

# **PHILIPPINE BIDDING DOCUMENTS**

Construction of New Clark City  
Connecting Road Package 1

Public Bidding No. 20-021-1

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## List of Acronyms

1 .	ABC	Approved Budget for the Contract
2 .	BAC	Bids and Awards Committee
3 .	BCDA	Bases Conversion and Development Authority
4 .	BDS	Bid Data Sheet
5 .	BIR	Bureau of Internal Revenue
6 .	BOQ	Bill of Quantities
7 .	BSP	Bangko Sentral ng Pilipinas
8 .	CDA	Cooperative Development Authority
9 .	CLC	Credit Line Commitment
10 .	CPES	Constructors Performance Evaluation System
11 .	CTRC	Contract Termination Review Committee
12 .	DPWH	Department of Public Works and Highways
13 .	DTI	Department of Trade and Industry
14 .	EFPS	Electronic Filing and Payment System
15 .	GCC	General Conditions of the Contract
16 .	GOP	Government of the Philippines
17 .	GPPB	Government Procurement Policy Board
18 .	IRR	Implementing Rules and Regulations
19 .	ITB	Instructions to Bidders
20 .	JV	Joint Venture
21 .	JVA	Joint Venture Agreement
22 .	LCB	Lowest Calculated Bid
23 .	LCRB	Lowest Calculated and Responsive Bid
24 .	LGU	Local Government Unit
25 .	NFCC	Net Financial Contracting Capacity
26 .	NTP	Notice to Proceed
27 .	PCAB	Philippine Contractors Accreditation Board
28 .	PERT/CPM	Project Evaluation Review Technique/Critical Path Method
29 .	PhilGEPS	Philippine Government Electronic Procurement System
30 .	PMO	Project Management Office or end-user unit.
31 .	RA	Republic Act
32 .	SCC	Special Conditions of the Contract
33 .	SEC	Securities and Exchange Commission
34 .	TWG	Technical Working Group
35 .	DUPA	Detailed Unit Price Analysis
36 .	VAT	Value-Added Tax

**SECTION I**

**Invitation to Bid**

# Invitation to Bid

*for the*

## CONSTRUCTION OF NEW CLARK CITY CONNECTING ROAD PACKAGE 1

New Clark City, Capas, Tarlac

Public Bidding No. 20-021-1

1. The **Bases Conversion and Development Authority (BCDA)** and the **Procurement Service – Department of Budget and Management (PS-DBM)**, through the General Appropriations Act FY 2020 intend to apply the sum being the Approved Budget for the Contract to payment under the contract for the following:

Qty	Item / Description	Approved Budget for the contract	Delivery Period
1 Lot	Construction of New Clark City Connecting Road Package 1	Php 1,205,444,643.31 <u>inclusive of all applicable taxes and fees</u>	The Intended Completion Date is within Four Hundred Fifty (450) Calendar Days, upon receipt by the contractor of the Notice to Proceed.

Bids received in excess of the ABC shall be automatically rejected at bid opening.

2. The PS-DBM and BCDA now invite PhilGEPS registered contractors with valid and current Philippine Contractors Accreditation Board (PCAB) License of at least Category “AAA” and classification “Large B” for General Engineering.

**Bidders should have completed a contract similar to the Project equivalent to at least fifty (50%) of the ABC.** The description of an eligible bidder is contained in the Bidding Documents, particularly in Clause 5. of Section II. Instructions to Bidders. **For purposes of this project, similar contracts shall refer to the contracts involving Construction of Roads and/or Bridges.**

3. Bidding will be conducted through open competitive bidding procedures using non-discretionary “pass/fail” criterion as specified in the 2016 Revised Implementing Rules and Regulations (IRR) of Republic Act 9184 (RA 9184), otherwise known as the “Government Procurement Reform Act.”

Bidding is restricted to Filipino citizens/sole proprietorships, cooperatives, and partnerships or organizations with at least sixty percent (60%) interest or outstanding capital stock belonging to citizens of the Philippines.

4. Interested bidders may obtain further information from *Procurement Service* and inspect the Bidding Documents at the address given below from **8:00 AM to 5:00PM**.
5. A complete set of Bidding Documents may be acquired by interested Bidders from the address below and upon payment of the applicable fee for the Bidding Documents in the amount as follows:

Qty	Item / Description	Amount of Bid Documents
1 Lot	Construction of New Clark City Connecting Road Package 1	Php 75,000.00

It may also be downloaded free of charge from the website of the Philippine Government Electronic Procurement System (PhilGEPS), provided that bidders shall pay the applicable fee for the Bidding Documents not later than the submission of their bids.

6. The schedule of bidding activities is as follows:

ACTIVITIES	SCHEDULE	VENUE
Advertisement/Posting of Invitation to Bid	July 21, 2020	PhilGEPS website, PS website, and at any conspicuous place reserved for this purpose in the premises of PS.
Issuance and Availability of Bid Documents	July 21, 2020	PS Cashier and PhilGEPS website
Site Inspection	To be coordinated with the Procuring Entity	New Clark City, Capas, Tarlac
Pre-Bid Conference	July 28, 2020 at 10:00AM	PS Conference Room, Cristobal St., Paco, Manila
Last day of Submission of Written Clarifications	August 14, 2020	PS Main Office Cristobal St., Paco, Manila or email at <a href="mailto:pd4@ps-philgeps.gov.ph">pd4@ps-philgeps.gov.ph</a>
Last day of Issuance of Supplemental Bid Bulletin	August 19, 2020	PhilGEPS website, PS website, PS bulletin board
Deadline of Submission and Receipt of Bids	August 26, 2020 ; 10:00 AM	PS Conference Room, Cristobal St., Paco, Manila
Opening of Bids	Immediately after the deadline for submission of Bids.	PS Conference Room, Cristobal St., Paco, Manila

7. Bids must be duly received by the Bids and Awards Committee I (BAC I) Secretariat of the Procurement Service at the address below on or before **10:00 AM of August 26, 2020**. All bids must be accompanied by a bid security in any of the acceptable forms and in the amount stated in **ITB** Clause 18.

The bidders or their duly authorized representatives may attend the opening of bids. Late bids shall not be accepted.

8. The *Procurement Service* reserves the right to reject any and all bids, declare a failure of bidding, or not award the contract at any time prior to contract award in accordance with Section 41 of RA 9184 and its 2016 IRR, without thereby incurring any liability to the affected bidder or bidders.
9. For further information, please refer to:  
*Bids and Awards Committee I (BAC I) Secretariat*  
*Procurement Service-DBM*  
*RR Road, Cristobal St., Paco, Manila*  
*Tel: 8 290 6300 or 8 290 6400*  
*[vdisu@ps-philgeps.gov.ph](mailto:vdisu@ps-philgeps.gov.ph)*

(SGD)  
**DICKSON PANTI**  
Chairperson, Bids and Awards Committee I

## **SECTION II**

### **Instructions to Bidders**



## A. General

### 1. Scope of Bid

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

### 2. Source of Funds

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

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

- 3.1. Unless otherwise specified in the **BDS**, the Procuring Entity, as well as bidders and contractors, shall observe the highest standard of ethics during the procurement and execution of the contract. In pursuance of this policy, the Funding Source:
  - (a) defines, for purposes of this provision, the terms set forth below as follows:
    - (i) "corrupt practice" means behavior on the part of officials in the public or private sectors by which they improperly and unlawfully enrich themselves, others, or induce others to do so, by misusing the position in which they are placed, and includes the offering, giving, receiving, or soliciting of anything of value to influence the action of any such official in the procurement process or in contract execution; entering, on behalf of the Procuring Entity, into any contract or transaction manifestly and grossly disadvantageous to the same, whether or not the public officer profited or will profit thereby, and similar acts as provided in Republic Act 3019;
    - (ii) "fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Procuring Entity, and includes collusive practices among Bidders (prior to or after Bid submission) designed to establish bid prices at artificial, non-competitive levels and to deprive the Procuring Entity of the benefits of free and open competition;
    - (iii) "collusive practices" means a scheme or arrangement between two or more Bidders, with or without the knowledge of the Procuring Entity,

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

- (iv) “coercive practices” means harming or threatening to harm, directly or indirectly, persons, or their property to influence their participation in a procurement process, or affect the execution of a contract;
  - (v) “obstructive practice” is
    - (aa) deliberately destroying, falsifying, altering or concealing of evidence material to an administrative proceedings or investigation or making false statements to investigators in order to materially impede an administrative proceedings or investigation of the Procuring Entity or any foreign government/foreign or international financing institution into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the administrative proceedings or investigation or from pursuing such proceedings or investigation; or
    - (bb) acts intended to materially impede the exercise of the inspection and audit rights of the Procuring Entity or any foreign government/foreign or international financing institution herein.
  - (b) will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the Contract; and
  - (c) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded Contract funded by the Funding Source if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing or, or in executing, a Contract funded by the Funding Source.
- 3.2. Further, the Procuring Entity will seek to impose the maximum civil, administrative, and/or criminal penalties available under the applicable laws on individuals and organizations deemed to be involved in any of the practices mentioned in **ITB** Clause 3.1(a).
- 3.3. Furthermore, the Funding Source and the Procuring Entity reserve the right to inspect and audit records and accounts of a contractor in the bidding for and performance of a contract themselves or through independent auditors as reflected in the **GCC** Clause 34.

#### **4. Conflict of Interest**

- 4.1. All Bidders found to have conflicting interests shall be disqualified to participate in the procurement at hand, without prejudice to the imposition of appropriate administrative,

civil, and criminal sanctions. A Bidder may be considered to have conflicting interests with another Bidder in any of the events described in paragraphs (a) through (c) and a general conflict of interest in any of the circumstances set out in paragraphs (d) through (g) below:

- (a) A Bidder has controlling shareholders in common with another Bidder;
- (b) A Bidder receives or has received any direct or indirect subsidy from any other Bidder;
- (c) A Bidder has the same legal representative as that of another Bidder for purposes of this Bid;
- (d) A Bidder has a relationship, directly or through third parties, that puts them in a position to have access to information about or influence on the bid of another Bidder or influence the decisions of the Procuring Entity regarding this bidding process;
- (e) A Bidder submits more than one bid in this bidding process. However, this does not limit the participation of subcontractors in more than one bid;
- (f) A Bidder who participated as a consultant in the preparation of the design or technical specifications of the goods and related services that are the subject of the bid; or
- (g) A Bidder who lends, or temporarily seconds, its personnel to firms or organizations which are engaged in consulting services for the preparation related to procurement for or implementation of the project, if the personnel would be involved in any capacity on the same project.

4.2. In accordance with Section 47 of the IRR of RA 9184, all Bidding Documents shall be accompanied by a sworn affidavit of the Bidder that it is not related to the Head of the Procuring Entity (HoPE), members of the Bids and Awards Committee (BAC), members of the Technical Working Group (TWG), members of the BAC Secretariat, the head of the Project Management Office (PMO) or the end-user unit, and the project consultants, by consanguinity or affinity up to the third civil degree. On the part of the Bidder, this Clause shall apply to the following persons:

- (a) If the Bidder is an individual or a sole proprietorship, to the Bidder himself;
- (b) If the Bidder is a partnership, to all its officers and members;
- (c) If the Bidder is a corporation, to all its officers, directors, and controlling stockholders;
- (d) If the Bidder is a cooperative, to all its officers, directors, and controlling shareholders or members; and

- (e) If the Bidder is a joint venture (JV), the provisions of items (a), (b), (c) or (d) of this Clause shall correspondingly apply to each of the members of the said JV, as may be appropriate.

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

## 5. Eligible Bidders

- 5.1. Unless otherwise indicated in the **BDS**, the following persons shall be eligible to participate in this Bidding:
  - (a) Duly licensed Filipino citizens/sole proprietorships;
  - (b) Partnerships duly organized under the laws of the Philippines and of which at least sixty percent (60%) of the interest belongs to citizens of the Philippines;
  - (c) Corporations duly organized under the laws of the Philippines, and of which at least sixty percent (60%) of the outstanding capital stock belongs to citizens of the Philippines;
  - (d) Cooperatives duly organized under the laws of the Philippines;
  - (e) Persons/entities forming themselves into a JV, i.e., a group of two (2) or more persons/entities that intend to be jointly and severally responsible or liable for a particular contract: Provided, however, that, in accordance with Executive Order No. 65 (EO 65), s. 2018<sup>1</sup>, Filipino ownership or interest of the joint venture concerned shall be at least sixty percent (60%): Provided, further, that joint ventures in which Filipino ownership or interest is less than sixty percent (60%) may be eligible where the structures to be built require the application of techniques and/or technologies which are not adequately possessed by a person/entity meeting the sixty percent (60%) Filipino ownership requirement: Provided, finally, that in the latter case, Filipino ownership or interest shall not be less than twenty five percent (25%). For this purpose, Filipino ownership or interest shall be based on the contributions of each of the members of the joint venture as specified in their JVA.
- 5.2. The Procuring Entity may also invite foreign bidders when provided for under any Treaty or International or Executive Agreement as specified in the **BDS**.
- 5.3. Government owned or controlled corporations (GOCCs) may be eligible to participate only if they can establish that they (a) are legally and financially autonomous, (b) operate under commercial law, and (c) are not attached agencies of the Procuring Entity.

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<sup>1</sup> Promulgating the Eleventh Foreign Investment Negative List issued on 29 October 2018

- 5.4. (a) The Bidder must have an experience of having completed a Single Largest Completed Contract (SLCC) that is similar to this Project, equivalent to at least fifty percent (50%) of the ABC adjusted, if necessary, by the Bidder to current prices using the Philippine Statistics Authority (PSA) consumer price index. However, contractors under Small A and Small B categories without similar experience on the contract to be bid may be allowed to bid if the cost of such contract is not more than the Allowable Range of Contract Cost (ARCC) of their registration based on the guidelines as prescribed by the PCAB
- (b) For Foreign-funded Procurement, the Procuring Entity and the foreign government/foreign or international financing institution may agree on another track record requirement, as specified in the **BDS**.

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

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

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

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

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

## **6. Bidder's Responsibilities**

- 6.1. The Bidder or its duly authorized representative shall submit a sworn statement in the form prescribed in Section IX as required in **ITB** Clause 12.1(b)(iii).
- 6.2. The Bidder is responsible for the following:
- (a) Having taken steps to carefully examine all of the Bidding Documents;
  - (b) Having acknowledged all conditions, local or otherwise, affecting the implementation of the contract;
  - (c) Having made an estimate of the facilities available and needed for the contract to be bid, if any;
  - (d) Having complied with its responsibility to inquire or secure Supplemental/Bid Bulletin/s as provided under **ITB** Clause 10.4;

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

In case there is a finding by the Procuring Entity or the DOLE of underpayment or non-payment of workers’ wage and wage-related benefits, bidder agrees that the performance security or portion of the contract amount shall be withheld in favor of the complaining workers pursuant to appropriate provisions of Republic Act No. 9184 without prejudice to the institution of appropriate actions under the Labor Code, as amended, and other social legislations.

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

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

- (iii) Inform the workers of their conditions of work, labor clauses under the contract specifying wages, hours of work and other benefits under prevailing national laws, rules and regulations; or collective bargaining agreement; or arbitration award, if and when applicable, through

posting in two (2) conspicuous places in the establishment's premises;  
and

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

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

- 6.3. The Bidder, by the act of submitting its bid, shall be deemed to have inspected the site, determined the general characteristics of the contract works and the conditions for this Project and examine all instructions, forms, terms, and project requirements in the Bidding Documents.
- 6.4. It shall be the sole responsibility of the prospective bidder to determine and to satisfy itself by such means as it considers necessary or desirable as to all matters pertaining to this Project, including: (a) the location and the nature of the contract, project, or work; (b) climatic conditions; (c) transportation facilities; (c) nature and condition of the terrain, geological conditions at the site communication facilities, requirements, location and availability of construction aggregates and other materials, labor, water, electric power and access roads; and (d) other factors that may affect the cost, duration and execution or implementation of the contract, project, or work.
- 6.5. The Procuring Entity shall not assume any responsibility regarding erroneous interpretations or conclusions by the prospective or eligible bidder out of the data furnished by the procuring entity. However, the Procuring Entity shall ensure that all information in the Bidding Documents, including supplemental/bid bulletins issued are correct and consistent.
- 6.6. Before submitting their bids, the Bidders are deemed to have become familiar with all existing laws, decrees, ordinances, acts, rules and regulations of the Philippines which may affect the contract in any way.
- 6.7. The Bidder shall bear all costs associated with the preparation and submission of his bid, and the Procuring Entity will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
- 6.8. The Bidder should note that the Procuring Entity will accept bids only from those that have paid the applicable fee for the Bidding Documents at the office indicated in the Invitation to Bid.

## **7. Origin of Goods and Services**

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

## **8. Subcontracts**

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

#### **A. Contents of Bidding Documents**

### **9. Pre-Bid Conference**

- 9.1. (a) If so specified in the **BDS**, a pre-bid conference shall be held at the venue and on the date indicated therein, to clarify and address the Bidders' questions on the technical and financial components of this Project.  
  
(b) The pre-bid conference shall be held at least twelve (12) calendar days before the deadline for the submission of and receipt of bids, but not earlier than seven (7) calendar days from the posting of the Invitation to Bid/Bidding Documents in the PhilGEPS website. If the Procuring Entity determines that, by reason of the method, nature, or complexity of the contract to be bid, or when international participation will be more advantageous to the GoP, a longer period for the preparation of bids is necessary, the pre-bid conference shall be held at least thirty (30) calendar days before the deadline for the submission and receipt of bids, as specified in the **BDS**.
- 9.2. Bidders are encouraged to attend the pre-bid conference to ensure that they fully understand the Procuring Entity's requirements. Non-attendance of the Bidder will in no way prejudice its bid; however, the Bidder is expected to know the changes and/or amendments to the Bidding Documents as recorded in the minutes of the pre-bid conference and the Supplemental/Bid Bulletin. The minutes of the pre-bid conference shall be recorded and prepared not later than five (5) calendar days after the pre-bid conference. The minutes shall be made available to prospective bidders not later than five (5) days upon written request.
- 9.3. Decisions of the BAC amending any provision of the bidding documents shall be issued in writing through a Supplemental/Bid Bulletin at least seven (7) calendar days before the deadline for the submission and receipt of bids.

### **10. Clarification and Amendment of Bidding Documents**



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

## **B. Preparation of Bids**

### **11. Language of Bids**

The eligibility requirements or statements, the bids, and all other documents to be submitted to the BAC must be in English. If the eligibility requirements or statements, the bids, and all other documents submitted to the BAC are in foreign language other than English, it must be accompanied by a translation of the documents in English. The documents shall be translated by the relevant foreign government agency, the foreign government agency authorized to translate documents, or a registered translator in the foreign bidder's country; and shall be authenticated by the appropriate Philippine foreign service establishment/post or the equivalent office having jurisdiction over the foreign bidder's affairs in the Philippines. However, for Contracting Parties to the Apostille Convention, the documents shall be authenticated through an apostille by the Competent Authority, except for countries<sup>2</sup> identified by the Department of Foreign Affairs (DFA) that will still require legalization (red ribbon) by the relevant Embassy or Consulate. A Contracting Party refers to a State that has joined the Apostille Convention, GPPB Resolution No. 13-2019, dated 23 May 2019 page 9 of 19 whether or not the Convention has entered into force for that State<sup>3</sup>.

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<sup>2</sup> As of May 14, 2019: Austria, Finland, Germany and Greece.

<sup>3</sup> Apostille Handbook, A Handbook on the Practical Operation of the Apostille Convention, p. xviii. Netherland: The Hague Conference on Private International Permanent Bureau.

A Competent Authority refers to the authority designated by a Contracting Party that is competent to issue an apostille. A Contracting Party may designate one or more Competent Authorities and may designate Competent Authorities that are competent to issue an apostille for certain categories of public documents. Information about designated Competent Authorities may be found on the Apostille Section of the Hague Conference website under "Competent Authorities".<sup>4</sup>

The English translation shall govern, for purposes of interpretation of the bid.

## **12. Documents Comprising the Bid: Eligibility and Technical Components**

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

(a) Eligibility Documents –

Class "A" Documents

(i) PhilGEPS Certificate of Registration and Membership in accordance with Section 8.5.2 of the IRR, for procurement to be performed overseas, it shall be subject to the Guidelines to be issued by the GPPB.

(ii) Statement of all its ongoing government and private contracts, including contracts awarded but not yet started, if any, whether similar or not similar in nature and complexity to the contract to be bid; and

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

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

(ii.1) name of the contract;

(ii.2) date of the contract;

(ii.3) contract duration;

(ii.4) owner's name and address;

(ii.5) nature of work;

(ii.6) contractor's role (whether sole contractor, subcontractor, or partner in a JV) and percentage of participation;

(ii.7) total contract value at award;

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<sup>4</sup> *Ibid.*

- (ii.8) date of completion or estimated completion time;
- (ii.9) total contract value at completion, if applicable;
- (ii.10) percentages of planned and actual accomplishments, if applicable;
- (ii.11) value of outstanding works, if applicable;

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

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

Class "B" Document

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

(b) Technical Documents –

- (i) Bid security in accordance with **ITB** Clause 18. If the Bidder opts to submit the bid security in the form of:
  - (i.1) a bank draft/guarantee or an irrevocable letter of credit issued by a foreign bank, it shall be accompanied by a confirmation from a Universal or Commercial Bank; or
  - (i.2) a surety bond accompanied by a certification coming from the Insurance Commission that the surety or insurance company is authorized to issue such instruments.
- (ii) Project Requirements, which shall include the following:
  - (ii.1) Organizational chart for the contract to be bid;
  - (ii.2) List of contractor's personnel (e.g., Project Manager, Project Engineers, Materials Engineers, and Foremen), to be assigned to the contract to be bid, with their complete qualification and experience data. These personnel must

meet the required minimum years of experience set in the **BDS**; and

- (ii.3) List of contractor's major equipment units, which are owned, leased, and/or under purchase agreements, supported by proof of ownership, certification of availability of equipment from the equipment lessor/vendor for the duration of the project, as the case may be, which must meet the minimum requirements for the contract set in the **BDS**; and
- (iii) Sworn statement in accordance with Section 25.3 of the IRR of RA 9184 and using the form prescribed in Section IX. Bidding Forms.

### 13. Documents Comprising the Bid: Financial Component

13.1. the financial component of the bid shall contain the following:

- (a) Financial Bid Form, which includes bid prices and the bill of quantities, in accordance with **ITB** Clauses 15.1 and 15.3; and
- (b) Any other document related to the financial component of the bid as stated in the **BDS**.

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

- (b) Unless otherwise indicated in the **BDS**, for foreign-funded procurement, a ceiling may be applied to bid prices provided the following conditions are met:
  - (i) Bidding Documents are obtainable free of charge on a freely accessible website. If payment of Bidding Documents is required by the procuring entity, payment could be made upon the submission of bids.
  - (ii) The procuring entity has procedures in place to ensure that the ABC is based on recent estimates made by the engineer or the responsible unit of the procuring entity and that the estimates are based on adequate detailed engineering (in the case of infrastructure projects) and reflect the quality, supervision and risk and inflationary factors, as well as prevailing market prices, associated with the types of works or goods to be procured.
  - (iii) The procuring entity has trained cost estimators on estimating prices and analyzing bid variances. In the case of infrastructure projects, the procuring entity must also have trained quantity surveyors.
  - (iv) The procuring entity has established a system to monitor and report bid prices relative to ABC and engineer's/procuring entity's estimate.

- (v) The procuring entity has established a monitoring and evaluation system for contract implementation to provide a feedback on actual total costs of goods and works.

#### **14. Alternative Bids**

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

#### **15. Bid Prices**

- 15.1. The contract shall be for the whole Works, as described in **ITB** Clause 1.1, based on the priced Bill of Quantities submitted by the Bidder.
- 15.2. The Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Bids not addressing or providing all of the required items in the Bidding Documents including, where applicable, Bill of Quantities, shall be considered non-responsive and, thus, automatically disqualified. In this regard, where a required item is provided, but no price is indicated, the same shall be considered as non-responsive, but specifying a zero (0) or a dash (-) for the said item would mean that it is being offered for free to the Government, except those required by law or regulations to be provided for.
- 15.3. All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, prior to the deadline for submission of bids, shall be included in the rates, prices, and total bid price submitted by the Bidder.
- 15.4. All bid prices for the given scope of work in the contract as awarded shall be considered as fixed prices, and therefore not subject to price escalation during contract implementation, except under extraordinary circumstances as specified in GCC Clause 48. Upon the recommendation of the Procuring Entity, price escalation may be allowed in extraordinary circumstances as may be determined by the National Economic and Development Authority in accordance with the Civil Code of the Philippines, and upon

approval by the GPPB. Furthermore, in cases where the cost of the awarded contract is affected by any applicable new laws, ordinances, regulations, or other acts of the GoP, promulgated after the date of bid opening, a contract price adjustment shall be made or appropriate relief shall be applied on a no loss-no gain basis.

