedure is normally carried out by the Procuring Entity to select such specialized contractors. To provide an element of competition among the Bidders in respect of any facilities, amenities, attendance, etc., to be provided by the successful Bidder as prime Contractor for the use and convenience of the specialist contractors, each related provisional sum should be followed by an item in the Bill of Quantities inviting the Bidder to quote a sum for such amenities, facilities, attendance, etc.

Signature Box

A signature box shall be added at the bottom of each page of the Bill of Quantities where the authorized representative of the Bidder shall affix his signature. Failure of the authorized representative to sign each and every page of the Bill of Quantities shall be a cause for rejection of his bid.

These Notes for Preparing a Bill of Quantities are intended only as information for the Procuring Entity or the person drafting the Bidding Documents. They should not be included in the final documents.

Tourism Infrastructure and Enterprise Zone Authority
7th Floor, Tower 1 Double Dragon, Double Dragon Meridian Park,
Macapagal Ave. cor. EDSA Extension,Bay Area, Pasay City

SUMMARY OF BID

PROJECT : **REHABILITATION OF BURNHAM PARK BAGUIO CITY BENGUET**

DURATION: 180 Calendar Days

Item No.	ITEM OF WORK	AMOUNT
A.	**GENERAL REQUIREMENTS**	
a.1	**Temporary Barracks**	
a.2	**Health and Safety**	
a.3	**Project Signboard**	
a.4	**Temporary Enclosure**	
a.5	**Construction Staking & Survey**	
B.	**MOBILIZATION/DEMOBILIZATION**	
C.	**SITE PREPARATION**	
D.	**CONTROL ROOM**	
E.	**HARD LANDSCAPING**	
F.	**SANITARY PLUMBING WORKS**	
G.	**ELECTRICAL WORKS**	
H.	**SOFT LANDSCAPING**	
I.	**RETAINING WALL**	

AMOUNT IN WORDS

Name of Company

Name & Signature of
Authorized Representative

Business Address

Designation

BILL OF QUANTITIES

Project : **REHABILITATION OF BURNHAM PARK**
Location : Baguio City, Benguet

ITEM NO	SCOPE OF WORK	QTY	UNIT	UNIT COST	AMOUNT
I.	**GENERAL REQUIREMENTS**				
	a. Temporary Barracks	1.00	lot		
	b. Health and Safety	1.00	lot		
	c. Project Signboard	1.00	set		
	d. Temporary Enclosure	817.60	lm		
	e. Construction Staking & Survey	0.82	km		
II.	**MOBILIZATION / DEMOBILIZATION**	1.00	l.s		
III.	**SITE PREPARATION**				
	a. Demolition Works	1.00	lot		
	b. Site Clearing and Disposal	1.00	lot		
IV.	**CONTROL ROOM**				
	a. Structure Excavation (Common Soil)	58.32	m^3		
	b. Embankment (From Structure Excavation)	46.78	m^3		
	c. Gravel Fill	2.92	m^3		
	d. Structural Concrete (Ready Mix Concrete, Class A, 28 Days)	33.00	m^3		
	e. Reinforcing Steel, Grade 40	8,752.00	kg		
	f. Formworks and Falseworks (for one-storey building)	113.00	m^2		
	g. Structural Steel Purlins	494.62	kg		
	h. Prepainted Metal Sheets (Rib Type, Long Span)	80.56	m^2		
	i. Fiber Cement Fascia Board	16.00	lm		
	j. 150mm CHB Non-loadbearing	72.44	m^2		
	k. Cement Plaster Finish	158.04	m^2		
	l. Ceiling Works	78.75	m^2		
	m. Homogenous Tiles	60.64	m^2		
	n. Wooden Panel Door	2.10	m^2		
	o. Aluminum Glass Window (Fixed)	38.40	m^2		
	p. Painting Works (Masonry Painting)	236.79	m^2		
	q. Painting Works (Metal Painting)	163.50	m^2		
	r. Railing	1.00	ls		
V.	**HARD LANDSCAPING**				
	a. Structure Excavation (Common Soil)	1,562.37	m^3		
	b. Embankment (From Structure Excavation, Manual)	98.00	m^3		
	c. Subgrade Preparation (Common Materials)	2,379.36	m^2		
	d. Aggregate Subbase Course	475.87	m^3		
	e. Gravel Fill	488.12	m^3		
	f. Damproofing (Polyethylene Sheets)	2,379.36	m^2		
	g. Structural Concrete (Ready Mix Concrete, Class A, 28 Days)	274.64	m^3		
	h. Reinforcing Steel, Grade 40	16,557.89	kg		
	i. Plantbox (150mm CHB Non-loadbearing)	1,163.48	m^2		
	j. Paver Blocks	517.44	m^2		
	k. Stamped Concrete	1,670.45	m^2		
	l. Pebble Washout Finish	191.48	m^2		
	m. Crazy Cut Stone Veneer	583.80	m^2		
	n. Wood Plastic Composite	1.00	ls		
VI.	**SANITARY-PLUMBING WORKS**				
	a. Structure Excavation (Common Soil, Manual)	280.33	m^3		

BILL OF QUANTITIES

Project : **REHABILITATION OF BURNHAM PARK**
Location : Baguio City, Benguet

ITEM NO	SCOPE OF WORK	QTY	UNIT	UNIT COST	AMOUNT
	b. Gravel Fill	16.39	m^3		
	c. Damproofing (Polyethylene Sheets)	42.20	m^2		
	d. Structural Concrete (Ready Mix Concrete, Class A, 28 Days)	52.00	m^3		
	e. Reinforcing Steel, Grade 40	5,949.00	kg		
	f. Formworks and Falseworks (for one-storey building)	57.00	m^2		
	g. 150mm CHB Non-loadbearing	516.43	m^2		
	h. Cement Plaster Finish	379.81	m^2		
	i. Cement-based Waterproofing	379.81	m^2		
	j. Steel Works	1.00	ls		
	k. Pipes & Fittings	1.00	ls		
VII.	**ELECTRICAL WORKS**				
	a. Decorative Lantern (Luminaires)	1.00	ls		
	b. Panel Board	1.00	ls		
	c. Wires	1.00	ls		
	d. Conduits	1.00	ls		
	e. Public Address System	1.00	ls		
VIII.	**SOFT LANDSCAPING**				
	a. Chinese Evergreen	1.00	l.s		
	b. Everlasting Flower	1.00	l.s		
	c. Mussifolium Plant	1.00	l.s		
	d. Lollipop Plant	1.00	l.s		
	e. Bermuda Grass	1.00	l.s		
IX.	**RETAINING WALL**				
	a. Structure Excavation (Common Soil)	2,888.30	m^3		
	b. Embankment (From Structure Excavation, Manual)	1,830.44	m^3		
	c. Embankment (From Common Borrow by Equipment)	3,396.00	m^3		
	d. Gravel Fill	763.96	m^3		
	e. Damproofing (Polyethylene Sheets)	10,730.00	m^2		
	f. Structural Concrete (Ready Mix Concrete, Class A, 28 Days)	2,534.00	m^3		
	g. Reinforcing Steel, Grade 40	295,059.00	kg		
	h. Formworks and Falseworks (for one-storey building)	2,975.67	m^2		
	i. Structural Sheet Pile, Furnished (Rental)	45,696.00	kg		
	j. Structural Sheet Pile (Driving & Extracting)	274,176.00	kg		
	k. Dewatering	640.00	hrs		
	GRAND TOTAL	In Words: Pesos In Figures: Php			

Submitted By

_____
Name of the Representative of the Bidder

_____
Name of the Bidder

_____
Position

Section IX. Checklist of Technical and Financial Documents

Notes on the Checklist of Technical and Financial Documents

The prescribed documents in the checklist are mandatory to be submitted in the Bid, but shall be subject to the following:

a. GPPB Resolution No. 09-2020 on the efficient procurement measures during a State of Calamity or other similar issuances that shall allow the use of alternate documents in lieu of the mandated requirements; or

b. any subsequent GPPB issuances adjusting the documentary requirements after the effectivity of the adoption of the PBDs.