**16. Bid Currencies**

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

**17. Bid Validity**

- 17.1. Bids shall remain valid for the period specified in the **BDS** which shall not exceed one hundred twenty (120) calendar days from the date of the opening of bids.
- 17.2. In exceptional circumstances, prior to the expiration of the bid validity period, the Procuring Entity may request Bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. The bid security described in **ITB** Clause 18 should also be extended corresponding to the extension of the bid validity period at the least. A Bidder may refuse the request without forfeiting its bid security, but his bid shall no longer be considered for further evaluation and award. A Bidder granting the request shall not be required or permitted to modify its bid.

**18. Bid Security**

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

Form of Bid Security	Amount of Bid Security (Not less than the Percentage of the ABC)
(a) Cash or cashier's/manager's check issued by a Universal or Commercial Bank.  <i>For biddings conducted by LGUs,</i>	Two percent (2%)

<p><i>the cashier's/manager's check may be issued by other banks certified by the BSP as authorized to issue such financial instrument.</i></p>	
<p>(b) Bank draft/guarantee or irrevocable letter of credit issued by a Universal or Commercial Bank: Provided, however, that it shall be confirmed or authenticated by a Universal or Commercial Bank, if issued by a foreign bank.</p> <p><i>For biddings conducted by LGUs, the Bank Draft/Guarantee, or irrevocable letter of credit may be issued by other banks certified by the BSP as authorized to issue such financial instrument.</i></p>	
<p>(c) Surety bond callable upon demand issued by a surety or insurance company duly certified by the Insurance Commission as authorized to issue such security;</p>	<p>Five percent (5%)</p>

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

- 18.2. The bid security should be valid for the period specified in the **BDS**. Any bid not accompanied by an acceptable bid security shall be rejected by the Procuring Entity as non-responsive.
- 18.3. No bid securities shall be returned to Bidders after the opening of bids and before contract signing, except to those that failed or declared as post-disqualified, upon submission of a written waiver of their right to file a request for reconsideration and/or protest, or lapse of the reglementary period without having filed a request for reconsideration or protest. Without prejudice on its forfeiture, Bid Securities shall be returned only after the Bidder with the Lowest Calculated Responsive Bid (LCRB) has signed the contract and furnished the Performance Security, but in no case later than the expiration of the Bid Security validity period indicated in **ITB Clause 18.2**.
- 18.4. Upon signing and execution of the contract, pursuant to **ITB Clause 31**, and the posting of the performance security, pursuant to **ITB Clause 32**, the successful

Bidder's Bid Security will be discharged, but in no case later than the Bid Security validity period as indicated in **ITB** Clause 18.2.

18.5. The bid security may be forfeited:

- (a) if a Bidder:
  - (i) withdraws its bid during the period of bid validity specified in **ITB** Clause 17;
  - (ii) does not accept the correction of errors pursuant to **ITB** Clause 27.3(b);
  - (iii) has a finding against the veracity of the required documents submitted in accordance with **ITB** Clause 28.2;
  - (iv) submission of eligibility requirements containing false information or falsified documents;
  - (v) submission of bids that contain false information or falsified documents, or the concealment of such information in the bids in order to influence the outcome of eligibility screening or any other stage of the public bidding;
  - (vi) allowing the use of one's name, or using the name of another for purposes of public bidding;
  - (vii) withdrawal of a bid, or refusal to accept an award, or enter into contract with the Government without justifiable cause, after the Bidder had been adjudged as having submitted the LCRB;
  - (viii) refusal or failure to post the required performance security within the prescribed time;
  - (ix) refusal to clarify or validate in writing its bid during post-qualification within a period of seven (7) calendar days from receipt of the request for clarification;
  - (x) any documented attempt by a Bidder to unduly influence the outcome of the bidding in his favor;
  - (xi) failure of the potential joint venture partners to enter into the joint venture after the bid is declared successful; or
  - (xii) all other acts that tend to defeat the purpose of the competitive bidding, such as habitually withdrawing from bidding, submitting late Bids or patently insufficient bid, for at least three (3) times within a year, except for valid reasons.



- (b) if the successful Bidder:
  - (i) fails to sign the contract in accordance with **ITB** Clause 31;
  - (ii) fails to furnish performance security in accordance with **ITB** Clause 32.

## **19. Format and Signing of Bids**

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

## **20. Sealing and Marking of Bids**

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

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

### **C. Submission and Opening of Bids**

#### **21. Deadline for Submission of Bids**

Bids must be received by the Procuring Entity's BAC at the address and on or before the date and time indicated in the **BDS**. In case the deadline for submission of bids fall on a non-working day duly declared by the president, governor or mayor or other government official authorized to make such declaration, the deadline shall be the next working day.

#### **22. Late Bids**

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

#### **23. Modification and Withdrawal of Bids**

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

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

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

## **24. Opening and Preliminary Examination of Bids**

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

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

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

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

#### **D. Evaluation and Comparison of Bids**

##### **25. Process to be Confidential**

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

##### **26. Clarification of Bids**

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

##### **27. Detailed Evaluation and Comparison of Bids**

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

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

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

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

## **28. Post Qualification**

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

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

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

## **29. Reservation Clause**

- 29.1. Notwithstanding the eligibility or post-qualification of a Bidder, the Procuring Entity concerned reserves the right to review its qualifications at any stage of the procurement process if it has reasonable grounds to believe that a misrepresentation has been made by the said Bidder, or that there has been a change in the Bidder's capability to undertake the project from the time it submitted its eligibility requirements. Should such review uncover any misrepresentation made in the eligibility and bidding requirements, statements or documents, or any changes in the situation of the Bidder which will affect its capability to undertake the project so that it fails the preset eligibility or bid evaluation criteria, the Procuring Entity shall consider the said Bidder as ineligible and shall disqualify it from submitting a bid or from obtaining an award or contract.

- 29.2. Based on the following grounds, the Procuring Entity reserves the right to reject any and all Bids, declare a Failure of Bidding at any time prior to the contract award, or not to award the contract, without thereby incurring any liability, and make no assurance that a contract shall be entered into as a result of the bidding:
- (a) If there is *prima facie* evidence of collusion between appropriate public officers or employees of the Procuring Entity, or between the BAC and any of the Bidders, or if the collusion is between or among the Bidders themselves, or between a Bidder and a third party, including any act which restricts, suppresses or nullifies or tends to restrict, suppress or nullify competition;
  - (b) If the Procuring Entity's BAC is found to have failed in following the prescribed bidding procedures; or
  - (c) For any justifiable and reasonable ground where the award of the contract will not redound to the benefit of the GOP as follows:
    - (i) If the physical and economic conditions have significantly changed so as to render the project no longer economically, financially or technically feasible as determined by the HoPE;
    - (ii) If the project is no longer necessary as determined by the HoPE; and
    - (iii) If the source of funds for the project has been withheld or reduced through no fault of the Procuring Entity.
- 29.3. In addition, the Procuring Entity may likewise declare a failure of bidding when:
- (a) No bids are received;
  - (b) All prospective bidders are declared ineligible;
  - (c) All bids fail to comply with all the bid requirements or fail post-qualification; or
  - (d) The Bidder with the LCRB refuses, without justifiable cause, to accept the award of contract, and no award is made in accordance with Section 40 of the IRR of RA 9184.

#### **E. Award of Contract**

### **30. Contract Award**

- 30.1. Subject to **ITB** Clause 28, the HoPE or its duly authorized representative shall award the contract to the Bidder whose bid has been determined to be the LCRB.
- 30.2. Prior to the expiration of the period of bid validity, the Procuring Entity shall notify the successful Bidder in writing that its bid has been accepted, through a Notice of Award



duly received by the Bidder or its representative personally or by registered mail or electronically, receipt of which must be confirmed in writing within two (2) days by the Bidder with the LCRB and submitted personally or sent by registered mail or electronically to the Procuring Entity.

30.3. Notwithstanding the issuance of the Notice of Award, award of contract shall be subject to the following conditions:

- (a) Submission of valid PCAB license and registration for the type and cost of the contract to be bid for foreign bidders when the Treaty or International or Executive Agreement expressly allows submission of the PCAB license and registration for the type and cost of the contract to be bid as a pre-condition to the Award, within ten (10) calendar days from receipt of the Notice of Award;
- (b) Posting of the performance security in accordance with **ITB** Clause 32;
- (c) Signing of the contract as provided in **ITB** Clause 31; and
- (d) Approval by higher authority, if required, as provided in Section 37.3 of the IRR of RA 9184.

### **31. Signing of the Contract**

31.1. At the same time as the Procuring Entity notifies the successful Bidder that its bid has been accepted, the Procuring Entity shall send the Contract Form to the Bidder, which Contract has been provided in the Bidding Documents, incorporating therein all agreements between the parties.

31.2. Within ten (10) calendar days from receipt of the Notice of Award, the successful Bidder shall post the required performance security, sign and date the contract and return it to the Procuring Entity.

31.3. The Procuring Entity shall enter into contract with the successful Bidder within the same ten (10) calendar day's period provided that all the documentary requirements are complied with.

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

- (a) Contract Agreement;
- (b) Bidding Documents;
- (c) Winning Bidder's bid, including the Technical and Financial Proposals, and all other documents/statements submitted (e.g., Bidder's response to request for clarifications on the bid), including corrections to the bid, if any, resulting from the Procuring Entity's bid evaluation;

- (d) Performance Security;
- (e) Notice of Award of Contract; and
- (f) Other contract documents that may be required by existing laws and/or specified in the **BDS**.

**32. Performance Security**

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

Form of Performance Security	Amount of Performance Security (Not less than the Percentage of the Total Contract Price)
(a) Cash or cashier's/manager's check issued by a Universal or Commercial Bank.  <i>For biddings conducted by the LGUs, the Cashier's/Manager's Check may be issued by other banks certified by the BSP as authorized to issue such financial instrument.</i>	Ten percent (10%)
(b) Bank draft/guarantee or irrevocable letter of credit issued by a Universal or Commercial Bank: Provided, however, that it shall be confirmed or authenticated by a Universal or Commercial Bank, if issued by a foreign bank.  <i>For biddings conducted by the LGUs, Bank Draft/Guarantee, or Irrevocable Letter of Credit may be issued by other banks certified by the BSP as authorized to issue such financial instrument</i>	

(c) Surety bond callable upon demand issued by a surety or insurance company duly certified by the Insurance Commission as authorized to issue such security.	Thirty percent (30%)
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32.3. Failure of the successful Bidder to comply with the above-mentioned requirement shall constitute sufficient ground for the annulment of the award and forfeiture of the bid security, in which event the Procuring Entity shall have a fresh period to initiate and complete the post qualification of the second Lowest Calculated Bid. The procedure shall be repeated until LCRB is identified and selected for recommendation of contract award. However if no Bidder passed post-qualification, the BAC shall declare the bidding a failure and conduct a re-bidding with re-advertisement, if necessary.

**33. Notice to Proceed**

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

**34. Protest Mechanism**

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

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**SECTION III**

**Bid Data Sheet**

### Bid Data Sheet

ITB Clause	
1.1	The Procuring Entity is the Bases Conversion and Development Authority (BCDA).
1.2	The name of the Contract is <b>Construction of New Clark City Connecting Road Package 1.</b>  The contract is to be bid under Public Bidding No. 20-021-1.
2	The Funding Source is:  <b>GAA in the amount of Php 1,205,444,643.31 <u>inclusive of all applicable taxes and fees.</u></b>  The name of the Project is <b>Construction of New Clark City Connecting Road Package 1.</b>  Terms of payment will be composed of:  a) 15% advance/mobilization payment; and b) Progress Payments
3.1	No further instructions.
5.1	Prospective bidders must have at least a license category “AAA” and a license classification “Large B” from the Philippine Contractors Accreditation Board (PCAB) for General Engineering. The PCAB license must be valid and effective at the time of submission of the bid.
5.2	Bidding is restricted to eligible bidders as defined in ITB Clause 5.1.
5.4(b)	No further instructions.  For this purpose, similar contracts shall refer to completed road and/or bridge projects.
8.1	The Bidder may subcontract a maximum of fifty percent (50%) of the Works subject to prior written approval of <u>Procuring Entity.</u>
8.2	Subcontractors shall comply with the eligibility criteria specified in ITB Clause 5.1.
9.1	The Procuring Entity will hold a pre-bid conference for this Project on July 28, 2020 – 10:00AM at the <u>PS Conference Room, Procurement Service – DBM, Cristobal St., Paco, Manila.</u>
10.1	Requests for clarification must be addressed to:  Chairperson Bids and Awards Committee I vdisu@ps-philgeps.gov.ph

12.1	No further instructions.		
12.1(a)(iii)	No other acceptable proof of registration is recognized.		
12.1(b)(ii.2)	<b>List of Minimum Key Personnel Nominated/To Be Assigned to the Project</b>		
	No.	Key Personnel	Minimum Required
	1.	Project Manager (Must be a Licensed Civil Engineer with 10 year minimum experience as Project Manager)	1
	2.	Project Engineer (Must be a Licensed Civil Engineer with 5 year minimum experience as Project Engineer)	1
	3.	Bridge/Structural Engineer (Must be a Licensed Civil Engineer with 5 year minimum experience as Bridge/Structural Engineer)	1
	4.	Quantity Engineer (Must be a Licensed Civil Engineer with 5 year minimum experience as Quantity Engineer)	2
	5.	Materials Engineer II (Must be a DPWH Accredited Materials Engineer II with 5 year minimum experience as Material Engineer)	1
	6.	Site Engineer (Must be a Licensed Civil Engineer with 5 year minimum experience as Site Engineer)	6
	7.	Electrical Engineer (Must be a Registered Electrical Engineer with 5 year minimum experience as Electrical Engineer)	1
	8.	Health and Safety Officer (Must be a DOLE	1

		Accredited Safety Officer with 5 year minimum experience as Safety Officer)																																																							
	9.	Drainage Engineer (Must be a Licensed Civil Engineer with 5 year minimum experience as Drainage Engineer position)	1																																																						
	10.	Geodetic Engineer (Must be a Licensed Geodetic Engineer with 5 year minimum experience as Geodetic Engineer position)	1																																																						
	<p>A Geodetic Engineer was required in order to ensure the accuracy of the vertical and horizontal control limits of the project as against to the design and validation of parcellary surveys.</p> <p>The bidder is not allowed to combine work experiences of two or more personnel in order to meet the required minimum years of experience.</p> <p>The bidder is not allowed to nominate a person more than once.</p>																																																								
12.1(b)(ii.3)	<table><tr><th colspan="3">List of minimum equipment requirement.</th></tr><tr><th>No</th><th>TYPE OF EQUIPMENT</th><th>QUANTITY</th></tr><tr><td>1</td><td>Backhoe Hydraulic Excavator, W.M. 0.50 cu.m., 128 hp</td><td>2</td></tr><tr><td>2</td><td>Backhoe Hydraulic Excavator, W.M. 0.92 cu.m., 130 hp</td><td>2</td></tr><tr><td>3</td><td>Cargo Truck, 6-8 tonner, 195 hp.</td><td>2</td></tr><tr><td>4</td><td>Cargo Truck, 11-12 tonner, 290 hp.</td><td>2</td></tr><tr><td>5</td><td>Crane, Hydraulic, 61-70 tonnes, 280 hp.</td><td>2</td></tr><tr><td>6</td><td>Concrete Finisher/Paver, 120 hp.</td><td>1</td></tr><tr><td>7</td><td>Concrete Pump/Trailer/Truck Mounted (Cont.) Turbo Uni30, 8 round, 3-5 cu.m/hr</td><td>2</td></tr><tr><td>8</td><td>Crawler Crane, 51-60 tones, 275 hp.</td><td>1</td></tr><tr><td>9</td><td>Crawler Tractor with Dozer, 105 hp.</td><td>1</td></tr><tr><td>10</td><td>Drilling Rig, Hydraulic Crawler Type LLAMADA P-100TT Bentonite Machine</td><td>1</td></tr><tr><td>11</td><td>Dump Truck, 9-11.50 cu.yd., 380 hp.</td><td>10</td></tr><tr><td>12</td><td>Motorize Grader, 125 hp.</td><td>2</td></tr><tr><td>13</td><td>Pile Vibrator Driver, 60 kw (Electric Driven), Tomen Vibro w/o Genset/ Hydraulic Pile Driver</td><td>2</td></tr><tr><td>14</td><td>Pumpcrete, Putmeister, 45.87 cu.m/fr. 180 hp.</td><td>1</td></tr><tr><td>15</td><td>Service Truck</td><td>1</td></tr><tr><td>16</td><td>Trailer Dolly, Low Bed, 15 tonnes</td><td>1</td></tr></table>			List of minimum equipment requirement.			No	TYPE OF EQUIPMENT	QUANTITY	1	Backhoe Hydraulic Excavator, W.M. 0.50 cu.m., 128 hp	2	2	Backhoe Hydraulic Excavator, W.M. 0.92 cu.m., 130 hp	2	3	Cargo Truck, 6-8 tonner, 195 hp.	2	4	Cargo Truck, 11-12 tonner, 290 hp.	2	5	Crane, Hydraulic, 61-70 tonnes, 280 hp.	2	6	Concrete Finisher/Paver, 120 hp.	1	7	Concrete Pump/Trailer/Truck Mounted (Cont.) Turbo Uni30, 8 round, 3-5 cu.m/hr	2	8	Crawler Crane, 51-60 tones, 275 hp.	1	9	Crawler Tractor with Dozer, 105 hp.	1	10	Drilling Rig, Hydraulic Crawler Type LLAMADA P-100TT Bentonite Machine	1	11	Dump Truck, 9-11.50 cu.yd., 380 hp.	10	12	Motorize Grader, 125 hp.	2	13	Pile Vibrator Driver, 60 kw (Electric Driven), Tomen Vibro w/o Genset/ Hydraulic Pile Driver	2	14	Pumpcrete, Putmeister, 45.87 cu.m/fr. 180 hp.	1	15	Service Truck	1	16	Trailer Dolly, Low Bed, 15 tonnes	1
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	17	Transit Mixer, 6.5-7.5 cu.yd.	10
	18	Truck Mounted Crane, Hydraulic Telescopic Broom, 51-60 tonnes	2
	19	Vibratory Roller (Tandem Smooth Drum) 10tonnes, 99 hp.	2
	20	Water Truck w/ water pump, 16000 liters, 360 hp.	2
	21	Wheel Loader, 2.29 cu.m., 150 hp.	4
	22	Concrete Batching Plant, Ross Uniplant, 80 cu.m./hour	1
	<p>Acceptable proof of ownership:</p> <ul style="list-style-type: none"> <li>• Official Receipt</li> <li>• Deed of Sale</li> <li>• OR/CR</li> <li>• Sales Invoice showing payment of VAT</li> <li>• Proforma Invoice supported by a Sales Invoice</li> <li>• Letter of Credit from bank with attached Purchase Order supported by a Sales Invoice</li> <li>• Acknowledgement Receipt from Supplier</li> <li>• Commercial Receipt/Commercial Invoice</li> <li>• Original Invoice with attached Packing List</li> <li>• Bill of Lading</li> <li>• Collection Receipt</li> <li>• Delivery Receipt</li> <li>• Lease Agreement</li> <li>• Under Purchase Agreement</li> </ul>		
13.1	No additional requirements.		
13.1(b)	<p>This shall include all of the following documents:</p> <ol style="list-style-type: none"> <li>1. Detailed estimates, including a summary sheet indicating the unit prices of construction materials, labor rates, and equipment rentals used in coming up with the Bid considering 12% VAT; and</li> <li>2. Cash flow by quarter or payment schedule.</li> </ol>		
13.2(a)	The ABC is Php 1,205,444,643.31 <u>inclusive of applicable taxes and fees</u> . Any bid with a financial component exceeding this amount shall not be accepted.		
13.2(b)	No further instructions.		
14.2	No further instructions.		
16.1	The bid prices shall be quoted in Philippine Pesos.		
16.3	No further instructions.		
17.1	<u>The Bid Validity shall be valid for One Hundred Twenty (120) Calendar Days from the date of opening of bids.</u>		



18.1	<p>The bid security shall be in the form of a Bid Securing Declaration or any of the following forms and amounts:</p> <ol style="list-style-type: none"> <li>1. The amount of not less than Twenty-Four Million One Hundred Eight Thousand Eight Hundred Ninety-Two and 87/100 Pesos (P24,108,892.87) if bid security is in cash, cashier's/manager's check, bank draft/guarantee or irrevocable letter of credit;</li> <li>2. The amount of not less than Sixty Million Two Hundred Seventy-Two Thousand Two Hundred Thirty-Two and 17/100 Pesos (P60,272,232.17) if bid security is in Surety Bond.</li> </ol>
18.2	The Bid Security shall be valid for One Hundred Twenty (120) Calendar Days from the date of opening of bids.
20.3	Each Bidder shall submit one (1) original and one (1) copy of its bid.
21	<p>The address for submission of bids is:</p> <p>Procurement Service  Bids and Awards Committee I  Secretariat Office  2nd Floor, PS Complex, RR Road  Cristobal St., Paco, Manila</p> <p>The deadline for submission of bids is on <u>August 26, 2020</u> at 10:00AM.</p>
24.1	<p>The place of bid opening is:</p> <p>Procurement Service Conference Room  2nd Floor, PS Complex, RR Road  Cristobal St., Paco, Manila</p> <p>The bid opening will be held immediately after the deadline of submission of bids.</p> <p>During the opening of bids only the authorized representative shall be allowed to assist in the opening of bids. In case the authorized representative is not present, any representative of the authorized representative may be allowed to assist in the opening of bids provided that a separate written authorization from the authorized representative shall be presented for the purpose. Provided that the authorized representative is duly authorized to issue such further authority and the same is reflected in the Board Resolution and/or Secretary's Certificate.</p>
24.2	No further instructions.
24.3	No further instructions.
27.3(a)	Partial bid is not allowed. The infrastructure project is packaged in a single lot and the lot shall not be divided into sub-lots for the purpose of bidding, evaluation, and contract award.

*Construction of New Clark City Connecting Road Package 1*  
**Bid Data Sheet**

27.4	No further instructions.
28.2	<p>No licenses and permits required.</p> <p>For purposes of Post-qualification the following document(s) shall be required to be submitted within five (5) calendar days from receipt of notice from the BAC:  Income Tax Returns for year 2019 (BIR Form 1701 or 1702);  Latest Value Added Tax Returns (Forms 2550M and 2550Q) or Percentage Tax Returns (Form 2551M). For this requirement, it is considered as latest return when filed within the last two (2) months before the deadline of the submission of bids.</p> <p>The income tax and business tax returns stated above should have been filed through the Electronic Filing and Payment System (eFPS).</p> <p>Proof of ongoing contracts</p>
31.4(f)	<p>List of additional contract documents relevant to the Project:</p> <ol style="list-style-type: none"> <li>1. Construction Schedule and S-Curve;</li> <li>2. Manpower Schedule;</li> <li>3. Construction Methods;</li> <li>4. Equipment Utilization Schedule; and</li> <li>5. Safety and Health Program approved by DOLE.</li> </ol>

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## **SECTION IV**

### **General Conditions of the Contract**

## 1. Definitions

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

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

- 1.16. **Equipment** refers to all facilities, supplies, appliances, materials or things required for the execution and completion of the Work provided by the Contractor and which shall not form or are not intended to form part of the Permanent Works.
- 1.17. The **Intended Completion Date** refers to the date specified in the **SCC** when the Contractor is expected to have completed the Works. The Intended Completion Date may be revised only by the Procuring Entity's Representative by issuing an extension of time or an acceleration order.
- 1.18. **Materials** are all supplies, including consumables, used by the Contractor for incorporation in the Works.
- 1.19. The **Notice to Proceed** is a written notice issued by the Procuring Entity or the Procuring Entity's Representative to the Contractor requiring the latter to begin the commencement of the work not later than a specified or determinable date.
- 1.20. **Permanent Works** are all permanent structures and all other project features and facilities required to be constructed and completed in accordance with this Contract which shall be delivered to the Procuring Entity and which shall remain at the Site after the removal of all Temporary Works.
- 1.21. **Plant** refers to the machinery, apparatus, and the like intended to form an integral part of the Permanent Works.
- 1.22. The **Procuring Entity** is the party who employs the Contractor to carry out the Works stated in the **SCC**.
- 1.23. The **Procuring Entity's Representative** refers to the Head of the Procuring Entity or his duly authorized representative, identified in the **SCC**, who shall be responsible for supervising the execution of the Works and administering this Contract.
- 1.24. The **Site** is the place provided by the Procuring Entity where the Works shall be executed and any other place or places which may be designated in the **SCC**, or notified to the Contractor by the Procuring Entity's Representative as forming part of the Site.
- 1.25. **Site Investigation Reports** are those that were included in the Bidding Documents and are factual and interpretative reports about the surface and subsurface conditions at the Site.
- 1.26. **Slippage** is a delay in work execution occurring when actual accomplishment falls below the target as measured by the difference between the scheduled and actual accomplishment of the Work by the Contractor as established from the work schedule. This is actually described as a percentage of the whole Works.
- 1.27. **Specifications** mean the description of Works to be done and the qualities of materials to be used, the equipment to be installed and the mode of construction.
- 1.28. The **Start Date**, as specified in the **SCC**, is the date when the Contractor is obliged to commence execution of the Works. It does not necessarily coincide with any of the Site Possession Dates.

- 1.29. A **Subcontractor** is any person or organization to whom a part of the Works has been subcontracted by the Contractor, as allowed by the Procuring Entity, but not any assignee of such person.
- 1.30. **Temporary Works** are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the Permanent Works.
- 1.31. **Work(s)** refer to the Permanent Works and Temporary Works to be executed by the Contractor in accordance with this Contract, including (i) the furnishing of all labor, materials, equipment and others incidental, necessary or convenient to the complete execution of the Works; (ii) the passing of any tests before acceptance by the Procuring Entity's Representative; (iii) and the carrying out of all duties and obligations of the Contractor imposed by this Contract as described in the **SCC**.

## 2. Interpretation

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

## 3. Governing Language and Law

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

- 3.2 This Contract shall be interpreted in accordance with the laws of the Republic of the Philippines.

#### **4. Communications**

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

#### **5. Possession of Site**

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

#### **6. The Contractor's Obligations**

- 6.1 The Contractor shall carry out the Works properly and in accordance with this Contract. The Contractor shall provide all supervision, labor, Materials, Plant and Contractor's Equipment, which may be required. All Materials and Plant on Site shall be deemed to be the property of the Procuring Entity.
- 6.2 The Contractor shall commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Program of Work submitted by the Contractor, as updated with the approval of the Procuring Entity's Representative, and complete them by the Intended Completion Date.
- 6.3 The Contractor shall be responsible for the safety of all activities on the Site.
- 6.4 The Contractor shall carry out all instructions of the Procuring Entity's Representative that comply with the applicable laws where the Site is located.
- 6.5 The Contractor shall employ the key personnel named in the Schedule of Key Personnel, as referred to in the **SCC**, to carry out the supervision of the Works. The Procuring Entity will approve any proposed replacement of key personnel only if their

relevant qualifications and abilities are equal to or better than those of the personnel listed in the Schedule.

- 6.6 If the Procuring Entity's Representative asks the Contractor to remove a member of the Contractor's staff or work force, for justifiable cause, the Contractor shall ensure that the person leaves the Site within seven (7) days and has no further connection with the Work in this Contract.
- 6.7 During Contract implementation, the Contractor and his subcontractors shall abide at all times by all labor laws, including child labor related enactments, and other relevant rules.
- 6.8 The Contractor shall submit to the Procuring Entity for consent the name and particulars of the person authorized to receive instructions on behalf of the Contractor.
- 6.9 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Procuring Entity between the dates given in the schedule of other contractors particularly when they shall require access to the Site. The Contractor shall also provide facilities and services for them during this period. The Procuring Entity may modify the schedule of other contractors, and shall notify the Contractor of any such modification thereto.
- 6.10 Should anything of historical or other interest or of significant value be unexpectedly discovered on the Site, it shall be the property of the Procuring Entity. The Contractor shall notify the Procuring Entity's Representative of such discoveries and carry out the Procuring Entity's Representative's instructions in dealing with them.

## **7. Performance Security**

- 7.1 Within ten (10) calendar days from receipt of the Notice of Award from the Procuring Entity but in no case later than the signing of the contract by both parties, the Contractor shall furnish the performance security in any of the forms prescribed in **ITB** Clause 32.2.
- 7.2 The performance security posted in favor of the Procuring Entity shall be forfeited in the event it is established that the Contractor is in default in any of its obligations under the Contract.
- 7.3 The performance security shall remain valid until issuance by the Procuring Entity of the Certificate of Final Acceptance.
- 7.4 The performance security may be released by the Procuring Entity and returned to the Contractor after the issuance of the Certificate of Final Acceptance subject to the following conditions:
- 7.5 There are no pending claims against the Contractor or the surety company filed by the Procuring Entity;
- 7.6 The Contractor has no pending claims for labor and materials filed against it; and
- 7.7 Other terms specified in the **SCC**.
- 7.8 The Contractor shall post an additional performance security following the amount and form specified in **ITB** Clause 31.2 to cover any cumulative increase of more than ten



percent (10%) over the original value of the contract as a result of amendments to order or change orders, extra work orders and supplemental agreements, as the case may be. The Contractor shall cause the extension of the validity of the performance security to cover approved contract time extensions.

- 7.9 In case of a reduction in the contract value or for partially completed Works under the contract which are usable and accepted by the Procuring Entity the use of which, in the judgment of the implementing agency or the Procuring Entity, will not affect the structural integrity of the entire project, the Procuring Entity shall allow a proportional reduction in the original performance security, provided that any such reduction is more than ten percent (10%) and that the aggregate of such reductions is not more than fifty percent (50%) of the original performance security.
- 7.10 Unless otherwise indicated in the **SCC**, the Contractor, by entering into the Contract with the Procuring Entity, acknowledges the right of the Procuring Entity to institute action pursuant to Act 3688 against any subcontractor be they an individual, firm, partnership, corporation, or association supplying the Contractor with labor, materials and/or equipment for the performance of this Contract.

## 8. Subcontracting

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

## 9. Liquidated Damages

- 9.1 The Contractor shall pay liquidated damages to the Procuring Entity for each day that the Completion Date is later than the Intended Completion Date. The applicable liquidated damages is at least one-tenth (1/10) of a percent of the cost of the unperformed portion for every day of delay. The Procuring Entity shall deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities. Once the cumulative amount of liquidated damages reaches ten percent (10%) of the amount of this Contract, the Procuring Entity may rescind or terminate this Contract, without prejudice to other courses of action and remedies available under the circumstances.

- 9.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer of the Procuring Entity shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate.

## **10. Site Investigation Reports**

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

## **11. The Procuring Entity, Licenses and Permits**

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

## **12. Contractor's Risk and Warranty Security**

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

prepared the design or undertook construction supervision for the project shall be held liable;

- 12.7 Procuring Entity's Representatives/Project Manager/Construction Managers and Supervisors – The project owner's representative(s), project manager, construction manager, and supervisor(s) shall be held liable in cases where the Structural Defects/Failures are due to his/their willful intervention in altering the designs and other specifications; negligence or omission in not approving or acting on proposed changes to noted defects or deficiencies in the design and/or specifications; and the use of substandard construction materials in the project;
- 12.8 Third Parties - Third Parties shall be held liable in cases where Structural Defects/Failures are caused by work undertaken by them such as leaking pipes, diggings or excavations, underground cables and electrical wires, underground tunnel, mining shaft and the like, in which case the applicable warranty to such structure should be levied to third parties for their construction or restoration works.
- 12.9 Users - In cases where Structural Defects/Failures are due to abuse/misuse by the end user of the constructed facility and/or non-compliance by a user with the technical design limits and/or intended purpose of the same, then the user concerned shall be held liable.
- 12.10 The warranty against Structural Defects/Failures, except those occasioned on force majeure, shall cover the period specified in the **SCC** reckoned from the date of issuance of the Certificate of Final Acceptance by the Procuring Entity.
- 12.11 The Contractor shall be required to put up a warranty security in the form of cash, bank guarantee, letter of credit, GSIS or surety bond callable on demand, in accordance with the following schedule:

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

- 12.12 The warranty security shall be stated in Philippine Pesos and shall remain effective for one year from the date of issuance of the Certificate of Final Acceptance by BCDA, and returned only after the lapse of said one year period.
- 12.13 In case of structural defects/failure occurring during the applicable warranty period provided in **GCC** Clause 12.10, the Procuring Entity shall undertake the necessary restoration or reconstruction works and shall be entitled to full reimbursement by the parties found to be liable for expenses incurred therein upon demand, without prejudice to the filing of appropriate administrative, civil, and/or criminal charges against the responsible persons as well as the forfeiture of the warranty security posted in favor of the Procuring Entity.

### **13. Liability of the Contractor**

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

### **14. Procuring Entity's Risk**

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

### **15. Insurance**

- 15.1 The Contractor shall, under his name and at his own expense, obtain and maintain, for the duration of this Contract, the following insurance coverage:
- a. Contractor's All Risk Insurance;
  - b. Transportation to the project Site of Equipment, Machinery, and Supplies owned by the Contractor;
  - c. Personal injury or death of Contractor's employees; and
  - d. Comprehensive insurance for third party liability to Contractor's direct or indirect act or omission causing damage to third persons.

15.2 The Contractor shall provide evidence to the Procuring Entity's Representative that the insurances required under this Contract have been effected and shall, within a reasonable time, provide copies of the insurance policies to the Procuring Entity's Representative. Such evidence and such policies shall be provided to the Procuring Entity's through the Procuring Entity's Representative.

15.3 The Contractor shall notify the insurers of changes in the nature, extent, or program for the execution of the Works and ensure the adequacy of the insurances at all times in accordance with the terms of this Contract and shall produce to the Procuring Entity's Representative the insurance policies in force including the receipts for payment of the current premiums.

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

15.4 If the Contractor fails to obtain and keep in force the insurances referred to herein or any other insurance which he may be required to obtain under the terms of this Contract, the Procuring Entity may obtain and keep in force any such insurances and pay such premiums as may be necessary for the purpose. From time to time, the Procuring Entity may deduct the amount it shall pay for said premiums including twenty five percent (25%) therein from any monies due, or which may become due, to the Contractor, without prejudice to the Procuring Entity exercising its right to impose other sanctions against the Contractor pursuant to the provisions of this Contract.

15.5 In the event the Contractor fails to observe the above safeguards, the Procuring Entity may, at the Contractor's expense, take whatever measure is deemed necessary for its protection and that of the Contractor's personnel and third parties, and/or order the interruption of dangerous Works. In addition, the Procuring Entity may refuse to make the payments under **GCC** Clause 40 until the Contractor complies with this Clause.

15.6 The Contractor shall immediately replace the insurance policy obtained as required in this Contract, without need of the Procuring Entity's demand, with a new policy issued by a new insurance company acceptable to the Procuring Entity for any of the following grounds:

- a) The issuer of the insurance policy to be replaced has:
  - i. become bankrupt;
  - ii. been placed under receivership or under a management committee;
  - iii. been sued for suspension of payment; or
  - iv. been suspended by the Insurance Commission and its license to engage in business or its authority to issue insurance policies cancelled; or
  - v. Where reasonable grounds exist that the insurer may not be able, fully and promptly, to fulfill its obligation under the insurance policy.

## 16. Termination for Default of Contractor

16.1 The Procuring Entity shall terminate this Contract for default when any of the following conditions attend its implementation:

- i. Due to the Contractor's fault and while the project is on-going, it has incurred negative slippage of fifteen percent (15%) or more in accordance with Presidential Decree 1870, regardless of whether or not previous warnings and notices have been issued for the Contractor to improve his performance;
- ii. Due to its own fault and after this Contract time has expired, the Contractor incurs delay in the completion of the Work after this Contract has expired; or
- iii. The Contractor:
  - (ii) abandons the contract Works, refuses or fails to comply with a valid instruction of the Procuring Entity or fails to proceed expeditiously and without delay despite a written notice by the Procuring Entity;
  - (iii) does not actually have on the project Site the minimum essential equipment listed on the bid necessary to prosecute the Works in accordance with the approved Program of Work and equipment deployment schedule as required for the project;
  - (iv) does not execute the Works in accordance with this Contract or persistently or flagrantly neglects to carry out its obligations under this Contract;
  - (v) neglects or refuses to remove materials or to perform a new Work that has been rejected as defective or unsuitable; or
  - (vi) sub-lets any part of this Contract without approval by the Procuring Entity.

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

## **17. Termination for Default of Procuring Entity**

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

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

## **18. Termination for Other Causes**

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

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

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

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

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

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

## **19. Procedures for Termination of Contracts**

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

- a) Upon receipt of a written report of acts or causes which may constitute ground(s) for termination as aforementioned, or upon its own initiative, the Procuring Entity shall, within a period of seven (7) calendar days, verify the existence of such ground(s) and cause the execution of a Verified Report, with all relevant evidence attached;
- b) Upon recommendation by the Procuring Entity, the HoPE shall terminate this Contract only by a written notice to the Contractor conveying the termination of this Contract. The notice shall state:
  - i. that this Contract is being terminated for any of the ground(s) afore-mentioned, and a statement of the acts that constitute the ground(s) constituting the same;
  - ii. the extent of termination, whether in whole or in part;
  - iii. an instruction to the Contractor to show cause as to why this Contract should not be terminated; and
  - iv. special instructions of the Procuring Entity, if any.



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

- c) Within a period of seven (7) calendar days from receipt of the Notice of Termination, the Contractor shall submit to the BCDA a verified position paper stating why the contract should not be terminated. If the Contractor fails to show cause after the lapse of the seven (7) day period, either by inaction or by default, the BCDA shall issue an order terminating the contract;
  - d) The Procuring Entity may, at any time before receipt of the Contractor's verified position paper described in item (c) above, withdraw the Notice to Terminate if it is determined that certain items or works subject of the notice had been completed, delivered, or performed before the Contractor's receipt of the notice;
  - e) Within a non-extendible period of ten (10) calendar days from receipt of the verified position paper, the BCDA shall decide whether or not to terminate this Contract. It shall serve a written notice to the Contractor of its decision and, unless otherwise provided in the said notice, this Contract is deemed terminated from receipt of the Contractor of the notice of decision. The termination shall only be based on the ground(s) stated in the Notice to Terminate; and
  - f) The HoPE may create a Contract Termination Review Committee (CTRC) to assist him in the discharge of this function. All decisions recommended by the CTRC shall be subject to the approval of the HoPE.
- 19.2 Pursuant to Section 69(f) of RA 9184 and without prejudice to the imposition of additional administrative sanctions as the internal rules of the agency may provide and/or further criminal prosecution as provided by applicable laws, the procuring entity shall impose on contractors after the termination of the contract the penalty of suspension for one (1) year for the first offense, suspension for two (2) years for the second offense from participating in the public bidding process, for violations committed during the contract implementation stage, which include but not limited to the following:
- a) Failure of the contractor, due solely to his fault or negligence, to mobilize and start work or performance within the specified period in the Notice to Proceed ("NTP");
  - b) Failure by the contractor to fully and faithfully comply with its contractual obligations without valid cause, or failure by the contractor to comply with any written lawful instruction of the procuring entity or its representative(s) pursuant to the implementation of the contract. For the procurement of infrastructure projects or consultancy contracts, lawful instructions include but are not limited to the following:
    - i. Employment of competent technical personnel, competent engineers and/or work supervisors;
    - ii. Provision of warning signs and barricades in accordance with approved plans and specifications and contract provisions;

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

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

## **20. Force Majeure, Release From Performance**

- 20.1 For purposes of this Contract the terms "*force majeure*" and "fortuitous event" may be used interchangeably. In this regard, a fortuitous event or *force majeure* shall be interpreted to mean an event which the Contractor could not have foreseen, or which though foreseen, was inevitable. It shall not include ordinary unfavorable weather conditions; and any other cause the effects of which could have been avoided with the exercise of reasonable diligence by the Contractor.
- 20.2 If this Contract is discontinued by an outbreak of war or by any other event entirely outside the control of either the Procuring Entity or the Contractor, the Procuring Entity's Representative shall certify that this Contract has been discontinued. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all works carried out before receiving it and for any Work carried out afterwards to which a commitment was made.

- 20.3 If the event continues for a period of eighty four (84) days, either party may then give notice of termination, which shall take effect twenty eight (28) days after the giving of the notice.
- 20.4 After termination, the Contractor shall be entitled to payment of the unpaid balance of the value of the Works executed and of the materials and Plant reasonably delivered to the Site, adjusted by the following:
- a) any sum to which the Contractor is entitled under **GCC** Clause 28;
  - b) the cost of his suspension and demobilization;
  - c) any sum to which the Procuring Entity is entitled.
- 20.5 The net balance due shall be paid or repaid within a reasonable time period from the time of the notice of termination.

## 21. Resolution of Disputes

- 21.1 If any dispute or difference of any kind whatsoever shall arise between the parties in connection with the implementation of the contract covered by the Act and this IRR, the parties shall make every effort to resolve amicably such dispute or difference by mutual consultation.
- 21.2 If the Contractor believes that a decision taken by the Procuring Entity's Representative was either outside the authority given to the Procuring Entity's Representative by this Contract or that the decision was wrongly taken, the decision shall be referred to the Arbitrator indicated in the **SCC** within fourteen (14) days of the notification of the Procuring Entity's Representative's decision.
- 21.3 Any and all disputes arising from the implementation of this Contract covered by the R.A. 9184 and its IRR shall be submitted to arbitration in the Philippines according to the provisions of Republic Act No. 876, otherwise known as the "Arbitration Law" and Republic Act 9285, otherwise known as the "Alternative Dispute Resolution Act of 2004": *Provided, however,* That, disputes that are within the competence of the Construction Industry Arbitration Commission to resolve shall be referred thereto. The process of arbitration shall be incorporated as a provision in this Contract that will be executed pursuant to the provisions of the Act and its IRR: *Provided, further,* That, by mutual agreement, the parties may agree in writing to resort to other alternative modes of dispute resolution.

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

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

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

### **23. BCDA's Representative's Decisions**

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

### **24. Approval of Drawings and Temporary Works by the Procuring Entity's Representative**

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

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

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

### **26. Extension of the Intended Completion Date**

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

## 27. Right to Vary

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

## 28. Contractors Right to Claim

If the Contractor incurs cost as a result of any of the events under **GCC** Clause 13, the Contractor shall be entitled to the amount of such cost. If as a result of any of the said events, it is necessary to change the Works, this shall be dealt with as a Variation.

## 29. Dayworks

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

## 30. Early Warning

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

### **31. Program of Work**

- 31.1 Within the time stated in the **SCC**, the Contractor shall submit to the Procuring Entity's Representative for approval a Program of Work showing the general methods, arrangements, order, and timing for all the activities in the Works.
- 31.2 An update of the Program of Work shall show the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.
- 31.3 The Contractor shall submit to the Procuring Entity's Representative for approval an updated Program of Work at intervals no longer than the period stated in the **SCC**. If the Contractor does not submit an updated Program of Work within this period, the Procuring Entity's Representative may withhold the amount stated in the **SCC** from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program of Work has been submitted.
- 31.4 The Procuring Entity's Representative's approval of the Program of Work shall not alter the Contractor's obligations. The Contractor may revise the Program of Work and submit it to the Procuring Entity's Representative again at any time. A revised Program of Work shall show the effect of any approved Variations.
- 31.5 When the Program of Work is updated, the Contractor shall provide the Procuring Entity's Representative with an updated cash flow forecast. The cash flow forecast shall include different currencies, as defined in the Contract, converted as necessary using the Contract exchange rates.
- 31.6 All Variations shall be included in updated Program of Work produced by the Contractor.

### **32. Management Conferences**

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

### **33. Bill of Quantities**

- 33.1 The Bill of Quantities shall contain items of work for the construction, installation, testing, and commissioning of work to be done by the Contractor.
- 33.2 The Bill of Quantities is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.

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

#### **34. Instructions, Inspections and Audits**

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

#### **35. Identifying Defects**

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

#### **36. Cost of Repairs**

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

#### **37. Correction of Defects**

- 37.1 The Procuring Entity's Representative shall give notice to the Contractor of any defects before the end of the Defects Liability Period, which is One (1) year from project completion up to final acceptance by the Procuring Entity's Representative.
- 37.2 Every time notice of a defect is given, the Contractor shall correct the notified defect within the length of time specified in the Procuring Entity's Representative's notice.
- 37.3 The Contractor shall correct the defects which he notices himself before the end of the Defects Liability Period.

- 37.4 The Procuring Entity shall certify that all defects have been corrected. If the Procuring Entity considers that correction of a defect is not essential, he can request the Contractor to submit a quotation for the corresponding reduction in the Contract Price. If the Procuring Entity accepts the quotation, the corresponding change in the SCC is a Variation.

### **38. Uncorrected Defects**

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

### **39. Advance Payment**

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

### **40. Progress Payments**

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



- a) Cumulative value of the work previously certified and paid for.
  - b) Portion of the advance payment to be recouped for the month.
  - c) Retention money in accordance with the condition of contract.
  - d) Amount to cover third party liabilities.
  - e) Amount to cover uncorrected discovered defects in the works.
- 40.3 Payments shall be adjusted by deducting therefrom the amounts for advance payments and retention. The Procuring Entity shall pay the Contractor the amounts certified by the Procuring Entity's Representative within twenty eight (28) days from the date each certificate was issued. No payment of interest for delayed payments and adjustments shall be made by the Procuring Entity.
- 40.4 The first progress payment may be paid by the Procuring Entity to the Contractor provided that at least twenty percent (20%) of the work has been accomplished as certified by the Procuring Entity's Representative, unless otherwise provided in the SCC.
- 40.5 Items of the Works for which a price of "0" (zero) has been entered will not be paid for by the Procuring Entity and shall be deemed covered by other rates and prices in the Contract.

#### **41. Payment Certificates**

- 41.1 The Contractor shall submit to the Procuring Entity's Representative monthly statements of the estimated value of the work executed less the cumulative amount certified previously, except when a different payment scheme is adopted under GCC Clause 40.4, in which case, the statement may only be submitted in accordance with the schedule prescribed by the Procuring Entity.
- 41.2 The Procuring Entity's Representative shall check the Contractor's statement and certify the amount to be paid to the Contractor.
- 41.3 The value of Work executed shall:
- a) be determined by the Procuring Entity's Representative;
  - b) comprise the value of the quantities of the items in the Bill of Quantities completed; and
  - c) include the valuations of approved variations.
- 41.4 The Procuring Entity's Representative may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

#### **42. Retention**

- 42.1 The Procuring Entity shall retain from each payment due to the Contractor an amount equal to a percentage thereof using the rate as specified in GCC Sub-Clause 42.2.

- 42.2 Progress payments are subject to retention of ten percent (10%), referred to as the "retention money." Such retention shall be based on the total amount due to the Contractor prior to any deduction and shall be retained from every progress payment until fifty percent (50%) of the value of Works, as determined by the Procuring Entity, are completed. If, after fifty percent (50%) completion, the Work is satisfactorily done and on schedule, no additional retention shall be made; otherwise, the ten percent (10%) retention shall again be imposed using the rate specified therefor.
- 42.3 The total "retention money" shall be due for release upon final acceptance of the Works. The Contractor may, however, request the substitution of the retention money for each progress billing with irrevocable standby letters of credit from a commercial bank, bank guarantees or surety bonds callable on demand, of amounts equivalent to the retention money substituted for and acceptable to the Procuring Entity, provided that the project is on schedule and is satisfactorily undertaken. Otherwise, the ten (10%) percent retention shall be made. Said irrevocable standby letters of credit, bank guarantees and/or surety bonds, to be posted in favor of the Government shall be valid for a duration to be determined by the concerned implementing office/agency or Procuring Entity and will answer for the purpose for which the ten (10%) percent retention is intended, *i.e.*, to cover uncorrected discovered defects and third party liabilities.
- 42.4 On completion of the whole Works, the Contractor may substitute retention money with an "on demand" Bank guarantee in a form acceptable to the Procuring Entity.

#### **43. Variation Orders**

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

- 43.4 Any cumulative Variation Order beyond ten percent (10%) shall be subject of another contract to be bid out if the works are separable from the original contract. In exceptional cases where it is urgently necessary to complete the original scope of work, the HoPE may authorize a positive Variation Order go beyond ten percent (10%) but not more than twenty percent (20%) of the original contract price, subject to the guidelines to be determined by the GPPB: *Provided, however,* That appropriate sanctions shall be imposed on the designer, consultant or official responsible for the original detailed engineering design which failed to consider the Variation Order beyond ten percent (10%).
- 43.5 In claiming for any Variation Order, the Contractor shall, within seven (7) calendar days after such work has been commenced or after the circumstances leading to such condition(s) leading to the extra cost, and within twenty-eight (28) calendar days deliver a written communication giving full and detailed particulars of any extra cost in order that it may be investigated at that time. Failure to provide either of such notices in the time stipulated shall constitute a waiver by the contractor for any claim. The preparation and submission of Variation Orders are as follows:
- a) If the Procuring Entity's representative/Project Engineer believes that a Change Order or Extra Work Order should be issued, he shall prepare the proposed Order accompanied with the notices submitted by the Contractor, the plans therefore, his computations as to the quantities of the additional works involved per item indicating the specific stations where such works are needed, the date of his inspections and investigations thereon, and the log book thereof, and a detailed estimate of the unit cost of such items of work, together with his justifications for the need of such Change Order or Extra Work Order, and shall submit the same to the HoPE for approval.
  - b) The HoPE or his duly authorized representative, upon receipt of the proposed Change Order or Extra Work Order shall immediately instruct the appropriate technical staff or office of the Procuring Entity to conduct an on-the-spot investigation to verify the need for the Work to be prosecuted and to review the proposed plan, and prices of the work involved.
  - c) The technical staff or appropriate office of the Procuring Entity shall submit a report of their findings and recommendations, together with the supporting documents, to the Head of Procuring Entity or his duly authorized representative for consideration.
  - d) The HoPE or his duly authorized representative, acting upon the recommendation of the technical staff or appropriate office, shall approve the Change Order or Extra Work Order after being satisfied that the same is justified, necessary, and in order.
  - e) The timeframe for the processing of Variation Orders from the preparation up to the approval by the Head of BCDA concerned shall not exceed thirty (30) calendar days.