The BAC shall be checking the submitted documents of each Bidder against this checklist to ascertain if they are all present, using a non-discretionary "pass/fail" criterion pursuant to Section 30 of the 2016 revised IRR of RA No. 9184.

Checklist of Technical and Financial Documents

I. TECHNICAL COMPONENT ENVELOPE

Class "A" Documents

Legal Documents

☐ (a) Valid PhilGEPS Registration Certificate (Platinum Membership) (all pages);
and

☐ (b) Registration certificate from Securities and Exchange Commission (SEC) with Articles of Incorporation (AOI), Department of Trade and Industry (DTI) for sole proprietorship, or Cooperative Development Authority (CDA) for cooperatives or its equivalent document;
and

☐ (c) Mayor's or Business permit issued by the city or municipality where the principal place of business of the prospective bidder is located, or the equivalent document for Exclusive Economic Zones or Areas;
and

☐ (e) Tax clearance per E.O. No. 398, s. 2005, as finally reviewed and approved by the Bureau of Internal Revenue (BIR).

Technical Documents

☐ (f) Statement of the prospective bidder of all its ongoing government and private contracts, including contracts awarded but not yet started must have supporting documents, if any, whether similar or not similar in nature and complexity to the contract to be bid; **and**

☐ (g) Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid must have supporting documents, except under conditions provided under the rules; **and**

☐ (h) 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 to be bid; **and**

☐ (i) Original copy of Bid Security. If in the form of a Surety Bond, submit also a certification issued by the Insurance Commission;
or
Original copy of Notarized Bid Securing Declaration; **and**

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

☐ a. Organizational chart for the contract to be bid;

☐ b. List of contractor's key 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;

☐ c. List of contractor's major equipment units, which are owned, leased, and/or under purchase agreements, supported by proof of ownership or certification of availability of equipment from the equipment lessor/vendor for the duration of the project, as the case may be; **and**

☐ (k) Original duly signed Omnibus Sworn Statement (OSS);

and if applicable, Original Notarized Secretary's Certificate in case of a corporation, partnership, or cooperative; or Original Special Power of Attorney of all members of the joint venture giving full power and authority to its officer to sign the OSS and do acts to represent the Bidder.

☐ (l) Statement of Exclusivity (the bidder must certify that the foregoing personne shall perform work and equipment shall be used exclusively for the project unti completion of the project. Please see the attached Form for the purpose.)

☐ (m) Certificate or Affidavit of Site Inspection

☐ (n) Additional Technical Requirements:

- construction schedule and S-curve ss
- manpower schedule
- construction methods
- equipment utilization schedule
- PERT/CPM
- Construction Safety and Health Program

☐ (o) Contractors Registration Certificate by DPWH for the list of all ongoing projects if none, affidavit that there is none.

Financial Documents

☐ (p) The prospective bidder's audited financial statements, showing, among others, the prospective bidder's total and current assets and liabilities, stamped "received" by the BIR or its duly accredited and authorized institutions, for the preceding calendar year which should not be earlier than two (2) years from the date of bid submission; **and**

☐ (q) The prospective bidder's computation of Net Financial Contracting Capacity (NFCC).

Class "B" Documents

(r) If applicable, duly signed joint venture agreement (JVA) in accordance with RA No. 4566 and its IRR in case the joint venture is already in existence;
or
duly notarized statements from all the potential joint venture partners stating that they will enter into and abide by the provisions of the JVA in the instance that the bid is successful.