#### 44. Contract Completion

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

#### 45. Suspension of Work

- 45.1 The Procuring Entity shall have the authority to suspend the work wholly or partly by written order for such period as may be deemed necessary, due to *force majeure* or any fortuitous events or for failure on the part of the Contractor to correct bad conditions which are unsafe for workers or for the general public, to carry out valid orders given by the Procuring Entity or to perform any provisions of the contract, or due to adjustment of plans to suit field conditions as found necessary during construction. The Contractor shall immediately comply with such order to suspend the work wholly or partly.
- 45.2 The Contractor or its duly authorized representative shall have the right to suspend work operation on any or all projects/activities along the critical path of activities after fifteen (15) calendar days from date of receipt of written notice from the Contractor to the district engineer/regional director/consultant or equivalent official, as the case may be, due to the following:
- a) There exist right-of-way problems which prohibit the Contractor from performing work in accordance with the approved construction schedule.
  - b) Requisite construction plans which must be owner-furnished are not issued to the contractor precluding any work called for by such plans.
  - c) Peace and order conditions make it extremely dangerous, if not possible, to work. However, this condition must be certified in writing by the Philippine National Police (PNP) station which has responsibility over the affected area and confirmed by the Department of Interior and Local Government (DILG) Regional Director.
  - d) There is failure on the part of the Procuring Entity to deliver government-furnished materials and equipment as stipulated in the contract.
  - e) Delay in the payment of Contractor's claim for progress billing beyond forty-five (45) calendar days from the time the Contractor's claim has been certified to by the procuring entity's authorized representative that the documents are complete unless there are justifiable reasons thereof which shall be communicated in writing to the Contractor.
- 45.3 In case of total suspension, or suspension of activities along the critical path, which is not due to any fault of the Contractor, the elapsed time between the effectivity of the order suspending operation and the order to resume work shall be allowed the Contractor by adjusting the contract time accordingly.

#### **46. Payment on Termination**

- 46.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Procuring Entity's Representative shall issue a certificate for the value of the work done and Materials ordered less advance payments received up to the date of the issue of the certificate and less the percentage to apply to the value of the work not completed, as indicated in the SCC. Additional Liquidated Damages shall not apply. If the total amount due to the Procuring Entity exceeds any payment due to the Contractor, the difference shall be a debt payable to the Procuring Entity.
- 46.2 If the Contract is terminated for the Procuring Entity's convenience or because of a fundamental breach of Contract by the Procuring Entity, the Procuring Entity's Representative shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.
- 46.3 The net balance due shall be paid or repaid within twenty eight (28) days from the notice of termination.
- 46.4 If the Contractor has terminated the Contract under **GCC** Clauses 17 or 18, the Procuring Entity shall promptly return the Performance Security to the Contractor.

#### **47. Extension of Contract Time**

- 47.1 Should the amount of additional work of any kind or other special circumstances of any kind whatsoever occur such as to fairly entitle the contractor to an extension of contract time, the Procuring Entity shall determine the amount of such extension; provided that the Procuring Entity is not bound to take into account any claim for an extension of time unless the Contractor has, prior to the expiration of the contract time and within thirty (30) calendar days after such work has been commenced or after the circumstances leading to such claim have arisen, delivered to the Procuring Entity notices in order that it could have investigated them at that time. Failure to provide such notice shall constitute a waiver by the Contractor of any claim. Upon receipt of full and detailed particulars, the Procuring Entity shall examine the facts and extent of the delay and shall extend the contract time completing the contract work when, in the Procuring Entity's opinion, the findings of facts justify an extension.
- 47.2 No extension of contract time shall be granted the Contractor due to (a) ordinary unfavorable weather conditions and (b) inexcusable failure or negligence of Contractor to provide the required equipment, supplies or materials.
- 47.3 Extension of contract time may be granted only when the affected activities fall within the critical path of the PERT/CPM network.
- 47.4 No extension of contract time shall be granted when the reason given to support the request for extension was already considered in the determination of the original contract time during the conduct of detailed engineering and in the preparation of the contract documents as agreed upon by the parties before contract perfection.

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

#### **48. Price Adjustment**

Except for extraordinary circumstances as determined by NEDA and approved by the GPPB, no price escalation shall be allowed. Nevertheless, in cases where the cost of the awarded contract is affected by any applicable new laws, ordinances, regulations, or other acts of the GoP, promulgated after the date of bid opening, a contract price adjustment shall be made or appropriate relief shall be applied on a no loss-no gain basis.

#### **49. Completion**

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

#### **50. Taking Over**

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

#### **51. Operating and Maintenance Manuals**

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

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## **SECTION V**

### **Special Conditions of the Contract**

## Special Conditions of Contract

GCC Clause	
1.17	The <b>Intended Completion Date</b> is on the 450 <sup>th</sup> day upon receipt of NTP.
1.22	The <b>Procuring Entity</b> is the <b>Bases Conversion and Development Authority</b> .
1.23	The <b>Procuring Entity's Representative</b> is:  1. Procuring Entity's assigned Project Manager.
1.24	The <b>Site</b> is located at New Clark City, Tarlac.
1.28	The <b>Start Date</b> is projected to be upon receipt by the Contractor of Notice to Proceed.
1.31	The <b>Works</b> shall consist of Construction of New Clark City Connecting Road Package 1.
2.2	There shall be no sectional completion of the Project.
5.1	The <b>Procuring Entity</b> shall give possession of all parts of the Site to the Contractor.
6.5	The Contractor shall employ at least the following <b>Key Personnel</b> :  1. Project Manager (1) 2. Project Engineer (1) 3. Bridge/Structural Engineer (1) 4. Quantity Engineer (2) 5. Materials Engineer (Materials Engineer II as per DPWH Standard) (1) 6. Site Engineer (6) 7. Electrical Engineer (1) 8. Health and Safety Officer (1) 9. Drainage Engineer (1) 10. Geodetic Engineer (1)
7.4(c)	No further instructions.
7.7	No further instructions.
8.1	No further instructions.
10	None
12.3	No further instructions.
12.5	Fifteen (15) years.



13	No additional provision.
18.3(h)(i)	No further instructions.
21.2	No further instructions.
29.1	Dayworks are applicable at the rate shown in the Contractor's original Bid.
31.1	The Contractor shall submit the Program of Work to the Procuring Entity's Representative within ten (10) calendar days from receipt of Notice of Award.
31.3	<p>The Program of Work shall be updated and shall be submitted to Procuring Entity's assigned Project Manager for approval:</p> <ol style="list-style-type: none"> <li>1. on the first working day of the week following a Weekly Accomplishment Report indicating the slippage; and</li> <li>2. together with the request for Variation Orders, either in the form of a change order or extra work order, that shall cover any increase or decrease in the original quantities of the Contract.</li> </ol> <p>No further instructions.</p>
34.3	The Funding Source is the Government of the Philippines through the GAA.
39.1	The amount of the advance payment shall be fifteen percent (15%) of the contract price.
40.1	No further instructions.
40.4	No further instructions.
51.1	The As-Built Drawings shall be required before the issuance of a Certificate of Completion.
51.2	The final payment shall be withheld for failing to submit the complete set of As-Built Drawings.

**SECTION VI**

**Technical Specifications**

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# **PART A**

## **Facilities for the Engineer**

**PART A. FACILITIES FOR THE ENGINEER****A.1 REQUIREMENTS****A.1.1 Offices and Living Quarters for the Engineer****A.1.1 .1 Offices and Living Quarters for the Engineer**

The Contractor shall provide and maintain until final completion of the project a one (1) unit field office building, and two (2) units of rented living quarters for the exclusive use of the Engineer and his staff. The office shall have at least 180 square meters in floor area, rectangular and made of concrete finished walls and partitions, G.I. roofing, glass windows and hard wooden doors, ply board ceilings, tiled floors, with complete sanitary connections and sewage connection to a septic tank, complete with electrical installation. This office building shall contain the supplies, appliances, equipment and furnishings specified in the Contract. The location and final plan of the office building shall require the approval of the Engineer prior to the start of the construction, while the rented living quarter shall also require the approval of the Engineer prior to the selection of the unit for lease. It is the intent of this Specification to locate the field office building in a government owned lot so that the use by the government of this facility can be maximized even after the completion of the project. However, if no government lot is available, and this structure are to be erected on private property, it is the responsibility of the Contractor to make necessary arrangements with the landowner(s) regarding the use of the lot for the Engineer's office and to remove and transfer, if so required under the Contract, the improvements thereon, including all appurtenances upon completion of the Works.

The office building shall be constructed in accordance with the approved Plans and Drawings which will be proposed and prepared by the Contractor and approved by the Engineer. It shall be at locations designated and oriented to the approval and satisfaction of the Engineer. All cost of labor, materials, equipment and ground rentals that maybe considered necessary for the construction of such facility shall be at the expense of the Contractor.

The field office and living quarters shall be provided with all the necessary electricity, telephone line, potable water supply, sewer and drainage services for twenty-four (24) hours a day. This office and living quarters must be ready for occupancy and use of the Engineer within two (2) months of the commencement of the Works. This is specified in Part A; Item A.1.1 (3), and Item A.1.1 (10).

However, if there will be delay in the provision of such facilities, the Contractor shall provide temporary facilities in rented building(s) conforming to all the requirements of the permanent facilities to the satisfaction of the Engineer. The Contractor shall maintain such temporary facilities for the Engineer over the same period.

All facilities provided by the Contractor shall conform to the best standard of the required types. On the completion of the Contract, these facilities (except those on rental basis) provided by the Contractor including utilities and communication facilities shall be

turned-over to the BCDA including office equipment, apparatus, pieces of furniture and furnishing, etc., unless otherwise directed by the Engineer.

The facilities provided by the Contractor shall be near the job site, where necessary and shall conform to the best standard for the required types. On the completion of the Contract, the facilities provided by the Contractor including utilities and communication facilities shall revert to the Government including office equipment, pieces of furniture, apparatus, appliances unless otherwise specified in the Contract documents.

The Contractor shall fence the office building with barbed wire (or equivalent), 1.8 meter high with necessary gates as directed by the Engineer. The Contractor shall raise the grade of the Engineer's facility (if necessary) and will provide drainage in the vicinity, with suitable access walkways, seeding and sodding of the ground as directed and approved by the Engineer. The facilities shall be provided with a parking area for at least eight (8) vehicles and a satisfactory access road to the parking area. Outside lighting around the facility and parking areas shall be installed to the satisfaction of the Engineer and be maintained at all times. Appropriate signs shall be erected to inform the public of the purpose of the facility.

The Contractor shall be responsible for the maintenance and protection of all facilities to be provided during the duration of the Contract, including providing adequate stock of all expendable items, such as light bulbs, light tubes and consumable stores at all times to ensure proper and continuous functioning of all the Engineer's Facilities.

All windows and door openings of all buildings/facilities shall be wire screened for insect protection.

The Contractor shall be responsible for all the materials quality control and laboratory tests needed in the execution the Works. The Contractor must submit for the approval of the Engineer the possible accredited materials and laboratory testing centers that will conduct the necessary tests needed. The Contractor shall also assign a qualified and experienced laboratory staff and Material Engineer to carry out, transport the specimen to the Accredited Laboratory Centers and testify on all the materials quality control tests as specified in the Contract and required by the Engineer. The person so appointed by the Contractor to manage the laboratory works and to be present during the actual testing shall be well experienced in the type of work to be undertaken and shall be subject to the approval of the Engineer. He shall work full time and shall be responsible to the Engineer for all works carried out.

#### **A.1.1.2 Operation and Maintenance of Office and Living Quarters**

The Contractor is required to maintain and protect the Engineer's field office, living quarters and all utilities therein in good condition throughout the whole period for which the facility is required and to repair and/or replace broken items that become defective in any way. Should the Contractor fail to maintain, repair or replace any item when such is required or fail to supply any material, article or thing



necessary within the time to be specified by the Engineer, the Engineer may deal with the matter himself in whatever manner he considers most appropriate, and all costs thereby incurred by the Engineer shall be recoverable from the Contractor and may be deducted from any money which is due or which may become due to the Contractor.

The Contractor shall provide and pay for all connection charges in respect of electricity, water, telephones and communication facilities. Electricity and water consumption costs and the cost of telephone services and calls shall be paid for by the Contractor.

The Contractor shall provide emergency generators or power generating units with enough capacity to supply the power needed in case of local power failure. For potable water requirement, the Contractor shall furnish drinking water dispenser with purifier, including daily supply of loaded mineral water containers, to the satisfaction of the Engineer.

In addition, the Contractor shall provide the following personnel for the Engineer's facilities:

- One(1) - Messenger/ Utility man
- Two (2) - Security Personnel

The Contractor shall provide protective clothing, waterproof clothing, rubber boots, and safety helmets for the site staff.

All office and living quarters and its surroundings shall be proficiently guarded at all times of the day and night, regularly and properly cleaned, adequately supplied and maintained for the duration of the Contract.

The above are specified in Part A, Item A.1.1 (16) and Item A.1.1 (18).

#### **A.1.1.3 Staffing for Engineer's Facilities**

All staff for the Engineer's office and living quarters, such as janitors, maintenance personnel, security staff, service drivers and support staff shall be provided by the Contractor and approved by the Engineer.

All staff assigned as assistance for the Engineer is defined in **Part A.1.3.- Assistance to the Engineer** and in Item A.1.3 (3).

#### **A.1.1.4 Furniture, Fixtures, Appliances and Equipment for the Office, and Living Quarters of the Engineer**

The Contractor shall, within thirty (30) calendar days after receipt of Notice to Proceed, will furnish the field office and living quarters with sufficient furnitures, fixtures, equipment, appliances and necessary supplies and consumable stores as specified in Items A.1.1(16), and Item A.1.1(18) hereunder to the satisfaction of the Engineer.

All furnitures, fixtures, appliances and equipment specified herein to be provided as specified in Item A.1.1(11) and Item A.1.1(13) hereunder and other items to be purchased for the use of the

Engineer shall be brand new when initially furnished and shall conform with those indicated in the Specifications as to kind, type and size or as determined by the Engineer.

The Contractor shall ensure that the furnitures, fixtures, furnishings, equipment and appliances therein are properly maintained and, if any problem arises, shall rectify the matter himself and shall not wait for the occupants of the property to take action if it is obvious that a delay in dealing with the matter would otherwise occur. All costs in connection with providing adequate maintenance shall be borne by the Contractor.

It shall be understood that if the Contractor cannot provide the articles as specified or intends to supply equivalent substitutes, the Contractor should secure the approval of the Engineer and if such approval is granted, it will be on the condition that adjustments in prices will be effected based on the submitted receipt invoices of the Contractor.

#### **A.1.1.5 Quality Control and Testing Centers**

All material laboratory tests and quality control tests shall be performed by the Contractor through an accredited material testing centers duly approved by the Engineer. The payment and costs of all the necessary tests shall be borne by the Contractor and understood to have been incorporated in all his contract unit price analysis. No extra payment for the said tests will be entertained.

### **A.1.2 Vehicles for the Engineer**

#### **A.1.2 (2) Provision of Vehicles for the Engineer (On Rental Basis)**

Within fifteen (15) days after the Commencement Date, the Contractor shall provide and deliver to the Site, the following brand new vehicles on rental basis for the exclusive use of the Engineer, the Engineer's assistants, staff and representatives working on the Site:

2 units 4WD Pick-Up Type, Double Crew Cab, Service Vehicle,  
2200cc, Diesel Engine with factory installed air-conditioner

The Contractor shall submit catalogues in the English language of the proposed rented vehicles to the Engineer for his approval within seven (7) days after the Commencement Date, and the final consent for the delivery of the rented vehicles on site shall be to the satisfaction of the Engineer.

All vehicles shall carry or be fitted with all tools and accessories as maybe prescribed by laws and with comprehensive insurances. They shall also be complete with seat belts for all seats, and shall be supplied with first aid kits, fire extinguishers, detachable magnetic flashing orange warning lights, accident warning triangles and any other safety kit requirements.

In case the Contractor fails to provide the aforesaid vehicles on the date required, the Engineer shall take such action as he deemed necessary, to acquire the usage of such vehicle and charge all relevant expenses to the Contractor.

The vehicles may be used by the Engineer and/or the Employer both on and off the site and outside the project area, both for business purposes during working hours and in other official purposes.

The rented vehicles shall be duly registered in the name of owner with all proper ownership documents kept by the Contractor together with a copy of contract of lease executed by the Contractor and the owner of the vehicle. These documents must be also furnished to the Engineer. Accordingly, when the assignments of the Engineer's and Employer's personnel in connection with the execution of the Works have been completed, the vehicles shall be returned to the Contractor.

**A.1.2(5) Operation and Maintenance of the Vehicles for the Engineer****A.) Driver of Vehicles for the Engineer**

Each vehicle shall be driven by a competent, qualified and experienced driver recruited and paid for by the Contractor, including overtime payments and the like. All such drivers shall be under the direct full-time control of the Engineer.

All drivers shall be:

- properly licensed, with demonstrable previous experience in driving in and under conditions prevailing on a major civil engineering construction site;
- able to read, write and speak English
- available to work any hour on any day of the week
- have the requisite flexibility to meet demands for their services at any time by the Engineer for any purpose under the Contract.

The Contractor shall manage and monitor the performance of drivers to ensure the provision and maintenance of drivers with a high level of skill and a demonstrated ability to drive efficiently and safely. Drivers not meeting these criteria shall be promptly replaced by the Contractor when so directed by the Engineer.

**B.) Operation and Maintenance of Vehicles**

The Contractor shall be solely responsible for all activities related to the procurement of the vehicles and for the registration of the vehicles, their annual road license/taxes and the provision of passes, access stickers and the like, as well as for providing fully comprehensive insurance until and including the date of issue of the Taking-Over Certificate; all costs thereof being at the Contractor's expense which is incorporated accordingly on his bare rental payments.

The Contractor shall maintain the vehicles in first class condition and shall be supplied with appropriate fuel and lubricants at all times. He shall also undertake entirely all servicing and maintenance requirements for the vehicles, including regularly cleaning inside and out and providing all such replacement parts as maybe from time to time become necessary. This is provided as specified in Item A.1.2 (5) Operation and Maintenance of the Vehicles for the Engineer.

The Contractor shall provide equivalent substitute vehicles during the period when specified vehicles are taken out of service due to

breakdown, for servicing, for maintenance, repair or any other reason.

Should the Contractor fail to maintain, repair or replace any vehicle when such is required, the Engineer may deal with the matter himself in whatever manner he considers most appropriate, and all costs thereby incurred by the Engineer shall be recoverable from the Contractor and may be deducted from any money which is due or which may become due to the Contractor.

The vehicles shall comply in all respect, with all relevant Philippine national or local laws, statutes and regulations.

### **A.1.3 Progress Photographs**

#### **A.1.3(1) Provision of Progress Photographs**

The Contractor shall provide a photographic record of the construction activities. Such photographs shall be taken when and where as directed by the Engineer at intervals of not more than one month or as required, taken selectively by the Engineer, which represents the progress of the Works.

The photographs shall be sufficient in number and location to record the exact progress of the Works. Such photograph shall be taken as per instruction of the Engineer or under the following occasions or events;

- 1) When a portion of the work is difficult or impossible to inspect at the time of a particular operation, where a portion will be covered by backfill, or filling materials after completion and acceptance of the work by the Engineer.
- 2) When or where special or unusual features of the work or latent conditions on the site are present.

When taking the photographs, the Contractor is required to observe the following;

- 1) An indicator such as scale, pole or similar item shall be placed thereon to signify or illustrate the relative dimensions of the pictures.
- 2) Each picture shall be captioned and identified as to date, location, description of the work in progress or completed operation or activity or presence of unusual features.
- 3) Each picture shall be properly referenced.
- 4) The picture shall be clearly discernible in color having a dimension of not less than 12.5cm x 9cm (DPWH DO No. 55, Series of 1994).

The photographs selected by the Engineer, which shall have his signature with copies furnished by the Contractor, shall be compiled in albums provided by the Contractor for the purpose and shall be so arranged in consecutive order in accordance with the construction program submitted to and approved by the Engineer. Each album shall show the name of the Project on the cover and shall contain a location map of the construction site.

All photographs retained by the Engineer shall become the property of the BCDA. A set of photographs shall consist of ten (10) proof prints of each photograph taken per month.

#### **A.1.4 Communication Facility**

##### **A.1.4(1) Communication Equipment**

The Contractor shall provide within fifteen (15) calendar days upon commencement of the Works and maintain for the duration of the Contract, six (6) sets of new portable cellular phones for use of the Engineer as communication facilities. Accessories shall include protective carrying case, AC charger and pre-paid cards at a nominal rate of PHP 1000 per month per cellular phone.

Failure on the part of the Contractor to provide such within the stipulated time shall allow the Engineer to take such action as he may be deemed necessary, and charge all relevant expenses to the Contractor by deducting the amount from the Contractor's monthly billing. This is specified in Item A.1.5(1) Provision of Communication Facility for the Engineer

##### **A.1.4 Schedule of Facilities for the Engineer**

###### **A.1.1(11) Provision of Furniture/Fixtures, Equipment & Appliances for the Engineer's Field Office**

###### **A.1.1(13) Provision of Furniture/Fixtures, Equipment & Appliances for the Living Quarters of the Engineer**

<b>PART A</b>	<b>FACILITIES FOR THE ENGINEER</b>		
<b>Item No.</b>	<b>A.1.1(11)</b>		
	<b>Provision of Furnitures/ Fixtures, Equipment and Appliances for the Engineer's Field Office</b>		
<b>Description</b>		<b>Unit</b>	<b>Quantity</b>
<b>A</b>	<b>Furnitures, Equipment, Fixtures and Appliances</b>		
1	Digital Camera	each	2
2	Working/Conference Table, with 10 chairs	set	2
3	Office Desk, 70 x 140 cm, (3 drawers on each side) with lock and keys	each	4
4	Office Desk, 60 x 105 cm, (3 drawers on each side) with lock and keys	each	4
5	Swivel Chair with padded seat and back arm rest, to match desk	each	8
6	Plan Rack	each	8
7	Steel Filling Cabinet, 4 Drawers with lock and keys, fire resistant	each	8
8	Scientific Calculator, Battery Operated, Casio Model or equivalent	each	8
9	Heavy Duty Combo Binder	each	4
10	Magnetic Whiteboard, 4ft x 8 ft.	each	2
11	Electric Stand Fan, 16" diameter	each	4
12	Fire Extinguisher, 10 lbs.	each	4
13	Hot and Cold Water Dispenser for drinking	each	2
14	Raincoats	set	20
15	Safety Shoes (Steel Toe)	pair	12
16	Hard Hat	each	20
17	Air conditioning Unit, Window Type, 2 Hp Remote	unit	3
18	Wall Clock	each	3
19	3 in 1 Inject Printer ( Print, Scan, Copy)	unit	2
20	Desktop Computer, Intel Core TM2 Duo; Loaded complete with Microsoft Office	unit	4

<b>PART A</b>	<b>FACILITIES FOR ENGINEER</b>		
<b>Item No.</b>	<b>A.1.1(13)</b>		
	<b>Provision of Furnitures/Fixtures, Equipment &amp; Appliances for the Living Quarters of the Engineer</b>		
<b>Description</b>		<b>Unit</b>	<b>Quantity</b>
<b>A</b>	<b>Furniture, Equipment, Fixtures and Appliances</b>		
1	Dining Table with 6 Chairs	set	2
2	Gas Stove Double Burner with Tank	set	2
3	Plate Cabinet	set	8
4	Single Bed with Foam	set	8
5	Hot and Cold Water Dispenser for drinking	each	2
6	Air conditioning Unit, Window Type, 1 Hp Remote	unit	2
7	Washing Machine 6.5kg	unit	2
8	Electric Stand Fan, 16" diameter	each	2
9	32" Flat TV, LED	each	2
10	Refrigerator, 6 cu.ft.	each	2
11	Electric Stand Fan, 16" diameter	each	6
12	Wall Clock	each	2

PART A	FACILITIES FOR ENGINEER		
	Minimum List of Contractor's Owned Laboratory Testing Equipment, Apparatus and Publications for the use of the Engineer (Optional)		
	Description	Unit	Quantity
I	<b><u>Mechanical Sieve Analysis of Soils and Analysis of Fine and Course Aggregates</u></b>		
	<b>Sieve Analysis Set, 203 mm <math>\phi</math> x 51 mm depth, Brass, AASHTO M92</b>		
1.	3" 8" $\phi$ Brass Sieve	each	1
2.	2 1/2" 8" $\phi$ Brass Sieve	each	1
3.	2" 8" $\phi$ Brass Sieve	each	1
4.	1 1/2" 8" $\phi$ Brass Sieve	each	1
5.	1" 8" $\phi$ Brass Sieve	each	1
6.	3/4" 8" $\phi$ Brass Sieve	each	1
7.	1/2" 8" $\phi$ Brass Sieve	each	1
8.	3/8" 8" $\phi$ Brass Sieve	each	1
9.	#4 8" $\phi$ Brass Sieve	each	1
10.	#8 8" $\phi$ Brass Sieve	each	1
11.	#10 8" $\phi$ Brass Sieve	each	1
12.	#12 8" $\phi$ Brass Sieve	each	1
13.	#16 8" $\phi$ Brass Sieve	each	1
14.	#20 8" $\phi$ Brass Sieve	each	1
15.	#30 8" $\phi$ Brass Sieve	each	1
16.	#40 8" $\phi$ Brass Sieve	each	1
17.	#50 8" $\phi$ Brass Sieve	each	1
18.	#100 8" $\phi$ Brass Sieve	each	1
19.	#200 8" $\phi$ Brass Wash Sieve	each	1
20.	#200 8" $\phi$ Brass Wash Sieve, 4" deep for washing	each	1
21.	Brass Pan, 8" $\phi$ x 2" deep	each	1
22.	Brass Cover with ring	each	1
23.	Galvanized Steel Pan, 24" x 24" x 2"	each	1
24.	Galvanized Steel Pan, 24" x 24" x 4"	each	1
25.	Volumetric Flask, 500 ml with top	each	1
26.	Hand Operated Shaker for 8" $\phi$ Sieve	each	1
27.	Mechanical Shaker	each	1
28.	Balance, sensitive to 0.50 gram, 20 kg. capacity set of weight to accommodate capacity of balance	unit	2
29.	Triple Beam Balance, 2610 grams per 0.10 gram	unit	2
30.	Volumetric Flask, 250 ml with top	each	1
II	<b><u>Atterberg Limits</u></b>		
31.	Liquid Limit Test	each	1
32.	Plastic Limit Test	each	1
33.	Balance, sensitive to 0.001 gram, 1.0 kg. capacity with set of weights	each	1
34.	Moisture Cans, 150 mm $\phi$	each	1
35.	Evaporating Disk	each	1
III	<b><u>Shrinkage Factor Test</u></b>		
36.	Shrinkage Limit Test	each	1
37.	Disk, for Mercury, 150 mm $\phi$	each	1
38.	Spatula	each	1



39.	Shrinkage Disk, 45 mm $\phi$	each	1
40.	Straight Edge, 300 mm	each	1
41.	Glass Container, 50 mm $\phi$	each	1
42.	Glass Plate, 2 mm x 80 mm x 80 mm	each	1
43.	Glass Plate with Prongs	each	1
44.	Graduated Cylinder, 25 ml.	each	1
45.	Mercury, 500 cc	bottle	1
<b>IV</b>	<b><u>Moisture Density</u></b>		
	<b>Compaction Test</b>		
46.	Compaction Mold, 4" $\phi$	each	1
47.	Compaction Rammer, 5.5 lbs.	each	1
48.	Compaction Mold, 6" $\phi$	each	1
49.	Compaction Rammer, 10 lbs.	each	1
50.	Sample Extruder	each	1
51.	Steel Straight Edge	each	1
52.	Mixing Pan, 24" x 24" x 3"	pc.	1
53.	Moisture Cans, 3 oz.	dozen	2
<b>V.</b>	<b><u>Specific Gravity Test</u></b>		
	<b>Specific Gravity Test Set of Soil</b>		
54.	Analytical Balance, 200 gms cap., sensitive to 0.0001 gm.	unit	1
55.	Pycnometer Top and Jar	pair	1
56.	Volumetric Flask, 500 ml.	each	1
57.	Thermometer, Range 0 -100°C graduated 1°C	each	1
	<b>Fine Aggregates Specific Gravity Test Set</b>		
58.	Balance, sensitive to 0.1 gram, 1.0 kg. capacity with set of weights	unit	1
59.	Volumetric Flask, 500 ml.	each	1
60.	Conical Mold, Metal	each	1
61.	Tamping Rod	each	1
	<b>Coarse Aggregates Specific Gravity Test Set</b>		
62.	L.A. Abrasion Machine Model	each	1
63.	Balance, sensitive to 0.5 gram, 5.0 kg. capacity with set of weights	unit	1
64.	Basket, Mesh Opening 3.35 or 2.86 mm $\phi$ ht. = 20mm	each	1
65.	Steel Container for Wire Basket	each	1
66.	Steel Stand with Rubber Plate covering upper surface	each	1
<b>VI</b>	<b><u>Sand Equivalent Value</u></b>		
67.	Sand Equivalent Base Set compose of:	set	1
	Sand Reading Indicator		
	Irrigator Tube		
	Measuring Graduated Cylinder		
	Siphon Assembly		
	Measuring Tin 90ml., 60 mm $\phi$		
	Funnel		
	Bottle, 4-Liter Enamel Tray, 345 mm x 265 mm		

	60 mm		
68.	Sieve 4.75 (No.4)	set	1
69.	Anhydrous, Calcium Chloride, 500 grams	each	1
70.	Glycerin	each	1
71.	Formaldehyde	each	1
<b>VII</b>	<b><u>California Bearing Ratio (CBR)</u></b>		
72.	Mechanical CBR Loading Apparatus with Strain Gauge proving ring and penetration piston	set	1
73.	CBR mold, 6" x 7" with perforated base plate and collar	each	6
74.	Spacer Disk	each	1
75.	Filter Screen	each	12
76.	Swell Plate	each	6
77.	Dial Gauge	each	1
78.	Tripod Attachment	each	3
79.	Slotted Surcharge Weights	each	6
80.	Circular Surcharge Weights	each	6
81.	Cutting Edge	each	1
<b>VIII</b>	<b><u>Density of Soil in-Place by Sand Cone Method</u></b>		
82.	Sand Density Apparatus	each	1
83.	Sand Cone and Jug	each	2
84.	Density Plate	each	1
85.	Replacement Jug	each	2
86.	Sampling Spoon	each	1
87.	One Gallon Field Cans	each	2
88.	Once Inch Steel Chisel	each	1
89.	Sand Scoop	each	1
90.	Ball Hammer	each	1
91.	Field Scale, 16 kg., 20 grams sensitivity	unit	1
92.	Spoon Sampling	each	1
<b>IX</b>	<b><u>Specific Gravity and Absorption Test</u></b>		
93.	Sand Absorption Cone and Tamper	each	1
94.	Tribble Beam Balance, 2610 grams/0.10 gram	unit	1
95.	Micro Poise Balance, 100 grams/0.10 gram	unit	1
96.	Density Basket	each	1
97.	Bucket for immersing aggregates	each	1
98.	Pycnometer Top and Jar	pair	1
99.	Volumetric Flask, 250 ml	each	1
100.	Volumetric Flask, 500 ml	each	1
101.	Tin Pans, Rectangular, 4" x 4" x 16"	each	1
<b>X</b>	<b><u>Compression Strength of Molded Concrete Cylinder</u></b>		
102.	Compression Machine, Hydraulic Operated with changeable head for flexural testing	set	1
103.	Air Entrapment Meter	each	1
104.	Capping set for Capping of Specimen	set	1
105.	Capping Compound	bag	8

<b>XI</b>	<b><u>Making and Curing Concrete Compression and Flexural Test Specimen in the Field</u></b>		
106.	Molds for Compression Test Specimen	each	1
107.	Molds for Flexural Test Specimen	each	1
108.	Tamping Rod, 5/8" ø, 24' long having one end hemispherical	each	1
109.	Small Tools	set	1
	Two (2) each of shovels, pail trowel wood float, blunted trowels, straight edge, feeler gauge, scoops, rubber mallet and rulers		
<b>XII</b>	<b><u>Concrete Coring and Saw Cutting</u></b>		
110.	Core Drill Machine with 150 mm ø with two drill bits	set	1
111.	4" ø, drill bit for concrete cored sample	each	2
112.	Concrete Saw Cutter	set	1
<b>XIII</b>	<b><u>Slump of Portland Cement Concrete</u></b>		
113.	Slump Test Apparatus: Slump Cone with Base and Graduated Tamping Rod	set	1
114.	Mixing Pan, 24" x 24" x 3"	each	1
115.	Cement Towel	each	1
116.	Armoured Thermometer	each	1
117.	Yield Bucket, 1/10 cu. ft.	each	1
118.	Yield Bucket, 1/2 cu. ft.	each	1
<b>XIV</b>	<b><u>Miscellaneous Equipment</u></b>		
119.	Laboratory Oven, Double Wall Gravity connection 220V/60 cy., A.C. Cap. 1 cu.m.	set	1
120.	Hot Plate, 12" x 12", 220 V	each	1
121.	Speedy Moisture Tester	each	1
122.	Organic Impurities Test Set	set	1
123.	Sand Equivalent Test Set	each	1
124.	Gas Range, 2 – Burners	each	1
<b>XIV</b>	<b><u>Miscellaneous Equipment</u></b>		
125.	Sodium Hydroxide Solution	bottle	1
126.	Capping Compound, 55 lbs.	bag	1
127.	Sodium Sulfate	bottle	1
128.	Calcium Carbide Reagent	bottle	1
129.	Sand Equipment Solution Standards	bottle	1

## A.2 MEASUREMENT AND PAYMENT

### A.2.1 Measurement

1. Lump sum items shall be provided for the following:

- a) Provision of one (1) Unit Field Office Building with all its land development. Land development includes the raising of the grades (as maybe required by the Engineer), the perimeter fencing to a desired height as approved by the Engineer and the

provision of access walkways, sodding or seeding of the ground around the building and provision of access roads to parking areas. Payment shall be made on a lump sum basis or on a pro-rata basis of the contract unit price as reflected in the Bill of Quantities or as directed by the Engineer.

- b) Provision for furnishing and transporting of Furniture/Fixtures, Equipment and Appliances for the Field Office and Living Quarters of the Engineer.
  - c) Provisions for furnishing Communication Equipment for the Engineer.
2. Provision of two (2) Units of Living Quarters for the Engineer will be paid for from the time the Engineer occupies the facilities. Payment shall be made on a monthly rental basis at the contract unit price shown in the Bill of Quantities.
  3. Operation and Maintenance of the Field Office and Living Quarters for the Engineer will be paid for from the time the Engineer occupies the facilities until the final completion of the Work. Payment shall be made on a monthly basis at the contract unit price shown in the Bill of Quantities.
  4. Provision for furnishing supplies and consumables stores for the Engineer's field office and communication equipment shall be paid upon the provision and supplied is accepted by the Engineer. Payment shall be made on a monthly basis at the contract unit price shown in the Bill of Quantities.
  5. Provision of rented vehicles for the Engineer as specified will be paid for during the time when the Engineer is supplied with each type of vehicles until the completion of the project. The unit of measurement to be paid shall be per vehicle per month.
  6. Operation and Maintenance of Vehicles for the Engineer as specified for shall be paid for during the time which the Engineer is supplied with each type of vehicles which shall be supplied with appropriate fuel and lubricants. Servicing and maintenance requirements included and regular cleaning inside and out with the provision of some necessary replacement parts from time to time. The salary of the respective drivers shall be under this item. This operation and maintenance will be from the start of the Engineer had accepted the said vehicle until the completion of the project. The unit of measurement to be paid for shall be per vehicle per month.
  7. The quantities for Progress Photographs shall be measured as per monthly basis with the number of photographs taken, selected and provided as progress photographs. The unit of measure is each at the contract unit price shown in the Bill of Quantities.

8. Provision of the communication facility for the Engineer shall be paid from the time the unit had been received and approved by the Engineer. Monthly pre-paid call cards for each unit are included in this Item and payment shall be for each unit provided at the contract unit price shown in the Bill of Quantities. The unit measure is "each".

### A.2.2 Payment

Payment will be made under:

PayItem Number	Description	Unit of Measurement
A.1.1(3)	Provision of Field Office Building for the Engineer	Lump Sum
A.1.1(10)	Provision of Living Quarter for the Engineer, 2 Units	Month
A.1.1(11)	Provision of Furnitures/Fixtures, Equipment and Appliances for Field Office for the Engineer	Lump Sum
A.1.1(13)	Provision of Furnitures/Fixtures, Equipment and Appliances for the Living Quarters for the Engineer	Lump Sum
A.1.1(16)	Operation and Maintenance of Field Office for the Engineer	Month
A.1.1(18)	Operation and Maintenance of Living Quarters for the Engineer	Month
A.1.2(2)	Provision of 2 Units, 4x4 Pick-Up Type, Service Vehicle for the Engineer	Month
A.1.2(5)	Operation and Maintenance of 2 Units, 4x4 Pick-Up Type, Service Vehicle for the Engineer	Month
A.1.4(1)	Provision of Progress Photographs	Month
A.1.5(1)	Provision of Communication Facility for the Engineer	Each

# **PART B**

## **Other General Requirements**

**PART B- OTHER GENERAL REQUIREMENTS****B.1 MEDICAL ROOM AND FIRST AID FACILITIES**

The Contractor shall provide and maintain throughout the duration of the project, a medical room together with all necessary supplies to be sited in the Contractor's main area. The medical room shall be waterproof; it could be a building or a room designated and used exclusively for the purpose. It shall have a floor area of at least 15 square meters and a glazed window area of at least 2 square meters.

The Contractor shall employ permanently on the site a fully trained Medical Aide, who shall be engaged solely on medical duties.

The location of such room and any other arrangements shall be made known to all employees by posting a notice on prominent locations suitable in the Site.

The Contractor's arrangement to comply with this Section shall be subject to the approval of the Engineer and also the approval of any qualified Medical Officer designated by the Government to supervise medical arrangements on the Site.

Payment and price is in Lump Sum basis and shall constitute full compensation for the compliance and provision of all the necessary first aid room and facilities with all the furniture and supplies as listed in the Schedule below. This item also includes the salary of the medical staff assigned solely for the project.

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
B.2	Medical Room and First Aid Facilities	Lump Sum

### B.1.1 Schedule of Other Requirements for Medical Room and First Aid Facilities

PART B.2	MEDICAL ROOM AND FIRST AID FACILITIES		
Description		Unit	Quantity
<b>A</b>	<b>Requirements for Medical Room and First Aid Facilities</b>		
1	Wash Basin (hand) with hot water and cold water	each	1
2	Bed	each	1
3	Chairs	each	4
4	Office Table,	each	1
5	Electric Kettle or Equivalent	each	1
6	Complete First Aid outfit	set	1
7	Bed Sheets, cotton, 150cm x 200cm	each	2
8	Pairs of Polyester Pillow, 30cm x 60cm x 15 cm	pair	1
9	Pillow Case, 40cm x 80cm.	each	2
10	Blanket Cotton, 160cm x 200cm.	each	2
11	Fire Extinguisher, 10 lbs.	each	2
12	Fire Extinguisher, Refill	each	2

## B.2 QUALITY CONTROL OF MATERIALS

All Quality Control Procedures should be in accordance with the DPWH Bureau of Research and Standard Requirements and the Contractor's Approved Quality Control/Quality Assurance Procedures. All Quality Control Tests will be done with the Accredited Material Testing Laboratories or Material Testing Centers approved by the Engineer.

### B.2.1 Source of Supply and Quality of Materials

Promptly after receiving the contract award, the Contractor shall notify the Engineer of all proposed material sources, including fabricators of steel or other finished products. Prior to delivery of materials, sources shall be approved first by the Engineer. If proposed material sources are not acceptable by the Engineer, the Contractor shall locate other sources and obtain approval from the Engineer.

All equipments, materials, and articles incorporated into the permanent work shall:

- 1) Be new, unless the Specifications permit otherwise;
- 2) Meet the requirements of the Contract and be approved by the Engineer;
- 3) Be inspected or tested at any time during their preparation and use; and



- 4) Not be used in the work if they become unfit after being previously approved.

**B.2.2 Samples and Tests for Acceptance**

The Contractor shall deliver material samples from the Manufacturer, Producer, or Fabricator to the Engineer prior to execution of work. In providing samples, the Contractor shall provide the Engineer with sufficient time and quantities for approval before use. The Engineer may require samples at any time. Samples not taken in the presence of the Engineer will not be accepted for testing, unless the Engineer permits otherwise.

The Contractor shall designate his experienced personnel as direct contact person for material testing and acceptance. In his absence, the Contractor shall designate other personnel of the same experience to ensure that direct contact is maintained during the execution of work.

The Engineer will designate also an experienced representative as point of contact for material testing and acceptance.

All field and laboratory material tests to be undertaken by the Contractor shall be in accordance with the methods described in the contract documents, or in the recognized standards of national organizations. The following provisions will apply when the Contractor uses the specifications or methods from the sources named hereunder:

**ASTM – American Society for Testing and Materials:** The ASTM designation number refers to the society's latest adopted or tentative standard. The standard or tentative standard in effect on the bid advertising date, will apply in each case.

Copies of any separate ASTM specifications or testing method may be obtained from: the American Society for Testing and Materials, 1916 Race Street, Philadelphia, USA.

**AASHTO – American Association of State Highway and Transportation Officials:** An AASHTO number refers to that organization's currently published (1) "Standard Specifications for Transportation Materials and Methods of Sampling and Testing" or any adopted revisions, or (2) "Interim Specifications and Methods of Sampling and Testing adopted by the AASHTO Subcommittee on Materials."

Any standards, revisions, and interim standards in effect on the bid advertising date will apply.

Copies of "Standard Specifications for Transportation Materials and Methods of Sampling and Testing" may be obtained from the American Association of State Highway and Transportation Officials, 917 National Press Building, Washington, DC, USA.

**JIS - Japan Industry Standard:** The JIS designation number refers to the latest adopted or tentative standard. The standard or tentative standard in effect on the bid advertising date, will apply in each case.

**JRA - Japan Road Association:** All references to JRA Specifications refer to the latest adopted or tentative specification. The specification or tentative specification in effect on the bid advertising date, will apply in each case.

### **B.2.3 Removed and Rejected Materials**

The Contractor may, prior to sampling, select to remove any defective material(s) and replace it with new material(s) at no expense to the Employer. Any such new material will be sampled, tested and evaluated for acceptance as a sub-lot in accordance with the sampling and testing procedure.

The Engineer may reject a sub-lot wherein tests show to be defective. Such rejected material shall be removed from the site and the results or test run on the rejected material will not be included in the original lot acceptance tests.

### **B.2.4 Manufacturer's Certificate of Compliance**

The Engineer may accept certain materials on the basis of a Manufacturer's Certificate of Compliance as an alternative to material inspection and testing. When a Manufacturer's Certificate of Compliance is authorized by these Specifications, the certificate shall be furnished to the Engineer for approval prior to the use of material.

The Contractor may request, in writing, authority from the Engineer to install such material prior to submitting the required certification; however, no payment shall be made for the work in the absence of the acceptable Manufacturer's Certificate of Compliance. The Employer reserves the right to deny the request for good cause.

If for any reason, the Contractor has no acceptable Manufacturer's Certificate of Compliance on the completion date of the work, the Employer may process the final payment without paying for the work performed on such basis.

The Manufacturer's Certificate of Compliance must identify the manufacturer, the type and quantity of material being certified, the applicable specifications being affirmed, and the signature of a responsible corporate official of the manufacturer and include supporting mill tests or documents. A Manufacturer's Certificate of Compliance shall be furnished with each lot of material delivered to the site and the lot so certified shall be clearly identified in the certificate.

All materials used and identified in the Manufacturer's Certificate of Compliance may be sampled and tested at any time. Any material not conforming to the requirements will be subject to rejection whether in place or not. The Employer reserves the right to refuse to accept materials not on the basis of a Manufacturer's Certificate of Compliance.

### **B.2.5 Handling and Storing Materials**

In storing and handling materials, the Contractor shall protect any materials against damage from careless handling, from exposure to weather, from mixture with foreign matter, and from all other causes.

The Engineer will reject and refuse to test materials improperly handled or stored.

#### **B.2.6 Sieves for Testing**

Test sieves shall be made either: (1) of woven wire cloth conforming to AASHTO Designation M 92 or ASTM Designation E 11, or (2) of square-hole, perforated plates conforming to ASTM Designation E 323.

#### **B.2.7 Compliance to Test Requirements**

All tests and quality control works shall be done by the Contractor's Accredited Materials Testing Centers and Laboratory Staff under the direct supervision of the Engineer.

All tests shall normally be carried out on the site, and that certain special test may, subject to the approval of the Engineer, be carried out at *an approved and accredited independent testing laboratory*. The Contractor shall make all the necessary arrangements for the supply and delivery of samples to, and collection of samples from such independent laboratory. Unless otherwise directed by the Engineer, the Contractor shall arrange for one copy of the independent testing laboratory test certificates to be delivered to the Engineer not less than three (3) days before the materials covered by the relevant test certificate are incorporated into the works, and the test certificate shall be related to the materials from which the samples were taken. These test and quality control works shall be the responsibility of the Contractor.

The Contractor shall comply with the Minimum Materials Testing Equipment Requirement given in, Appendix 4 to Bid, Volume 1 of the Bidding Documents

When requested, the Contractor shall furnish a complete written statement of the origin, composition and/or manufacture of any or all materials (manufactured, produced or grown) that are to be used in the works.

Unless otherwise provided, sampling and testing of materials shall be made by the Contractor, under the direct supervision of the Engineer in accordance with the methods given in the "Standard Specifications for Highway Materials and Methods of Sampling and Testing" of the latest edition of AASHTO.

#### **1. Soils and Aggregates**

T-11	Amount of Materials Finer than 0.75mm sieve in Aggregate
T-88	Particle Size Analysis of Soils
T-89	Determining the Liquid Limit of Soils
T-90	Determining the Plastic Limit and Plasticity Index of Soils
T-99	Moisture Density Relations of Soils Using a 2.5 kg Rammer and 305 mm Drop
T-100	Specific Gravity of Soils
T-180	Moisture Density Relations of Soils Using a 4.54 kg Rammer and a 457 mm Drop
T-191	Density of Soils In-Place by the Sand Cone Method

T-193	The California Bearing Ratio of Laboratory Compacted Soils (CBR)
T-84	Specific Gravity and Absorption of Fine Aggregate
T-85	Specific Gravity and Absorption of Coarse Aggregate
T-19	Unit Weight of Aggregate
T-27	Sieve Analysis of Fine and Coarse Aggregates
T-96	Resistance to Abrasion by use of Los Angeles machine

**2. Concrete**

T-21	Organic Impurities of Sands for Concrete
T-22	Compressive Strength of Molded Concrete Cylinder
T-23	Making and Curing Concrete Compressive and Flexural Strength Test Specimens in the Field
T-24	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
T-97	Flexural Strength of Concrete
T-119	Slump of Portland Cement Concrete
T-126	Making and Curing of Concrete Test Specimens in the Laboratory
T-141	Sampling of Fresh Concrete
T-148	Measuring Length of Drilled Concrete Cores
T-231	Capping Cylinder Concrete Specimen

**3. Bituminous Materials**

T-40	Sampling Bituminous Materials
T-49	Penetration of Bituminous Materials

**4. Publications**

The Contractor shall provide two (2) copies each of the latest edition of the following publications:

- Part I, American Association of State Highway and Transportation Officials – Specifications
- Part II, American Association of State Highway and Transportation Officials – Tests
- Japan Road Association (JRA) Standard Specifications for Highway Bridges, Parts 1, 2, 3, 4 and 5 (in English if available)
- JIS Standard for Paints, Screw Threads, Quality Control, Welding, Ferrous Materials and Metallurgy, Piping and other JIS standards as may be requested by the Engineer.

These publications may be stored visibly in the office of the Engineer for future reference.

**B.4 CONSTRUCTION SURVEY AND STAKING****B.4.1 Description**

The Contractor shall provide all necessary equipment, materials, skilled and experienced engineering personnel to execute both survey, stake, field works, calculate and record data for the control of work in accordance with this Specification and conforming to the instruction given to him by the Engineer. Quality performance of work and strict conformity to the lines, grades and dimensions shown on the Plans or

as established or required by the Engineer shall be observed in the field. Field survey work to be performed by the Contractor shall include but not necessarily limited to the following:

- 1) Setting-out / Staking-out of the Works; and
- 2) Measurements of the Works for quantities.

In addition to the above routine field survey services, the Contractor shall assign a geo-technical engineering specialist to monitor and ensure compliance with additional soil borings, if ordered by the Engineer.

#### **B.4.2 Setting-Out/Staking-Out of the Work**

The Contractor shall have sole responsibility of establishing and maintaining all horizontal and vertical control points required or as may be directed by the Engineer. Information for the existing control monuments is shown on the Drawings and shall be used by the Contractor for establishing the horizontal and vertical controls needed for his work.

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

Schedule and notification to survey shall be provided to the Engineer and be subject for review and monitoring by the Engineer's representative.

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 setting 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.

The Contractor shall make minor adjustments subject to the Engineer's approval in the event that discrepancies are found between the information shown on the Drawings and the actual field conditions.

From the control points provided by the Engineer, the Contractor shall establish all additional and intermediate controls for accurately locating all structures, centerlines, right-of-way limits, slopes, etc. as shown on the Drawings and required by the Contract.

Prior to construction, the Engineer shall be notified of any missing initial reference lines, control points, or stakes. The Engineer shall reestablish 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 the 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 method
2. Stake marking/concrete monuments
3. Grade control for courses of material
4. Referencing
5. Structure control
6. Any other procedures and controls necessary for the work

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.

Work shall only be started after staking for the affected work as 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 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.

#### **B.4.2.1 Equipment**

Survey equipments and supporting equipment capable of achieving the specified tolerances shall be furnished.