II. FINANCIAL COMPONENT ENVELOPE

☐ (s) Original of duly signed and accomplished Financial Bid Form; **and**

☐ (t) Soft Copy of Financial Proposal in the form of Flash Drive (USB) must be included inside the Original Financial Envelope

Other documentary requirements under RA No. 9184

☐ (u) Original of duly signed Bid Prices in the Bill of Quantities; **and**

☐ (v) Duly accomplished Detailed Estimates Form, including a summary shee indicating the unit prices of construction materials, labor rates, and equipmen rentals used in coming up with the Bid; **and**

☐ (w) Cash Flow by Quarter.

Republic of the Philippines
Tourism Infrastructure & Enterprise Zone Authority

MANPOWER & EQUIPMENT

Project: **REHABILITATION OF BURNHAM PARK**
Location: Baguio City, Benguet
Duration: 180 CD

Minimum Required Manpower	Quantity
a. Project Manager	1
b. Project Engineer	1
c. Materials Engineer	1
d. Geodetic Engineer	1
e. Safety Officer	1
f. Certified First Aider	1
g. Project Foreman	2
h. Skilled Worker	25
i. Helper/Laborer	46

Minimum Required Equipment	Quantity
1 Basic Construction Tools	1 lot
2 One-Bagger Mixer	1
3 Dump Truck (5 cu.m)	1
4 Jack Hammer	1
5 Plate Compactor (5 hp)	1
6 Backhoe (Crawler Mounted, 0.80 cu.m, 50HP)	1
7 Bar Bender	1
8 Bar Cutter	1
9 Water Pump, 100mm suction (2,667 ipm, 16 hp)	1
10 Vibro Hammer (30T, 79HP)	1
11 Vibratory Roller (10 mt)	1
12 Motorized Road Grader (140 hp)	1
13 Concrete Saw, Blade (14" Blade dia. With 3/4" cutting Depth, 7.5hp)	1
14 Generator Set (300 kW, 375 Kva)	1
15 Cutting Outfit	1
16 Welding Machine	1
14 Truck Mounted Crane (45T, 246 HP)	1
15 Cargo Truck 10 mt, 270 HP)	1
16 Concrete Vibrator	1

Prepared By:

RUSSELL U. SORIANO
Sr. PPDO

Checked by:

ENGR. RENE LENARD M. BUENAVENTURA
Officer-in-Charge, PMD

Noted:

ENGR. JEOFFREY L. MACALALAD
Manager, PEPD

Bid Form for the Procurement of Infrastructure Projects

[shall be submitted with the Bid]

BID FORM

Date : _____

Project Identification No. : _____

To: [name and address of Procuring Entity]

Having examined the Philippine Bidding Documents (PBDs) including the Supplemental or Bid Bulletin Numbers *[insert numbers]*, the receipt of which is hereby duly acknowledged, we, the undersigned, declare that:

a. We have no reservation to the PBDs, including the Supplemental or Bid Bulletins, for the Procurement Project: *[insert name of contract]*;

b. We offer to execute the Works for this Contract in accordance with the PBDs;

c. The total price of our Bid in words and figures, excluding any discounts offered below is: *[insert information]*;

d. The discounts offered and the methodology for their application are: *[insert information]*;

e. The total bid price includes the cost of all taxes, such as, but not limited to: *[specify the applicable taxes, e.g. (i) value added tax (VAT), (ii) income tax, (iii) local taxes, and (iv) other fiscal levies and duties]*, which are itemized herein and reflected in the detailed estimates,

f. Our Bid shall be valid within the a period stated in the PBDs, and it shall remain binding upon us at any time before the expiration of that period;

g. If our Bid is accepted, we commit to obtain a Performance Security in the amount of *[insert percentage amount]* percent of the Contract Price for the due performance of the Contract, or a Performance Securing Declaration in lieu of the the allowable forms of Performance Security, subject to the terms and conditions of issued GPPB guidelines[1] for this purpose;

h. We are not participating, as Bidders, in more than one Bid in this bidding process, other than alternative offers in accordance with the Bidding Documents;

i. We understand that this Bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal Contract is prepared and executed; and

j. We understand that you are not bound to accept the Lowest Calculated Bid or any other Bid that you may receive.