Acceptable tools, supplies, and stakes of the type and quality normally used in the highway survey work and suitable for the intended use shall be furnished. Stakes and hubs of sufficient length to provide a solid set in the ground with surface area above ground for necessary legible markings shall also be furnished.

#### **B.4.2.2 Survey and Staking Requirements**

All survey, staking, recording of data, and calculations necessary to

construct the project from the initial layout to the final completion shall be performed. Stakes shall be reset as many times as necessary to construct the work.

### **1. Control Points**

Established initial horizontal and vertical control points in conflict with the 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 meters and vertical parabolic curve radius is less than or equal to 100 meters, cross-sections shall be taken at a maximum centerline spacing of 10 meters.

When the centerline horizontal curve radius is greater than 150 meters and vertical parabolic curve radius is greater than 100 meters, cross-sections shall be taken at a maximum centerline spacing of 20 meters.

Additional cross-sections shall be taken at significant breaks in topography and at changes in the typical roadway sections including transition change to superelevated sections. 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.

### **4. Clearing and Grubbing Limits**

Clearing and grubbing limits shall be set on both sides of centerline at roadway cross-section locations, extending one (1) meter beyond the toe of the fill slopes or beyond the rounding of cut slopes as the case may be for the entire length of the project unless otherwise shown on the plans or as directed by the Engineer.

#### **B.4.3 Centerline Reestablishment**

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

#### **B.4.4 Culvert Survey and Staking**

Culverts shall be staked to fit field conditions. The locations 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 meters 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, the length of the degree of elbow of culvert, and treatments, grade and other appurtenances.
- e) Plot into scale the cross-section of the inlet and outlet channel at not more than 5 meters interval.
- f) Submit the plotted Pipe Projection Plan for the 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 stakes inlet and outlet to make the structure functional.

#### **B.4.5 Bridge Survey and Staking**

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 the centerline of bridge.



**B.4.6 Retaining Walls and Other Types of Slope Protection Works Survey and Staking**

Profile measurements along the face of the proposed wall and 2 meters 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 meters along the length of the wall and all major breaks in terrain. For each cross-section, points shall be measured and recorded every 5 meters and all major breaks in terrain. Adequate references and horizontal and vertical control points shall be set.

**B.4.7 Grade Finishing Stakes**

Grade finishing stakes shall be set for grade elevations and horizontal alignment, at the centerline and at each shoulder of the 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 meters when the centerline horizontal curve radius is less than or equal to 150 meters and vertical parabolic curve radius is less than or equal to 100 meters. When the centerline horizontal curve radius is greater than 150 meters and vertical parabolic curve radius is greater than 100 meters, the maximum transverse spacing between stakes shall be 5 meters. Brushes or guard stakes shall be used at each stake.

**B.4.8 Permanent Monuments and Markers**

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

**B.4.9 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

**B.4.10 Method of Measurement and Payment**

The Contractor and Engineer shall jointly measure the Works for the purpose of establishing progress and final pay quantities. 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 lumpsum.

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

Culvert survey and staking shall be measured by the each.

Grade finishing stakes shall be measured by the kilometer. Subgrade shall be measured one tie 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.

The Contractor shall provide all necessary personnel and equipment to perform the measurements for payment required by the Contract. Such measurements and quantity calculations will not be accepted unless conducted jointly with and monitored by the Engineer.

Whenever required for the purposes of measurement of quantities, the Contractor shall take cross sections on the original ground at intervals of 20 meter or less, as directed by the Engineer. The profiles so established shall be plotted on tracing paper to a scale, size and layout as stipulated by the Engineer or encoded in a CAD system to the approval of the Engineer. The drawn cross sections shall include the proposed finished lines derived from the approved design details.

The original profile together with the three copies shall be submitted to the Engineer who will endorse one copy with his approval, or his revision thereof, and return it to the Contractor.

At any locations, measurement for pay quantities shall require material volumes to determine the difference between the after-construction (or design) profile and the existing before-construction profile. The Contractor shall carry out as part of his routine survey works all the necessary topographic surveys in sufficient detail to enable the work volumes to be accurately calculated.

The Contractor in his routine survey work for quantity measurement is required not only to make geometric measurement using precise levels, theodolites, chains, etc. but also is required to take and measure pavement cores as required by the Engineer. The Contractor is also required to check the embankment thickness by auger boring or settlement plates.

The Contractor shall also keep the haulage truck tallies and all other

methods of work volume measurement as the Engineer may direct. The detailed requirements for the measurement of the Works are specified for each Pay Item in the relevant sections of these Technical Specifications.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
B.4 (1)	Construction Survey and Staking	Kilometer
B.4 (2)	Slope, Reference, with Clearing and Grubbing Stakes	Kilometer
B.4 (3)	Centerline Reestablishment	Kilometer
B.4 (4)	Culvert Survey and Staking	Each
B.4 (5)	Bridge Survey and Staking	Lump Sum
B.4 (7)	Grade Finishing Stakes	Kilometer
B.4 (8)	Permanent Monuments and Markers	Each

#### **B.5 PROJECT SIGNBOARD**

Unless otherwise specified in other pay items of the Contract, the Contractor shall provide and erect project signboard at the exact location approved by the Engineer. The design, layout and wordings are all to be approved by the Engineer. All signboards shall display the title of the project, the name of the Employer, the funding agency and the consulting engineering company, and the funding Loan Agreement Reference Number. The signboard shall be maintained in good condition throughout the duration of the Contract, and shall be removed upon completion of the project to the satisfaction of the Engineer.

The quantities of Project Sign Board to be paid for shall be the number of project sign boards of size installed in place and accepted and shall be paid at the contract unit price indicated in the Bill of Quantities. Payment and price shall constitute full compensation for furnishing and installing all materials, all labor, equipment, tools and other incidental necessary to complete the item.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
B.5	Project Sign Board	Each

#### **B.7 CONSTRUCTION OCCUPATIONAL SAFETY AND HEALTH PROGRAM**

In compliance with the DPWH Department Order No. 56, S 2005, that all projects regardless of amount, funding source and mode of implementation shall comply with the minimum safety and health requirements.

Occupational hazards are continually emerging. Construction workers often encountered different types of hazards which may result to accidents, injuries and the worst is the loss of life.

**Requirements**

The Contractor shall employ a full-time Certified Safety and Health Personnel that is accredited by DOLE or the Department of Labor and Employment. This is in compliance with government regulations (OSHS and DO13). This full-time officer assigned as the general construction safety and health officer will oversee full time the overall management of Construction Safety and Health Program of the Contractor and its personnel working within the construction site. A requirement of one (1) Construction Safety and Health Officer for every ten(10)unitsofheavyequipmentassignedtotheprojectsite,tooverseetheeffective compliance with the Construction Safety and Health Program at the construction site, in terms of heavy equipment utilization and maintenance. Other requirements are medicines, supplies, equipment and facilities that conform to the OSHS.

**Safety and Warning Signs**

Mandatory provision of safety and warning signs are reiterated not only for the protection of workers, but also the public in general. The following signs should conform to the standard requirements of the OSHS;

- Usage ofPPE
- Falling/fallingobjects
- Explosives and flammablesubstances
- Tripping or slippinghazards
- Toxic or irritant airbornecontaminants/substances
- Electricalfacility
- Dangerous moving parts ofmachines
- Fire alarms/firefighting
- Instructional signs/Update of man-hours lost

**Committee**

Each site shall, at the start of the construction have a construction safety and health committee which is composed of the following personnel;

- Project Manager or his representative as thechairperson
- General Construction Safety and healthOfficer;
- Safety representative/SO from eachsubcontractor;
- Doctors, Nurses and Health personnel;
- Workers' representatives(min.of 3, not necessarily from oneemployer)

**Monthly Summary Reports to DOLE**

A monthly submission of Summary Reports to DOLE is required. The summary reports shall include safety committee meeting agreements and hazardous assessments with the corresponding remedial action/measured required.

The Contractor will send a notification of major accidents to DOLE within 24 hours.

**Worker's Welfare Facilities**

The Contractor shall provide to his workers for adequate supply of safe drinking water, adequate sanitary and washing facilities in order to ensure humane conditions of work.

The total cost of Construction Safety and Health Program shall be mandatory integral part of the construction project. It shall be treated as a separate pay item and reflected in the Contractor's bid.

The quantities of Construction Safety and Health Program shall be paid for in monthly basis as per the contract unit price indicated in the Bill of Quantities and upon recommendation and approval of the Engineer.

Payment and price shall constitute full compensation for the compliance and provision of necessary health and safety requirements listed above which conform to the standard requirements of the OSHS.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
B.7	Construction Occupational Safety and Health Program	Month

#### **B.9 MOBILIZATION/DEMOBILIZATION (CLEARING/FINISHING THE SITE)**

Upon completion of all construction operations, the entire roadway or roadways shall be finished/cleared as specified herein these Specifications.

Stockpiling of materials on the finished pavement and drifting of materials across the pavement will not be permitted. The finished pavement shall be cleaned of all dirt and foreign materials.

The slopes in embankments; excavations; road approaches; road connections; ditches; channel changes; and material sites within or adjacent to the project boundaries shall be cleared and finished to the lines and grades called for on the Drawings. Ditches and channels within or adjacent to the project boundaries shall be cleared of debris and obstructions. Sewers, culverts and other drainage facilities and their appurtenant structures constructed under the contract shall be cleaned out. All stores and other waste materials exposed on slopes, which are liable to become loosened, shall be removed and disposed of. All materials and debris resulting from clearing and grubbing operations not previously removed shall be disposed of.

All materials resulting from the above-specified clearing/finishing operations shall become the property of the Contractor and shall be disposed of outside the project boundaries unless otherwise permitted by the special provisions.

Disposal of materials outside the highway right of way shall be in accordance with the provision in Item B.8, "Disposal of Materials outside the Project Boundaries". The entire roadway and right of way shall be left in a neat and presentable condition.

Payment for this Item shall be in a Lump Sum basis and divided into two (2) parts; Part A-Mobilization, once the Contractor had mobilized his staff/manpower, equipment requirements and his facilities for the project and Part B-Demobilization, once the Contractor had completed his works and everything cleared on site including clean-up and removal of all his

installations/plants.

The basis of payment can be done on a staggered or percentage form based upon his actual mobilization and demobilization status. The Contractor's claim for each shall be inventoried and upon recommendation and approval of the Engineer.

Payment and price shall constitute the full compensation for the compliance of the above specifications on mobilization and demobilization.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
B.9	Mobilization and Demobilization	Lump Sum

### **B.13 MEASUREMENT AND PAYMENT**

Unless specifically included in the Bill of Quantities as pay item(s) of work, under PART B – OTHER GENERAL REQUIREMENTS, the work(s) shall not be measured for direct payments but shall be considered as subsidiary work for other related pay items.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
B.2	Medical Room and First Aid Facilities	Lump Sum
B.4 (1)	Construction Survey and Staking	Kilometer
B.4 (2)	Slope, Reference, Clearing and Grubbing Staking	Kilometer
B.4 (3)	Centerline Reestablishment	Kilometer
B.4 (4)	Culvert Survey and Staking	Each
B.4 (5)	Bridge Survey and Staking	Lump Sum
B.4 (7)	Grade Finishing Stakes	Kilometer
B.4 (8)	Permanent Monuments and Markers	Each
B.5	Project Sign Board	Each
B.7	Construction Occupational Safety and Health Program	Month
B.9	Mobilization and Demobilization	Lump Sum

# **PART C**

## **Earthworks**

**PART C EARTHWORK****ITEM 100 CLEARING AND GRUBBING****100.1 Description**

This Item shall consist of the removal, hauling, and stockpiling of all materials including trees, stumps, roots, vegetations, logs, wastes, debris and protruding objects except those that are designated to remain in accordance with other items of this Specification and where directed by the Engineer. The holes resulting from clearing and grubbing operations, where directed by the Engineer, shall be filled with approved materials, which shall be placed and compacted to the maximum dry density. The work shall also include the preservation from injury or defacement of all objects designated to remain.

**100.2 Construction Requirements****100.2.1 General**

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

Clearing shall be extended to one (1) meter beyond the toe of the fill slopes, or beyond rounding of cut slopes or outside edge of drainage facilities, unless otherwise shown on the Drawings or directed by the Engineer, with the exception of trees under the jurisdiction of the Forest Management Bureau and/or such tree and brush designated for preservation. Trees, shrubs or bushes designated to remain in place shall be carefully trimmed as directed by the Engineer and shall be protected from scarring, debarking and other injuries during construction operations.

Within the town or village areas, clearing and grubbing shall be strictly limited to the extent of cut and fill as shown in the Drawings or as designated by the Engineer. No private properties such as buildings, crops, signs, fences, and others shall be removed, relocated or altered without the written authorization from the Engineer.

Structures, properties and the likes which need to be removed but are still under legal expropriation proceedings shall in the meantime be preserved or excluded from the works, otherwise the Contractor shall be solely liable for any complaints or litigation filed by the owner of any damage to the structure and/or property as a result of his action.

Any unauthorized interference and damage to private property shall be made good or restored by the Contractor to the satisfaction of the Engineer and the Owner.

**100.2.2 Clearing and Grubbing**

All surface objects and all trees, stumps, roots and other protruding obstructions, not designated to remain shall be cleared and/or



grubbed, including mowed as required, except as provided below;

- (1) Removal of undisturbed stumps and roots and nonperishable solid objects with a minimum depth of one (1) meter below subgrade or slope of embankment will not be required.
- (2) In areas outside of the grading limits of cut and embankment areas, stumps and nonperishable solid objects shall be cut off not more than 150mm above the ground line or below water level.
- (3) In areas to be rounded at the top of cut slopes, stumps shall be cut off flush with or below the surface of the final slopeline.
- (4) Grubbing of pits, channel changes and ditches will be required only to the depth necessitated by the proposed excavation within such areas.
- (5) In areas covered by cogon/talahib, wild grass and other vegetations, top soil shall be cut to a maximum depth of 150mm below the original ground surface or as designated by the Engineer, and disposed outside the clearing and grubbing limits as indicated in the typical roadway section.

Unless otherwise directed by the Engineer, materials from clearing and grubbing and other unsuitable materials shall be delivered and stockpiled at the approved designated areas.

#### **100.2.3 Individual Removal of Trees or Stumps**

The Contractor, prior to any tree cutting/removal operation shall prepare inventory of the trees scheduled for cutting/removal for the Engineer's approval. List of trees to be cut shall be submitted in tabulated form, showing as much information for easy identification as follows:

- Station Limit
- Description/Name/Species of Trees
- Size/Diameter (in centimeter)
- Distance from the centerline of the road
- Location (Left/Right)

Upon Engineer's approval of the list, the Contractor shall make a request from the Local DENR (with the approved list attached) that such number of trees will be cut/removed for the improvement of the project road. No trees shall be cut/removed unless a "Permit to Cut Trees" is issued by the DENR to the Contractor authorizing him to cut only such approved number of trees.

Trees cut shall be disposed of in a manner conforming to the requirements of Sub-Section 100.2.2 and with the requirements contained in the DENR permit.

All fees relating to securing permit(s) shall be to expense of the Contractor.

Individual trees or stumps intended to be removed and relocated as indicated on the Drawings or as designated by the Engineer shall be removed and relocated by the Contractor with care.

**100.3 Method of Measurements**

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

- (1) Area Basis. The work to be paid for shall be based on the total number of hectares and fractions thereof acceptably cleared and grubbed within the limits indicated on the Plans/Drawings or may be adjusted in the field staking by the Engineer. Areas not within the clearing and grubbing limits shown in the Plans/Drawings or not staked for clearing and grubbing will not be measured for payment.
- (2) Lump-Sum Basis. When the Bill of Quantities contains a Clearing and Grubbing lump-sum item, no measurement of area will be made for such item.
- (3) Individual Unit Basis (Selective Clearing). The diameter of trees will be measured at a height of 1.4m (54 inches) above the ground. Trees less than 150mm (6 inches) in diameter will not be measured for payment.

When Bill of Quantities indicates measurement of trees by individual unit basis, the units will be designated and measured in accordance with the following schedule of sizes:

Diameter at height of 1.4 m	Pay Item Designation
150mm to 900mm diameter	Small
Over 900mm diameter	Large

**100.4 Basis of Payment**

The accepted quantities, measured as prescribed in *Section 100.3*, shall be paid for at the Contract unit price for each of the Pay Items listed below that is included in the Bill of Quantities, with price and payment shall be full compensation for furnishing of 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
100(1)	Clearing and Grubbing	Hectares
100(3)a2	Individual Removal of Trees, Small (301-500mm diameter)	Each
100(3)a4	Individual Removal of Trees, Small (751-900mm diameter)	Each

**ITEM 102 EXCAVATION****102.1 Description**

This Item shall consist of roadway drainage and borrow excavation, and the disposal of material in accordance with this Specification and in conformity with the lines, grades and dimension shown on the plans or establishes by the Engineer.

It shall be understood that the hauling of excavated fill material to stockpiles or its hauling to areas of fill and the disposal of unsuitable materials to disposal areas is at any distance and therefore no overhauling cost will be paid.

**102.1.1 RoadwayExcavation**

Roadway excavation will include excavation and grading of roadways, parking areas, intersections, approaches, slope rounding, benching, waterways and ditches; removal of unsuitable material from the roadbed and beneath the embankment areas; and excavating selected materials found in the roadway as ordered by the Engineer for specific use in the improvement. Roadway excavation will be classified as "unclassified excavation", "rock excavation", "common excavation", or "muck excavation" as indicated in the Bill of Quantities and hereinafterdescribed.

- 1) Common Excavation. Common excavation shall consist of all excavation including any pavement layer of the existing roadway not covered by a separate item in the Bill of Quantities regardless of the nature of the materials excavated, other than borrow excavation, unsuitable excavation, soft rock and solid rock excavation.

Common excavation shall include excavation for the reshaping of side ditches in accordance with the lines, levels and details shown on the drawings and as per instruction by the Engineer.

- 2) Rock Excavation. Rock excavation shall consist of excavation of igneous, sedimentary and metamorphic rocks which cannot be excavated without blasting or the use of rippers, and all boulders or detached stones each having a volume of 1 cubic meter or more as determined by physical measurements or visually by the Engineer.

A.) Soft Rock Excavation shall consist of excavation of rock which can be effectively removed by ripping with a tractor of 150kw (200 Flywheel HP) equipped with a rear mounted heavy-duty hydraulicripper.

B.) Hard/Solid Rock Excavation shall consist of hard material in masses (including individual rock bouldersexceeding 1.0 m<sup>3</sup> in volume) which in the opinion of the Engineer cannot be excavated without blasting.

Hard/solid rock excavation shall include all materials that cannot be ripped when worked with a tractor of at least 150 KW (200 Flywheel HP) fitted with a rear mounted heavy-duty hydraulic single ripper and requires either of the following:

- a. Requires drilling and blasting for its removal,
- b. Requires the use of compressed air jack hammers for its removal.

Individual boulders greater than 1 cubic meter in volume shall be included in this class when the nature and size are such that in the opinion of the Engineer it cannot be removed without recourse to one of the above methods.

Where a portion of excavation contains 50% or more by volume of boulders of this order, such portion shall be considered as hard/solid rock excavation throughout

- 3) Muck Excavation. Muck excavation shall consist of removal and disposal of deposits of saturated or unsaturated mixtures of soils and organic matter such as muck, peat, organic silt, soil or sod, which is not suitable for foundation materials regardless of moisture content. This is sometimes considered as Unsuitable Excavation and will be for the opinion and approval of the Engineer.
- 4) Unclassified Excavation. Unclassified excavation shall consist of the excavation and disposal of all materials regardless of the nature, not classified and included in the Bill of Quantities under other pay items.

#### **102.1.2 BorrowExcavation**

Borrow excavation shall consist of the excavation and utilization of approved materials required for the construction of embankments or for other portions of the work, and shall be obtained from approved sources, in accordance with Clause 61, Standard Specifications for Public Works and Highways, Volume 1 and the following;

- (1) Borrow, Case1  
Borrow Case 1 will consist of material obtained from sources designated on the plans or in the Special Provisions.
- (2) Borrow, Case2  
Borrow Case 2 will consist of material obtained from sources provided by the Contractor.

The material shall meet the quality requirements determined by the Engineer unless otherwise provided in the Contract.

Irrespective of the source of borrow materials whether as indicated in the Drawings, or as directed by the Engineer or from the Contractor's own source, it is understood that materials obtained from these

sources are only of the desired quality passing the requirements of the Specifications. All preparatory works, problems of access and other related matters in connection with quarrying operations shall be the sole responsibility of the Contractor.

## **102.2 Construction Requirements**

### **102.2.1 General**

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

All excavations shall be finished to reasonably smooth and uniform surfaces. No materials shall be wasted without the authority of the Engineer. Excavation operations shall be conducted so that material outside of the limits of slopes will not be disturbed. Prior to excavation, all necessary clearing and grubbing in that area shall have been performed in accordance with Item 100, Clearing and Grubbing.

### **102.2.2 Conservation of Topsoil**

Suitable topsoil encountered in excavation and on areas where embankment is to be placed shall be removed to such extent and to such depth as directed by the Engineer. The removed topsoil shall be transported and stockpiled at locations approved by the Engineer. The topsoil shall be completely removed to the required depth from any designated area prior to the beginning of regular excavation or embankment work in the area and shall be kept separately from other excavated materials for later use.

### **102.2.3 Utilization of Excavated Materials**

All suitable materials removed from the excavation shall be used in the formation of the embankment, subgrade, shoulders, slopes, bedding, and backfill for structures, and for other purposes shown on the Plans or as directed by the Engineer.

Only approved materials shall be used in the construction of embankments and backfills.

All excess materials, including rock and boulders that cannot be used in embankments shall be disposed off as directed by the Engineer.

Borrow Materials shall not be placed until after the readily accessible materials from roadway excavation has been placed in the fill, unless otherwise permitted or directed by the Engineer. If the Contractor places more borrow than is required and thereby causes waste of excavation, the amount of such waste will be deducted from the borrow volume.

### **102.2.4 Prewatering**

Excavation areas and borrow pits may be prewatered before

excavating the material. When prewatering is used, the areas to be excavated shall be moistened to the full depth, from the surface to the bottom of the excavation. The water shall be controlled so that the excavated material will contain the proper moisture to permit compaction to the specified density with the use of standard compacting equipment.

The Contractor shall provide drilling equipment capable of suitably checking the moisture penetration to the full depth of the excavation.

#### **102.2.5 Presplitting**

Unless otherwise provided in the Contract, rock excavation, which requires drilling and shooting, shall be presplit.

Explosives maybe used only when authorized in writing by the Engineer, in accordance with the provisions of all laws, orders and regulations. The Engineer's approval on the use of explosives shall, in no case relieve the Contractor from any liability for claims caused by blasting operations.

The Contractor at all times shall, with the Engineer's permission, use materials containing hazardous substances with strict compliance to safety requirements and all manufacturer's warning, application instruction and specifications.

Regardless of the variance allowed in the formation of slope in rock excavations, only the volume within the limits indicated in the drawings, unless adjusted by the Engineer, shall be considered as pay quantity.

#### **102.2.6 Excavation of Ditches, Gutters, etc.**

All materials excavated from side ditches and gutters, channel changes, irrigation ditches, inlet and outlet ditches, toe ditches, furrow ditches, and such other ditches as may be designated on the Plans or staked by the Engineer, shall be utilized as provided in Subsection 102.2.3.

Ditches and side ditches at cut sections, whether on rock or on common soil, shall conform to the slope, grade and shape of the required cross-section, with no projections of the roots, stumps, rock, or similar matter. The Contractor shall maintain and keep open and free from leaves, sticks and other debris all ditches dug by him until final acceptance of the work.

At sections of fill where the original ground and toe of slope of the designed road meet, and where the original ground slopes away from the intersection such that run off water does not accumulate and flow freely away from the roadbed, drainage ditch will not be necessary. However, if the ground slopes down towards the roadbed, the provisions of drainage ditches to convey run-off water away from the road will be necessary whether or not indicated on the drawings. Whenever the longitudinal gradient of drainage ditches constructed on common soil exceeds the maximum allowed by the drawings or when the conditions exist, which in the opinion of the Engineer, will result to damage of the roadbed through the action of erosion, the Contractor

may be required to provide the corresponding protection. Erosion control protection whenever required shall be constructed in accordance to the relevant provisions of Part G- Drainage and Slope Protection Structures.

Structures to be constructed related to erosion control shall be measured and paid for in accordance with the relevant items in the Bill of Quantities under Part G: Drainage and Slope Protection Structures and Part H: Miscellaneous Structures of the Specifications, whichever is appropriate.

#### **102.2.7 Excavation of RoadbedLevel**

Rock shall be excavated to a depth of 150 mm below the subgrade within the limits of the roadbed, and the excavation be backfilled with material designated on the Plans or approved by the Engineer and compacted to the required density.

Materials below subgrade, other than rock shall be thoroughly scarified to a depth of 150 mm and the moisture content increased or reduced, as necessary, to bring the material throughout this 150mm layer to the moisture content suitable for maximum compaction. This layer shall then be compacted in accordance with Subsection 104.3.4 (Embankment-Compaction).