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[1] currently based on GPPB Resolution No. 09-2020

k. We likewise certify/confirm that the undersigned, 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 for the [Name of Project] of the [Name of the Procuring Entity].

l. We acknowledge that failure to sign each and every page of this Bid Form, including the Bill of Quantities, shall be a ground for the rejection of our bid.

Name: _____

Legal Capacity: _____

Signature: _____

Duly authorized to sign the Bid for and behalf of: _____

Date: _____

Bid Securing Declaration Form

[shall be submitted with the Bid if bidder opts to provide this form of bid security]

REPUBLIC OF THE PHILIPPINES)
CITY OF _____) S.S.

BID SECURING DECLARATION
Project Identification No.: *[Insert number]*

To: *[Insert name and address of the Procuring Entity]*

I/We, the undersigned, declare that:

1. I/We understand that, according to your conditions, bids must be supported by a Bid Security, which may be in the form of a Bid Securing Declaration.

2. I/We accept that: (a) I/we will be automatically disqualified from bidding for any procurement contract with any procuring entity for a period of two (2) years upon receipt of your Blacklisting Order; and, (b) I/we will pay the applicable fine provided under Section 6 of the Guidelines on the Use of Bid Securing Declaration, within fifteen (15) days from receipt of the written demand by the procuring entity for the commission of acts resulting to the enforcement of the bid securing declaration under Sections 23.1(b), 34.2, 40.1 and 69.1, except 69.1(f),of the IRR of RA No. 9184; without prejudice to other legal action the government may undertake.

3. I/We understand that this Bid Securing Declaration shall cease to be valid on the following circumstances:

   a. Upon expiration of the bid validity period, or any extension thereof pursuant to your request;
   b. I am/we are declared ineligible or post-disqualified upon receipt of your notice to such effect, and (i) I/we failed to timely file a request for reconsideration or (ii) I/we filed a waiver to avail of said right; and
   c. I am/we are declared the bidder with the Lowest Calculated Responsive Bid, and I/we have furnished the performance security and signed the Contract.

IN WITNESS WHEREOF, I/We have hereunto set my/our hand/s this ____ day of *[month] [year]* at *[place of execution]*.

[Insert NAME OF BIDDER OR ITS AUTHORIZED REPRESENTATIVE]
[Insert signatory's legal capacity]
Affiant

[Jurat]
[Format shall be based on the latest Rules on Notarial Practice]

Omnibus Sworn Statement (Revised)

[shall be submitted with the Bid]

REPUBLIC OF THE PHILIPPINES)
CITY/MUNICIPALITY OF _____) S.S.

AFFIDAVIT

I, [Name of Affiant], of legal age, [Civil Status], [Nationality], and residing at [Address of Affiant], after having been duly sworn in accordance with law, do hereby depose and state that:

1. *[Select one, delete the other:]*

   [If a sole proprietorship:] I am the sole proprietor or authorized representative of [Name of Bidder] with office address at [address of Bidder];

   [If a partnership, corporation, cooperative, or joint venture:] I am the duly authorized and designated representative of [Name of Bidder] with office address at [address of Bidder];

2. *[Select one, delete the other:]*

   [If a sole proprietorship:] As the owner and sole proprietor, or authorized representative of [Name of Bidder], I have 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 for [Name of the Project] of the [Name of the Procuring Entity], as shown in the attached duly notarized Special Power of Attorney;

   [If a partnership, corporation, cooperative, or joint venture:] I am 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 for [Name of the Project] of the [Name of the Procuring Entity], as shown in the attached [state title of attached document showing proof of authorization (e.g., duly notarized Secretary's Certificate, Board/Partnership Resolution, or Special Power of Attorney, whichever is applicable;)];