Tolerance for excavation shall be as follows:

- Cut Slopes in Soil shall be plus or minus one hundred millimeters (+/- 100mm)
- Cut Slopes in Soft Rock and Blasted Rock shall be plus or minus three hundred millimeters (+/- 300mm)

#### **102.2.8 BorrowAreas**

Material from borrow areas shall be used for the construction of embankment or for backfill when there is no suitable materials available from roadway excavation or structural excavation or excavation of ditches or waterways. Permission to use material from borrow areas shall first be obtained from the Engineer. Nevertheless, the total volume of material from roadway excavation, ditch and watercourse excavations, and structure excavation less the materials declared unsuitable by the Engineer shall be considered available for use in the work regardless of haul distance. Surplus materials resulting from the Contractor's use of borrow materials, without first exhausting the available common excavation, shall not be measured for payment.

No borrow material shall be taken nearer than 30 meters from the toe of embankment or top of the cuts, unless called for in the widening of cuts or authorized by the Engineer. The distance from the work sites shall not be grounds for any claims for extra payment or revision of the contract price.

In addition, no borrow material shall be obtained from any area within two hundred (200) meters downstream of the drainage structure without the approval of the Engineer.

The Contractor shall notify the Engineer sufficiently in advance of opening any borrow area so that the cross-section elevations and measurements on the ground surface after stripping maybe taken, and the borrow material can be tested before being used. Sufficient time for testing the borrow material shall be allowed.

#### **102.2.9 Removal of Unsuitable Materials**

In general, whenever materials of doubtful characteristics are discovered during excavation and embankment construction, such materials shall be subjected to laboratory test at the option of the Contractor. If the test results show that the materials could be treated or blended to produce materials of the required quality for incorporation into the Works, the Contractor may perform such treatment or blending operations to the complete satisfaction of the Engineer. In all cases, the Contractor, in electing to undertake the testing and treatment/blending operations, shall not be entitled to extension of time or additional compensation.

Where excavation to the finished graded section results in a subgrade or slopes of unsuitable soil, the Engineer may require the Contractor to remove the unsuitable material and backfill to the finished graded section with approved material. The Contractor shall conduct his operations in such a way that the Engineer can take necessary cross-sectional measurements before the backfill is placed.

When any material including surplus or unsuitable materials from excavations are to be disposed off outside the right-of-way, the Contractor shall first obtain a written permission from the property owner of the proposed disposal site. The Contractor shall submit to the Engineer a certified copy of the written permission together with a written release of responsibility by the property owner absolving the government from any responsibility in connection with the disposal of material at the sites. The disposal of materials at the site as provided shall be made in a neat and uniform manner and the disposal site must be approved by the Engineer.

#### **102.3 Method of Measurement**

The cost of excavation of material, which is incorporated in the Works or in other areas utilized as fill, shall be deemed included in the Items of Works where the material is used. The measurement of Unsuitable or Surplus material shall be the net volume in its original position.

For measurement purposes, surplus suitable material shall be calculated as the difference between the net volume of suitable material required to be used in embankment, corrected by applying a shrinkage factor or a swell factor in case of rock excavation, determined by the laboratory tests to get its original volume measurement, and the net volume of suitable material from excavation in the original position. Separate pay items shall be provided for surplus common, unclassified and rock material.

The Contractor shall be deemed to have included in the contract unit prices all costs of obtaining land for the disposal of unsuitable or surplus material.



**102.4 Basis of Payment**

The accepted quantities, measured as prescribed in Section 102.3 shall be paid for in the contract unit price for each of the Pay Items listed below that is included in the Bill of Quantities which price and payment shall be full compensation for the removal and disposal of excavated materials including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
102(2)	Roadway Surplus Common Excavation	Cubic Meter

**ITEM 103 STRUCTURE EXCAVATION****103.1 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.

Structure excavation shall also include the furnishing and placing of approved foundation fill material to replace unsuitable materials encountered below the foundation elevations of the structures.

**103.2 Construction Requirements****103.2.1 Clearing and Grubbing**

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

**103.2.2 Excavation**

Generally, in 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.

Any excavation carried beyond the limits and dimensions as shown or described on the Drawings or Specifications shall be backfilled with acceptable materials.

Trenches or foundation pits for structures or structure footings shall be excavated to the lines and grades or elevation 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 as shown on the Plans. 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 maybe deemed necessary, to secure a satisfactory foundation.

If excess excavation occur which resulted to a greater depth or width than is necessary, then the Contractor shall at his own expense backfill the excess excavation with approved materials, compacted to the density of the adjacent ground, to the correct levels and dimensions to the approval of the Engineer.

When instructed by the Engineer, the Contractor shall carefully set aside the various materials encountered so that they may be replaced in their original position

Trenches shall be kept clean and free from water during excavation, concreting, laying of pipes and backfilling. In cases where presence of water is unavoidable during excavation and prior the laying of pipes, the Contractor shall dig diversion channels, erect cofferdams or otherwise de-water the trench to ensure proper procedure and compaction before concreting or laying of pipes.

Where, in the opinion of the Engineer, any invert has become soft or unsuitable to receive the culvert or concrete bed due to the Contractor's method of working, the Contractor shall at his own expense remove and replace the material with non-structural concrete or other approved material as instructed by the Engineer. Where concrete is specified, the mix shall consist of ordinary portland cement and aggregate, both complying with the Specifications Item 405. The weight of cement mixed with 0.3m<sup>3</sup> of aggregate shall not be less than 50 kg. The quantity of water shall not exceed that required to produce a smooth cement paste, which coat evenly the whole of the aggregate.

For 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 300mm or 4mm for each 100mm 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 300mm 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 150mm in uncompacted depth to form a uniform but yielding foundation.

For culverts which are to be constructed under a “trenched” or “negative projection” conditions, where the pipes are laid in a trench excavated below existing ground level or in a trench excavated in a previously constructed embankment, the top 150mm in the trench invert shall be compacted to a dry density of at least 95% MDD (AASHTO T99) or at least the same density as the adjacent ground, whichever is the greater, unless otherwise specified.

Where culverts are to be laid under the “embankment” or “positive projection” conditions, the Contractor shall level the existing ground by excavating and backfilling. The Contractor shall then compact the ground for 150 mm below invert or underside of bedding material to a dry density of 95% MDD (AASHTO T99) or to the density of the adjacent ground, whichever is the greater, such that the foundation of the culvert of bedding is true to grade and of uniform density over the whole length of the culvert.

The Engineer’s approval is required before placing concrete in all excavations for structures made through water bearing strata that require dewatering.

#### **103.2.3 Utilization of Excavated Materials**

All suitable excavated materials 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 not to endanger the partly finished structure.

#### **103.2.4 Cofferdams**

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

#### **103.2.5 Preservation of Channel**

Unless otherwise permitted, no excavation shall be made outside of caissons, cribs, cofferdams, or sheet piling and the natural streambed adjacent to structure shall not be disturbed without the permission from the Engineer. If any excavation or dredging is made at the side of the structure before the 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.

#### **103.2.6 Backfill and Embankment for Structures Other than Pipe Culvert**

Excavated areas around structures shall be backfilled with free draining granular materials approved by the Engineer and placed in horizontal layers not over 150mm 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.

Backfill and embankment for structures other than pipe culverts shall be of suitable common materials excavated from required excavation or from borrow source.

#### **103.2.7 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.

#### **103.2.8 Choring, Cribbing, and Related Work**

Shoring, cribbing, and related protective works if required in the construction shall not be measured and paid for separately and shall be considered subsidiary to the item for which they are constructed and utilized.

### **103.3 Method of Measurement**

#### **103.3.1 Structure Excavation**

The volume of excavation to be paid for will be the number of cubic meters measured in original position of material acceptably excavated in conformity with the Plans or as directed by the Engineer, except as noted, will any of the following volumes be included in the measurement for payment:

- (1) The volume outside the vertical planes 450mm outside of the parallel to the neat lines of footings and the inside walls of the pipe and pipe-arch culverts at the widest horizontal dimensions.
- (2) The volume of excavation for culvert and section outside the vertical plane for culverts stipulated in (1) above.
- (3) The volume outside of the 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 of more than 1.5m below the lowest elevation for such footings shown on the original Contract Plans for individual footings.

### **103.3.2 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 separately from the excavation for all structures for payment purposes.

The volume of bridge excavation to be paid shall be the vertical 450mm outside 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.

### **103.3.3 Foundation Fill**

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

### **103.3.4 Shoring, Cribbing, and Related Work**

Shoring, cribbing and related work whenever included as a pay item in the Bill of Quantities will be paid for at a 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 1.5m below the lowest elevation shown on the Plans for each separable foundation structure.

## **103.4 Basis of Payment**

The accepted quantities, measured as prescribed in Section 103.3, shall be paid for in the Contract unit price for each of the particular pay items listed below that is included in the Bill of Quantities.

The payment for structure excavation and bridge excavation shall be deemed to include the cost of backfilling, shoring, cribbing, protective works, removing and disposing unsuitable materials off site and removal and hauling of excess suitable materials to stockpiles as directed by the Engineer. The payment shall be the full compensation for the work item including the cost of labor, equipment, tools and incidentals necessary to complete the work prescribed in this item.

No measurement for separate payment to the Contractor shall be made for backfill being the relevant compensation included by the Contractor in his rates in the Bill of Quantities in the pay items for excavation for structures and bridges.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
103(2)a	Bridge Excavation (Common Soil)	Cubic Meter
103(3)	Foundation Fill	Cubic Meter
103(6)a	Structure Excavation (Electrical)	Cubic Meter
103(6)a	Structure Excavation (Pipe Culverts and Drain Excavation)	Cubic Meter

## ITEM 104 EMBANKMENT

### 104.1 Description

This item shall consist of the construction of embankment in accordance with this Specification and in conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer.

### 104.2 Material Requirements

Embankment shall be constructed of suitable materials in accordance with the following definition:

#### 1. Suitable Material

Material which is acceptable in accordance with the contract and which can be compacted in the manner specified in this Item. It can be common material or rock provided however, it shall have a CBR value of not less than seven (7%) percent when tested according to AASHTO 193-81 after four days soaking when compacted to 95% of the maximum dry density according to AASHTOT-99-90.

Selected Borrow, for topping - shall be soil of such gradation that all particles will pass a sieve with 75 mm (3 inches) square openings and not more than 15 mass percent will pass the 0.075 mm (No. 200) sieve, as determined by AASHTO T 11. The material shall have a plasticity index ranging from 6% -11% as determined by AASHTO T 90, a liquid limit of not more than 35 % as determined by AASHTO T89.

#### 2. Unsuitable Material - Material other than suitable materials such as:

- (a) Materials containing detrimental quantities of organic materials, such as grass, roots and sewerage.
- (b) Organic soils such as peat and muck.
- (c) Soils with liquid limit exceeding 80 and/or plasticity index exceeding 55.
- (d) Soils with natural water content exceeding 100%.
- (e) Soils with very low natural density, 800 kg/m<sup>3</sup> or lower.

- (f) Soils that cannot be properly compacted as determined by the Engineer.

### **3. Selected Granular Embankment**

In situations where placing and/or compaction under saturated or flooded conditions cannot be avoided, selected granular embankment shall be river run gravelly sand or gravel or other clean granular materials as specified on the drawing or as directed and approved by the Engineer.

## **104.3 Construction Requirements**

### **104.3.1 General**

Prior to the construction of embankment, all necessary clearing and grubbing in that area shall have been performed in conformity with the item 100, Clearing and Grubbing.

The Contractor shall submit to the Engineer for review and approval the methodology he intends to apply for the formation of embankment satisfying all requirements. The methodology shall show the systematic procedure of constructing the embankment in conjunction with the procedure proposed for the slope protection as shown in the drawings.

The approval of the proposed methodology however does not relieve the Contractor of the responsibilities for any unsatisfactory or defective works as results of such methodology. The Engineer at his discretion may reject or require remedial measures to the defective works. The cost of replacing or remedying defective works shall be borne by the Contractor.

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

Before embankment construction is started, the Contractor shall construct in accordance with his methodology, a section of trial embankment in accordance with Sub-section 104.3.3 Compaction Trials.

### **104.3.2 Method of Construction**

In places where the road embankment will be constructed over the existing gravel or dirt road, as shown in the plan or as directed by the Engineer, the surface of the existing road shall be ripped to a depth of 150 mm. Then the existing road shall be reshaped and compacted to the same or greater density as the materials to be placed thereon, to provide a uniform foundation for the embankment materials to follow.

Thin bituminous layers less than 50 mm may be incorporated in the layer of the embankment.

In places where the road embankment will be constructed over the existing PCC pavement, the existing concrete pavement shall be broken into pieces with greatest dimensions of not more than 500 mm in accordance with the provisions of Sub-Section 105.3.6-Subgrade Preparation on Existing Pavement.

- Thin bituminous layers less than 50 mm may be incorporated in the layer of the embankment.
- In places where the road embankment will be constructed over the existing PCC pavement, the existing concrete pavement shall be broken into pieces with greatest dimensions of not more than 500 mm in accordance with the provisions of Sub-Section 105.3.6.
- 95% of maximum density as determined by AASHTO T 99, for all the embankment, except the top 300 mm (subgrade).
- 98% of the maximum density as determined by AASHTO T 180 for the top 300 mm (subgrade) of the embankment.

The embankment shall be compacted with compaction equipment over the full width and in a longitudinal direction until there is no visible movement of the rock fill materials when under the compacting equipment.

Placing of fill will be suspended if, in the opinion of the Engineer, there is no adequate compaction and grading equipment available on site in operating condition to shape and compact the fill immediately upon placement.

### **104.3.3 Compaction**

#### **Compaction Trials**

##### **1) General**

Before starting the formation of embankments, the Contractor shall submit in writing to the Engineer for approval of his proposals for the compaction of each type of fill material to be used in the works. The proposals shall include the relationship between the types of compaction equipment, the number of passes required and the method of adjusting moisture content. The Contractor shall carry out full scale compaction trials on areas not less than 10m wide and 50 m long as required by the Engineer and using his proposed procedures or such amendments thereto as may be found necessary to satisfy the Engineer that all requirements regarding compaction can be consistently achieved. Compaction trials with the main types of fill material to be used in the works shall be completed before work with the corresponding materials will be allowed to commence.

All findings obtained from the trial compaction and tests shall be submitted to the Engineer for establishing desirable criteria for the quality control of the embankment works. The Contractor shall make joint efforts with the Engineer until acceptable criteria and methodology are established.

This compaction trial on trial embankments shall also include the Contractor's plan and schedule for the construction of the trial



embankment including location and area of embankment, type and quality of equipment, manner of blending, placing, spreading and compaction, items and quantity of test, and other information for the trial embankment.

No separate payment shall be made of the trial embankment, all the cost thereof are deemed to be included in the payment specified in this work item.

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

## **2) Execution of Trial Embankment**

The trial embankment shall be carried out simulating normal construction conditions by using all the equipment and methods proposed for placing, spreading and compaction the embankment materials.

The trial embankment shall be carried out at a minimum of four (4) independent sites, and the section of each trial embankment shall be constructed to the full width of the embankment over a 30m length and to a height of 0.6 m at least after compaction. Each trial embankment section shall be tested by various kind of compaction equipment.

Spreading depth of the trial embankment shall be not more than 20 cm after compaction.

The number of passes shall be varied to provide at least four (4) cases to establish a relation between number of passes and degree of compaction.

Several kinds of material, which can cover representative soil characteristics of the whole embankment materials, shall be tested. Should clearly different materials be used for a section of embankment, such materials shall also be tested in the same manner.

## **3) Soil Test and Measurement**

All materials of embankment shall be conditioned beforehand and tested in accordance with Clause 104.2 of this Specification. The Contractor shall carry out, as a minimum, the following tests during the operation of the trial embankment:

### **a) Settlement measurement of layer.**

Settlement of layer shall be measured after compaction at a minimum of nine (9) points per each trial in each site using a taut line horizontally strung between the batter boards at both ends of embankment.

- b) Measurement of in-place density and moisture content in accordance with Sub-Section 104.3.12 of this Specification. Measurement shall be made at a minimum of nine (9) points per each trial in each site.

#### **4) Establishment of Criteria**

The Contractor shall investigate results of the trial embankment and shall submit to the Engineer for approval his proposed method and manner of embankment operation which shall include full height construction of embankment, spreading depth, number of passes, type of equipment, combination of equipment, construction of slope protection, and other information necessary for establishing the criteria of embankment operation.

If acceptable criteria are not established, the Contractor shall repeat the trial embankment to the satisfaction of the Engineer.

### **104.3.4 Embankment Operation**

#### **a) General**

This Sub-Section shall cover the manner of embankment construction, no separate payment shall be made for the requirements of this Sub-Section, and all the costs except surface preparation are deemed included in the payment specified in this work item.

Costs of the surface preparation stated in the succeeding paragraph are deemed included in the related items of payment such as clearing and grubbing.

#### **1) Operation of Borrow Pit**

Borrow pits shall be cleared and grubbed as directed by the Engineer to remove all unsuitable materials. The Contractor shall, at his own expense secure the necessary right-of-way and access thereto and shall bear all royalty fees imposed by the owner and municipalities where these borrow areas are situated. The Contractor shall construct and maintain the haul roads, together with the necessary right-of-way for such roads.

Borrow pits where practicable shall be excavated to drain it to the nearest natural outlet or to such outlet as directed by the Engineer. The surface of the borrow pits shall be left in a reasonably smooth and even condition and then stripped top soil, if any, shall be returned and spread to the satisfaction of the Engineer before abandoning such borrow pit areas. Planting trees and grass of the leveled area may also be required from the Contractor before abandoning the borrow pit as directed by the Engineer.

#### **2) Surface Preparation**

Ground surface to be covered with embankment materials shall be prepared as follows:

- a) Clearing and grubbing shall be executed in accordance with the requirements specified in Item 100 of these Specifications.
- b) Stump holes or other small excavations in the limits of embankment shall be filled with embankment materials and thoroughly tamped by approved methods before commencing any of the embankment operation.
- c) The embankment operation shall be performed always in the dry condition. Springs and seepage along the foundation, if any, shall be treated by the method approved by the Engineer.
- d) Prior to placing of any fill upon the area, all clearing and grubbing operations and stripping of top soil, where required, shall have been completed.
- e) Where shown on the Drawings or ordered by the Engineer, the surface of the existing ground shall be compacted to the depth of 150 mm and in accordance with the requirements of Sub-section 104.3.3.

### **3) Excavation, Transportation and Stockpile**

The Contractor shall excavate embankment materials at approved borrow pit, or at the stockpiles when the materials are stockpiled under the scope of the excavation works specified in Item 102, Excavation.

The material suitable for the embankment, which is, too wet for immediate compaction shall be placed temporarily to the stockyard and aerated until the moisture content is sufficiently reduced to permit them for the embankment operation.

### **4) Placing, Spreading and Compaction**

Placing spreading and compaction of embankment materials shall be executed in the manner of the approved criteria of embankment operation established through the trial embankment. Materials shall be placed and spread so that no single layer exceeds 200 mm in thickness after compaction. As far as practicable, the material shall be dried or wetted to have proper moisture content within the allowable range determined through the regular compaction test.

Equipment for placing, spreading and compaction shall be as specified in the approved criteria of embankment operation. No other equipment shall be used without the approval of the Engineer.

Degree of compaction shall be as specified in Sub-Section 104.3.3. When any layer fails to comply with the specified degree of compaction, the Contractor shall immediately re-compact, wet or dry, improve or replace the materials. All soft or yielding areas that may develop in the embankment shall be corrected by re-compaction, by removing the unsuitable materials and replacing them immediately upon order of the Engineer.

When the results of embankment monitoring show the possibility of slope or embankment failure, the Contractor shall take immediate action such as tentative removal of a part of embankment, tentative counterweight fill, or any other measures, which the Contractor deems necessary. The Contractor shall in this case, notify the Engineer of such possibility and the measures being promptly taken by the Contractor to the extent possible.

## 5) Tolerance

The completed embankment section shall have elevation and dimensions which fall within the following tolerances.

Elevation/Dimension	Tolerance (mm)
Crest Elevation of Embankment	$\pm 50$
Crest Width of Embankment	$\pm 100$
Length of Embankment Slope	$\pm 200$

### i. Quality Control of Embankment Operation

#### 1) General

Quality control of the embankment operation shall be carried out through the regular compaction test and the daily control test as specified hereinafter.

No separate payment shall be made for the requirements of this Sub-Section and all the costs thereof are deemed included in the payment specified in this work Item.

#### 2) Regular Compaction Test

The regular compaction test shall be carried out once every 20,000 m<sup>3</sup> of the materials before compaction in accordance with JIS-A-1210 and before a new source of material is placed in the works. Measurement of natural moisture content and specific gravity of soils and determination of the optimum moisture content and the maximum dry density shall be made and results shall be submitted to the Engineer for approval.

#### 3) Daily Quality Control Test

##### a) General

Daily quality control test shall be executed at embankment sites by use of the radioisotope type soil density and moisture gauge (RI gauge) which shall be procured by the Contractor.

The Contractor shall measure in-place dry density and in-place moisture content using the RI gauge on daily basis when the embankment operation is executed.

**b) Execution of Daily Quality Control Test**

Measurement of in-place dry density and in-place moisture content shall be made daily at the rate of one (1) point measurement per 500 square meter area of each layer of compacted fill.

All measurement data shall be recorded and filed with direct output from the RI gauge. Record format shall contain, but not limited to, the following items.

- Date and time of measurement
- Weather condition
- Rainfall
- Location of Embankment
- Location of Measurement
- Approximate work volume of embankment
- Type of embankment material.
- Moisture content at borrow pit or stockyard
- In-place moisture content at embankment site
- In-place density of embankment material
- Degree of compaction
- Presence of the Engineer

The Contractor shall plot the data in a form of daily control graph and shall monitor its daily change.

The Contractor shall submit all the test results of daily quality control test to the Engineer once every week for approval.

The Contractor, when requested by the Engineer, shall measure in-place density of the soils by the sand replacement method in a manner specified in JIS-A -1214 or ASTM equivalent.

**ii. Protection of Roadbed during Construction**

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

**iii. Protection of Structures**

If embankment can be deposited on one-side only of abutments, wing walls, piers or culvert headwalls, care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that it will cause overturning of, or excessive pressure against the structure. When noted on the Plans, the fill adjacent to the end bent of the bridge shall not be placed higher than the bottom of the

backfill of the bent until the superstructure is in place. When the embankment is to be placed on both sides of a concrete wall or box type structure, operations shall be so conducted that the embankment is always at approximately the same elevation on both sides of the structure.

**iv. Monitoring of Embankment**

The settlement and stability of the major embankment formation shall be periodically monitored by the Contractor in accordance.

**104.4 Method of Measurement**

Any material coming from roadway, structure, drainage or ditch excavations which are suitable for use but are replaced by the Contractor with borrow materials without prior approval by the Engineer, shall not be measured for payment.

Measurement of quantities for embankment to be paid for shall be the volume of embankment materials placed and compacted in place to the lines, grades, and dimensions shown on the drawings or as directed by the Engineer and shall be taken only in the presence of the Engineer. The Engineer shall be notified at least 24 hours before taking such measurement. The volume of embankment materials shall be computed by end area method and determined from the execution section of the embankment established on the original ground line after stripping. The original ground line shall be surveyed and reported to the Engineer for checking and approval prior the execution of the embankment operation.

The quantity of Embankment from Borrow shall be calculated as the balance between the total embankment volume (as shown on the drawings plus volume due to settlement) and the total volume of suitable material from roadway excavation, from excess structure, bridge, pipe culvert and drainage excavation and from excess dredging and realignment of river channel excavation, employing the compaction factor 0.95 for common soil.

Materials from excavation per Item 102 and materials coming from dredging operation and realignment of river channel and structure excavation that is used in embankment formation and accepted by the Engineer will be paid under Embankment. Moreover, such payment will be deemed to include the cost of excavating, hauling, blending, drying and wetting if necessary, placing, spreading and compaction, stockpiling and all other costs incidental to the work.

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

**104.5 Basis of Payment**

The accepted quantities, measured as prescribed in Section 104.4, shall be paid for at the Contract unit price for each of the Pay Items listed below that is included in the Bill of Quantities. The payment shall continue full compensation for the furnishing, placing and compacting all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

The unit price shall also include the costs for procurement and furnishing of required materials if not coming from approved excavation. No separate payment shall be made for the tentative removal of embankment, counterweight fill, placing and removal of surcharge and preload and secondary excavation and backfilling for structures to be constructed on the embankment, cost of which shall be deemed included in the unit price of the embankment.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
104 (1)a	Embankment (from Roadway Excavation)	Cubic Meter
104 (1)b	Embankment (from Borrow)	Cubic Meter

## ITEM 105 SUBGRADE PREPARATION

### 105.1 Description

This item shall consist of the preparation of the subgrade for the support of overlying structural layers. It shall extend to full width of the roadway. Unless authorized by the Engineer, subgrade preparation shall not be done unless the Contractor is able to start immediately the construction of the pavement structure.