3. [Name of Bidder] is not "blacklisted" or barred from bidding by the Government of the Philippines or any of its agencies, offices, corporations, or Local Government Units, foreign government/foreign or international financing institution whose blacklisting rules have been recognized by the Government Procurement Policy Board, **by itself or by relation, membership, association, affiliation, or controlling interest with another blacklisted person or entity as defined and provided for in the Uniform Guidelines on Blacklisting;**

4. 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;

5. [Name of Bidder] is authorizing the Head of the Procuring Entity or its duly authorized representative(s) to verify all the documents submitted;

6. *[Select one, delete the rest:]*

   [If a sole proprietorship:] The owner or sole proprietor is not related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical

Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

[If a partnership or cooperative:] None of the officers and members of *[Name of Bidder]* is related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

[If a corporation or joint venture:] None of the officers, directors, and controlling stockholders of *[Name of Bidder]* is related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

7. *[Name of Bidder]* complies with existing labor laws and standards; and

8. *[Name of Bidder]* is aware of and has undertaken the responsibilities as a Bidder in compliance with the Philippine Bidding Documents, which includes:

    a. Carefully examining all of the Bidding Documents;
    b. Acknowledging all conditions, local or otherwise, affecting the implementation of the Contract;
    c. Making an estimate of the facilities available and needed for the contract to be bid, if any; and
    d. Inquiring or securing Supplemental/Bid Bulletin(s) issued for the *[Name of the Project]*.

9. *[Name of Bidder]* 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 government in relation to any procurement project or activity.

10. **In case advance payment was made or given, failure to perform or deliver any of the obligations and undertakings in the contract shall be sufficient grounds to constitute criminal liability for Swindling (Estafa) or the commission of fraud with unfaithfulness or abuse of confidence through misappropriating or converting any payment received by a person or entity under an obligation involving the duty to deliver certain goods or services, to the prejudice of the public and the government of the Philippines pursuant to Article 315 of Act No. 3815 s. 1930, as amended, or the Revised Penal Code.**

IN WITNESS WHEREOF, I have hereunto set my hand this __ day of ___, 20__ at _____, Philippines.

[Insert NAME OF BIDDER OR ITS AUTHORIZED REPRESENTATIVE]
[Insert signatory's legal capacity]
Affiant

[Jurat]
[Format shall be based on the latest Rules on Notarial Practice]

STATEMENT OF EXCLUSIVITY

I certify that the personnel and the equipment pledged for the bidding for (name of the project) shall be **exclusively used** for the project during its entire duration.

(Date)

(Authorized Representative)

Name of contractor

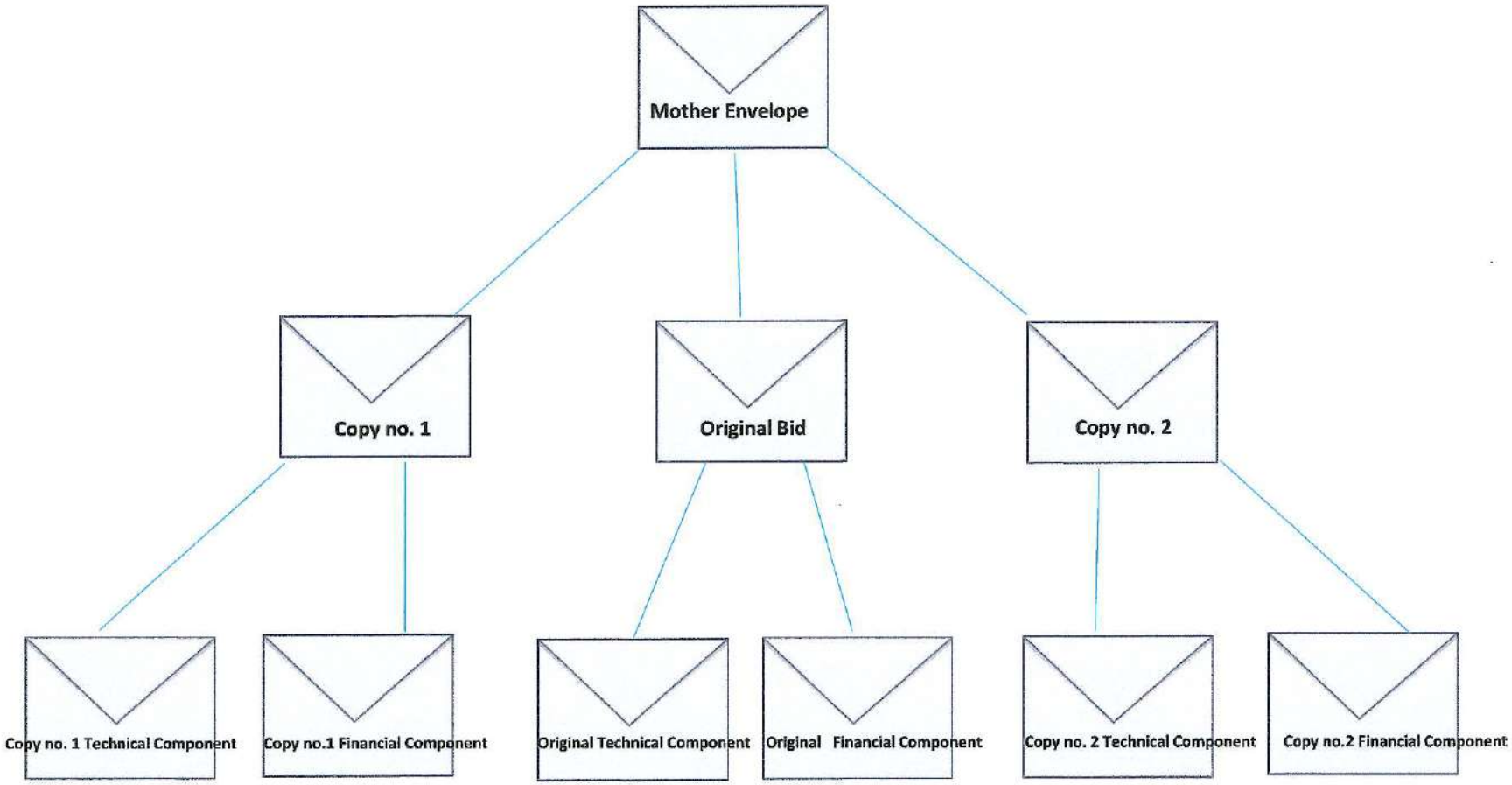
_____

Signature

IN WITNESS WHEREOF, I have hereunto set my hand this __ day of ___, 20__ at _____, Philippines.

NAME OF NOTARY PUBLIC
Serial No. of Commission _____
Notary Public for _____ until _____
Roll of Attorneys No. _____
PTR No. _____
IBP No. _____

Doc. No. _____
Page No. _____
Book No. _____
Series of _____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Original Bid
Copy no. 2
Copy no. 1 Technical Component
Copy no.1 Financial Component
Original Technical Component
Original Financial Component
Copy no. 2 Technical Component
Copy no.2 Financial Component

FORMAT FOR 360 CD

Use you letter Head

Project ID. No:

Project :

Location:

Duration : Calendar Days

CASH FLOW BY QUARTER

PARTICULAR	TOTAL	1st Quarter	2nd Quarter	3 rd Quarter	4th Quarter
ACCOMPLISHMENT, IN %					
CASH FLOW, IN Php					
CUMULATIVE ACCOMPLISHMENT, IN %					
CUMULATIVE CASH FLOW, IN Php					

Prepared By:


Republic of the Philippines
gppb
Government Procurement Policy Board