### 105.2 Material Requirements

Unless otherwise stated in the Contract and except when the subgrade is in rock cut, all materials below subgrade level to a depth of 150mm or to such greater depth as may be specified shall meet the requirements of Section 104.2- Materials Requirement for Embankment

### 105.3 Construction Requirements

#### 105.3.1 Prior Works

Prior to commencing preparation of the subgrade, all culverts, cross drains, ducts and the like (including their fully compacted backfill), ditches, drains and drainage outlets shall be completed. Any work on the preparation of the subgrade shall not be started unless prior work herein described shall have been approved by the Engineer.

#### 105.3.2 Subgrade Level Tolerances

The finished compacted surface of the subgrade shall conform to the allowable tolerances as specified hereunder:

Permitted variation from	+ 20 mm
design LEVEL OF SURFACE	- 30 mm

Permitted SURFACE IRREGULARITY MEASURED BY 3-m STRAIGHT EDGE	30 mm
Permitted variation from design CROSSFALL OR CAMBER	$\pm$ 0.5 %



Permitted variation from  
design LONGITUDINAL GRADE  $\pm 0.1\%$   
over 25 m length

### 105.3.3 Subgrade in Common Excavation

Unless otherwise specified, all materials below subgrade level in earth cuts to a depth of 150 mm or other depth shown on the Plans or as directed by the Engineer shall be excavated. The material, if suitable, shall be set aside for future use or, if unsuitable, shall be disposed of in accordance with the requirements of Sub-sections 102.2.9.

Where material has been removed from below subgrade level, the resulting surface shall be compacted to a depth of 150 mm and in accordance with the requirements of Sub-Section 104.3.3.

All materials immediately below subgrade level in earth cuts to a depth of 150 mm, or to such greater depth as may be specified, shall be compacted in accordance with the requirements of Subsection 104.3.3.

The roadbed material in cuts shall be moistened or dried to uniform moisture content within + or - 2% of optimum moisture and shall be thoroughly compacted.

- 95% of the maximum density as determined by AASHTO T 180 in case the roadbed will constitute the subgrade of the new pavement.
- 100% of the maximum dry density as determined by AASHTO T 180, in case the roadbed will constitute the subbase of the new pavement

### 105.3.4 Subgrade in Rock Excavation

Surface irregularities under the subgrade level remaining after trimming of the rock excavation shall be leveled by placing specified material and compacted to the requirements of Subsection 104.3.3.

### 105.3.5 Subgrade on Embankment

After the embankment has been completed, the full width shall be conditioned by removing any soft or other unstable material that will not compacted properly. The resulting areas and all other low sections, holes or depressions shall be brought to grade with suitable material. The entire roadbed shall be shaped and compacted to the requirements of Subsection 104.3.3. Scarifying, blading, dragging, rolling or other method of work shall be performed or used as necessary to provide a thoroughly compacted roadbed shaped to the cross-sections shown on the Plans.

### 105.3.5 Subgrade on Existing Pavement

Where the new pavement is to be constructed immediately over an existing Portland Cement Pavement and if so specified in the Contract, the slab shall be broken into pieces with greatest dimension of not more than 500 mm and the existing pavement material compacted as specified in Subsection 104.3.3, as directed by the Engineer. The resulting subgrade level shall, as part of pavement construction be

shaped to conform to the allowable tolerances of Subsection 105.3.2 by placing and compacting where necessary a leveling course comprising the material of the pavement course to be placed immediately above.

Where the new pavement is to be constructed immediately over an existing Asphalt Concrete Pavement or gravel surface pavement and if so specified in the Contract, the pavement shall be scarified, thoroughly loosened, reshaped and recompactd in accordance with Subsection 104.3.3. The resulting subgrade level shall conform to the allowable tolerances if Subsection 105.3.2.

#### **105.3.6 Protection of Completed Work**

The Contractor shall be required to protect and maintain at his own expense the entire work within the limits of his Contract in good condition satisfactory to the Engineer from the time he first started work until all work shall have been completed. Maintenance shall include repairing and recompactd ruts, ridges, soft spots and deteriorated sections of the subgrade caused by the traffic of the Contractor's vehicle/equipment or that of the public.

#### **105.3.7 Templates and Straightedges**

The Contractor shall provide for use of the Engineer, approved templates and straightedges in sufficient number to check the accuracy of the work, as provided in this Specification.

### **105.4 Method of Measurement**

#### **105.4.1 Measurement of Items for payment shall be provided only for:**

1. The compaction of existing ground below subgrade level in cuts of common material as specified in Subsection 105.3.3.
2. The breaking up or scarifying, loosening, reshaping and recompactd of existing pavement as specified in Subsection 105.3.6. The quantity to be paid for shall be the area of the work specified to be carried out and accepted by the Engineer.
3. The preparation of the subgrade at locations where unsuitable materials have been excavated and disposed shall be measured in square meters, which shall be calculated based on surveys carried out defining the limits as directed by the Engineer.
4. Should a leveling course be necessary to correct the irregularities of the prepared subgrade or for non-compliance to the maximum allowable tolerances prescribed in Section 105.3.5 such course shall not be measured separately and shall be deemed to have been included in the pay item for embankment.

### **105.5 Basis of Payment**

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
105 (1)a	Subgrade Preparation (Common Material)	Square Meter

# **PART D**

## **Subbase and Base Course**

**PARTD SUBBASE AND BASE COURSE****ITEM 200 AGGREGATE SUBBASECOURSE****200.1 Description**

This item shall consist of furnishing, placing and compacting an aggregate subbase course on a prepared subgrade in accordance with this Specification and the lines, grades and cross-sections shown on the plans, or as directed by the Engineer.

**200.2 Material Requirements**

Aggregate for subbase shall consist of hard, durable particles or fragment crushed stone, crushed slag, or crushed or natural gravel and filler of natural or crushed sand or other finely divided mineral matter. The composite material shall be free from vegetable matter and lumps or balls of clay, and shall be of such nature that it can be compacted readily to form a firm, stable subbase.

The subbase material shall conform to Table 200.1, Grading Requirements

**Table 200.1 – Grading Requirements**

Sieve Designation		Mass Percent Passing
Standard, mm	Alternate US Standard	
50	2"	100
25	1"	55 – 85
9.5	3/8"	40 – 75
0.075	No. 200	0 – 12

The fraction passing the 0.075 mm (No.200) sieve shall not be greater than 0.66 (two thirds) of the fraction passing the 0.425 mm (No. 40) sieve.

The fraction passing the 0.425 mm (No. 40) sieve shall have a liquid limit not greater than 35 and plasticity index not greater than 12 as determined by AASHTO T89 and T 90, respectively.

The coarse portion, retained on a 2.00 mm (No. 10) sieve, shall have a mass percent of wear not exceeding 50 by the Los Angeles Abrasion Tests as determined by AASHTO T 96.

The material shall have a soaked CBR value of not less than 30% as determined by AASHTO T 193. The CBR value shall be obtained at the maximum dry density and determined by AASHTO T 180, Method D.

**200.3 Construction Requirements****200.3.1 Preparation of Existing Surface**

The existing surface shall be graded and finished as provided under Item 105, Subgrade Preparation, before placing the subbase material.

**200.3.2 Placing**

The aggregate subbase material shall be placed at a uniform mixture on a prepared subgrade in a quantity which will provide the required compacted thickness. When more than one layer is required, each layer shall be shaped and compacted before the succeeding layer is placed.

The placing of material shall begin at the point designated by the Engineer. Placing shall be from equipment especially equipped to distribute the material in a continuous uniform layer or window. The layer or window shall be of such size that when spread and compacted the finished layer be in reasonably close conformity to the nominal thickness shown on the plans.

When hauling is done over previously placed material, hauling equipment shall be dispersed uniformly over the entire surface of the previously constructed layer, to minimize rutting or uneven compaction.

### **200.3.3 Spreading and Compacting**

When uniformly mixed, the mixture shall be spread to the plan thickness, for compaction.

Where the required thickness is 150 mm or less, the material may be spread and compacted in one layer. Where the required thickness is more than 150 mm, the aggregate subbase shall be spread and compacted in two or more layers of approximately equal thickness, and the maximum compacted thickness of any layer shall not exceed 150 mm. All subsequent layers shall be spread and compacted in a similar manner.

The moisture content of subbase material shall, if necessary, be adjusted prior to compaction by watering with approved sprinklers mounted on trucks or by drying out, as required in order to attain the required compaction.

Immediately following final spreading and smoothing, each layer shall be compacted to the full width by means of approved compaction equipment. Rolling shall progress gradually from the sides to the center, parallel to the centerline of the road and shall continue until the whole surface has been rolled. Any irregularities or depressions that develop shall be corrected by loosening the material at these places and adding or removing material until surface is smooth and uniform. Along curbs, headers, and walls, and at all places not accessible to the roller, the subbase material shall be compacted thoroughly with approved tampers or compactors.

If the layer of subbase material, or part thereof, does not conform to the required finish, the Contractor shall at his own expense, make the necessary corrections.

Compaction of each layer shall continue until a field density of at least 100 percent of the maximum dry density determined in accordance with AASHTO T 180, method D has been achieved. In-place density determination shall be made in accordance with AASHTO T 191.

**200.3.4 Trial Sections**

Prior the subbase formation, the Contractor shall spread and compact trial sections as directed by the Engineer. The purpose of the trial sections is to check the suitability of the materials and the efficiency of the equipment and construction method, which is proposed to be used by the Contractor. Therefore, the Contractor must use the same material, equipment and procedures that he proposes to use for the main work. One trial section of about 500 m<sup>2</sup> shall be made for every type of material and/or construction equipment/procedure proposed for use.

After final compaction of each trial section, the Contractor shall carry out such field density tests and other tests required as directed by the Engineer.

If a trial section shows that the proposed materials, equipment or procedures in the Engineer's opinion are not suitable for subbase, the material shall be removed at the Contractor's expense, and a new trial section shall be constructed.

If the basic conditions regarding the type of material or procedure change during the execution of the work, new trial sections shall be constructed.

**200.3.5 Tolerances**

Aggregate subbase shall be spread with equipment that will provide a uniform layer which when compacted will conform to the designed level and transverse slope as shown on the plans. The allowable tolerances shall be as specified hereunder:

Permitted variation from design THICKNESS OF LAYER	± 20 mm
Permitted variation from design LEVEL OF SURFACE	+ 10 mm - 20 mm
Permitted SURFACE IRREGULARITY Measured by 3-m straight-edge	20 mm
Permitted variation from design CROSSFALL OR CAMBER	± 0.3%
Permitted variation from design LONGITUDINAL GRADE over 25 m in length	± 0.1%

**200.4 Method of Measurement**

Aggregate Subbase Course will be measured by the cubic meter (m<sup>3</sup>). The quantity to be paid for shall be the design volume compacted in-place as shown on the plans, and accepted in the completed course. No allowance will be given for materials placed outside the design limits shown on the cross-section. Trial

section shall not be measured separately but shall be included in the quantity of subbase herein measured.

### 200.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 200.4, shall be paid for at the contract unit price for Aggregate Subbase Course which price and payment shall be full compensation for furnishings and placing all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
200(1)	Aggregate Subbase Course	Cubic Meter

## ITEM 202 CRUSHED AGGREGATE BASE COURSE

### 202.1 Description

This item shall consist of furnishing, placing and compacting crushed gravel, crushed stone or crushed rock on a prepared subgrade/subbase in one or more layers in accordance with this Specification, and the lines, grades, thickness and typical cross – sections shown on the Plans or as established by the Engineer.

### 202.2 Material Requirements

#### 202.2.1 Crushed Aggregate

It shall consist of hard, durable particles or fragments of stone or gravel crushed to the size and of the quality requirements of this item.

It shall be clean and free from vegetable matters, lumps or balls of clay and other deleterious substances. The material shall be of such nature that it can be compacted readily to form a firm, stable base.

The base material shall conform to the grading requirements of Table 202.1, whichever is called for in the Bill of Quantities.

**Table 201.1 – Grading Requirements**

Sieve Designation		Mass percent Passing	
Standard, mm	Alternate US Standard	Grading A	Grading B
37.5	1-1/2"	100	
25	1"	-	100
19	3/4"	60 –85	-
12.5	1/2"	-	60 –90
4.75	No. 4	30 –55	30 –65
0.425	No. 40	5 –20	10 –30
0.075	No. 200	2 –14	5 –15



The portion of the material passing the 0.075 mm (No. 200) sieve shall not be greater than 0.66 (two thirds) of the fraction passing the 0.425 mm (No. 40)sieve.

The portion of the material passing the 0.425 mm (No. 40) sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 6 as determined by AASHTO T 89 and T 90, respectively.

The coarse aggregate retained on a 2.00 mm (No. 10) sieve shall have a mass percent of wear not exceeding 45 by the Los Angeles Abrasion Test as determined by AASHTO T 96, and not less than 50 mass percent shall have at least one (1) fracturedface.

The material passing the 19 mm sieve shall have a minimum soaked CBR value of 80% tested according to AASHTO T 193. The CBR value shall be obtained at the maximum dry density (MDD) as determined by AASHTO T 180, Method D.

If filler, in addition to that naturally present, is necessary for meeting the grading requirements or for satisfactory bonding, it shall be uniformly blended with the crushed base course material on the road or in a pug mill unless otherwise specified or approved. Filler shall be obtained from sources approved by the Engineer, free from hard lumps and shall not contain more than 15 percent of material retained on the 4.75 mm (No. 1) sieve.

## **202.3 Construction Requirements**

### **202.3.1 Preparation of ExistingSurface**

The existing surface shall be graded and finished as provided under Item 105- Subgrade Preparation and Item 200- Aggregate Subbase Course before placing the base material.

### **202.3.2 Placing**

The aggregate base course material shall be placed at a uniform mixture on a prepared subbase in a quantity, which will provide the required compacted thickness. When more than one layer is required, each layer shall be shape and compacted before the succeeding layer is placed.

The placing of material shall begin at the point designated by the Engineer. Placing shall be from vehicles especially equipped to distribute the material in a continuous uniform layer or windrow. The layer or windrow shall be of such size that when spread and compacted, the finished layer shall be in reasonably close conformity to the nominal thickness shown on the Plans.

When hauling is done over previously place material, hauling equipment shall be dispersed uniformly over the entire surface of the previously constructed layer, to minimize rutting or uneven compaction.

### **202.3.3 Spreading andCompacting**

When uniformly mixed, the mixture shall be spread to the plan thickness, for compaction.

Where the required thickness is 150 mm or less, the material may be spread and compacted in one layer. Where the required thickness is more than 150 mm, the aggregate base course shall be spread and compacted in two or more layers of approximately equal thickness, and the maximum compacted thickness of any layer shall not exceed 150 mm. All subsequent layers shall be spread and compacted in a similar manner.

Immediately following final spreading, each layer shall be compacted to the full width by means of approved compaction equipment. Rolling shall progress gradually from the side to the center, parallel to the centerline of the road and shall continue until the whole surface has been rolled. Any irregularities or depression that develop shall be corrected by loosening the material at these places and adding or removing material until surface is uniform.

If the layer of base course material, or part thereof, does not conform to the required finish, the Contractor shall, at his own expense, make the necessary corrections.

#### 202.4 Method of Measurement

Crushed Aggregate Base Course will be measured by the cubic meter (m<sup>3</sup>). The quantity to be paid for shall be the design volume compacted in-place as shown on the Plans, and accepted in the completed course. No allowance shall be given for materials placed outside the design limits shown on the cross-sections. Trial sections shall not be measured separately but shall be included in the quantity of crushed aggregate base course.

#### 202.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 202.4, shall be paid for at the contract unit price for Crushed 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
202 (1)	Crushed Aggregate Base Course	Cubic Meter

# **PART E**

## **Surface Courses**

**PARTE SURFACE COURSES****ITEM 311 PORTLAND CEMENT CONCRETE PAVEMENT****311.1 Description**

This Item shall consist of pavement of Portland Cement Concrete, with or without reinforcement, constructed on the prepared base in accordance with this Specification and in conformity with lines, grades, thickness and typical cross-section shown on the Plans.

**311.2 Material Requirements****311.2.1 Portland Cement**

It shall conform to the applicable requirements of Item 700, Hydraulic Cement. Only Type I Portland Cement shall be used unless otherwise provided for in the Special Provisions. Different brands or the same brands from different mills shall not be mixed nor be mixed nor shall they be used alternately unless the mix is approved by the Engineer. However, the use of Portland Pozzolan Cement Type IP meeting the requirements of AASHTO M 240/ASTM C 595, Specifications for Blended Hydraulic Cement shall be allowed, provided that trial mixes shall be done and that the mixes meet the concrete strength requirements, the AASHTO/ASTM provisions pertinent to the use of Portland Pozzolan Cement Type IP shall be adopted.

Cement which for any reason, has become partially set or which contains lumps of caked cement shall be rejected. Cement salvaged from discarded or used bags shall not be used.

Sample of Cement shall be obtained in accordance with AASHTO T 127.

**311.2.2 Fine Aggregate**

It shall consist of natural sand, stone screenings or other inert materials with similar characteristics, or combinations thereof, having hard, strong and durable particles. Fine aggregate from different sources of supply shall not be mixed or stored in the same pile nor used alternately in the same class of concrete without the approval of the Engineer.

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

If the fine aggregate is subjected to five (5) cycles of the sodium sulfate soundness test, the weighted loss shall not exceed 10 mass percent.

The fine aggregate shall be free from injurious amounts of organic impurities. If subjected to the colorimatic test for organic impurities and a color darker than the standard is produced, it shall be rejected. However, when tested for the effect of organic impurities on strength of mortar by AASHTO T 71, the fine aggregate may be used if the relative strength at 7 and 28 days is not less than 95 percent.

The fine aggregate shall be well-graded from coarse to fine and shall conform to Table 311.1

**Table 311.1 – Grading Requirement for Fine Aggregate**

Sieve Designation	Mass Percent Passing
9.5 mm (3/8 in)	100
4.75 mm (No. 4)	95 – 100
2.36 mm (No. 8)	-
1.18 mm (No. 16)	45 – 80
0.600 mm (No. 30)	-
0.300 mm (No. 50)	5 – 30
0.150 mm (No. 100)	0 – 10

### 311.2.3 Coarse Aggregate

It shall consist of crushed stone, gravel, blast furnace slag, or other approved inert materials (coralline or dolomites) of similar characteristics, or combinations thereof, having hard, strong, durable pieces and free from any adherent coatings.

It shall consist of crushed stone, gravel, blast furnace slag, or other approved inert materials of similar characteristics, or combinations thereof, having hard, strong, durable pieces and free from any adherent coatings.

It shall contain not more than one (1) mass percent of material passing the 0.075 mm (No. 200) sieve, not more than 0.25 mass percent of clay lumps, nor more than 3.5 mass percent of soft fragments.

If the coarse aggregate is subjected to five (5) cycles of the sodium sulfate soundness test, the weighted loss shall not exceed 12 mass percent.

It shall have a mass percent of wear not exceeding 40 when tested by AASHTO T 96.

If the slag is used, its density shall not be less than 1120 kg/m<sup>3</sup>. The gradation of the coarse aggregate shall conform to Table 311.2.

Only one grading specification shall be used from any one source.

**Table 311.2 – Grading Requirement for Coarse Aggregate**

Sieve Designation		Mass Percent Passing		
Standard mm	Alternate U.S. Standard	Grading A	Grading B	Grading C
75.00	3 in.	100	-	-
63.00	2-1/2 in.	90-100	100	100
50.00	2 in.	-	90-100	95-100
37.5	1-1/2 in.	25 - 60	35-70	-
25.0	1 in.	-	0-15	35-70
19.0	¾ in.	0-10	-	-
12.5	½ in.	0-5	0-5	10-30
4.75	No. 4	-	-	0- 5

#### 311.2.4 Water

Water used in mixing, curing or other designated application shall be reasonably clean and free of oil, salt, acid, alkali, grass or other substances injurious to the finished product. Water will be tested in accordance with and shall meet the requirements of Item 714, Water. Water which is drinkable may be used without test. Where the source of water is shallow, the intake shall be so enclosed as to exclude silt, mud, grass or other foreign materials.

#### 311.2.5 Reinforcing Steel

It shall conform to the requirements of Item 404 Reinforcing Steel. Dowels and tie bars shall conform to the requirements of AASHTO M 31 or M 42, except that rail steel shall not be used for tie bars that are to be bent and restrengthened during construction. Tie bars shall be deformed bars. Dowels shall be plain round bars. Before delivery to the site of work, one-half of the length of each dowel shall be painted with one coat of approval lead or tar paint.

The sleeves for dowel bars shall be metal of approved design to cover 50 mm, plus or minus 5 mm of the dowel, with a closed end, and with a suitable stop to hold the end of the sleeve at least 25 mm from the end of the dowel. Sleeves shall be of such design that they do not collapse during construction.

#### 311.2.6 Wire Mesh

The diameter of wire for lateral and longitudinal directions shall not be less than 6 mm in diameter. Tie wire shall be No. 16 gauged annealed wire.

##### 311.2.6.1 Fabrication of WireMesh

The spacing on the lateral direction is twice wider than that of the longitudinal direction. The weight of wire mesh shall not be less than 3 kg/m<sup>2</sup>. It shall be fabricated by welding or binding at each crossing point and shall meet the requirements of ASTM A185.

##### 311.2.6.2 Installation of WireMesh

After placement of slip bar placed at every 9.0 m maximum interval for weakened plane joint, wire mesh shall be placed at a depth of 5.0 cm to 7.5 cm below the surface of the slab or at 2/3 of thickness from the bottom of the pavement. It shall be supported by any approved support assemblies or spacers against displacement and shall be tied to it using tie wires. The sheets of the welded wire mesh shall be flat, and proper care shall be observed in handling and placing it to ensure its installation in the proper position.

Welded wire meshes that have become bent or kinked shall be rejected.

#### **311.2.7 Joint Fillers**

Poured joint fillers shall be mixed asphalt and mineral or rubber filler conforming to the applicable requirements of Item 705, Joint Materials. It shall also conform to the requirements of AASHTO M173.

##### **As per Item 705.1 Joint Fillers:**

Preformed fillers for joints shall conform to the requirements of AASHTOM 33 (ASTM D 994), AASHTO M 153, AASHTO M 213, AASHTO M 220, as specified, and shall be punched to admit the dowels where called for on the Plans. The filler for each joint shall be furnished in a single piece for the depth and width required for the joint unless otherwise authorized by the Engineer. When the use of more than one piece is authorized for a joint, the abutting ends shall be fastened securely and held accurately to shape, by stapling or other positive fastening satisfactory to the Engineer.

#### **311.2.8 Admixtures**

Air-entraining admixture shall conform to the requirements of AASHTO M 154.

Chemical admixtures, if specified or permitted, shall conform to the requirements of AASHTO M 194.

Fly Ash, if specified or permitted as a mineral admixture and not exceeding 20% partial replacement of Portland Cement in concrete mix shall conform to the requirements of ASTM C618.

Admixture/s maybe added to the concrete mix to produce some desired modifications to the properties of concrete if necessary, but

not as partial replacement of cement. If specified, monofilament polypropylene synthetic fibrin fibers, which are used as admixture to prevent the formation of temperature/shrinkage cracks and increase impact resistance of concrete slabs shall be applied in the dosage rate recommended by its manufacturer.

**311.2.9 Curing Materials**

Curing materials shall conform to the following requirements as specified;

- a) Burlapcloth - AASHTO M182
- b) Liquid membrane forming compounds - AASHTO M148
- c) Sheeting (film)Materials - AASHTO M 171

Cotton mats and water-proof paper can be used.

**311.2.10 Calcium Chloride/Calcium Nitrate**

It shall conform to AASHTO M 144, if specified or permitted by the Engineer, as accelerator.

**311.2.11 Storage of Cement and Aggregate**

All cement shall be stored, immediately upon delivery at the Site, in weatherproof building which will protect the cement from dampness. The floor shall be raised from the ground. The building shall be placed in locations approved by the Engineer. Provisions for storage shall be ample, and the shipments of cement as received shall be separately stored in such a manner as to allow the earliest deliveries to be used first and to provide easy access for identification and inspection of each shipment. Storage buildings shall have capacity for storage of a sufficient quantity of cement to allow sampling at least twelve (12) days before the cement is to be used. Bulk cement, if used, shall be transferred to elevated air tight and weatherproof bins. Stored cement shall meet the test requirements at any time after storage when retest is ordered by the Engineer. At the time of use, all cement shall be free-flowing and free of lumps.

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

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

**311.2.12 Proportioning, Consistency and Strength of Concrete**

The Contractor shall prepare the design mix based on the absolute volume method as outlined in the American Concrete Institute (ACI) Standard 211.1, "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete".

It is the intent of this Specification to require at least 364 kg of cement per cubic meter of concrete to meet the minimum strength requirements. The Engineer shall determine from laboratory tests of the material to be used, the cement content and the proportions of



aggregate and water that will produce workable concrete having a slump of between 40 and 75 mm (1-1/2 and 3 inches) if not vibrated or between 10 and 40 mm (1/2 and 1-1/2 inches) if vibrated, and a flexural strength of not less than 3.8 MPa (550 psi) when tested by the third-point method or 4.5 MPa (650 psi) when tested by the mid-point method at fourteen (14) days in accordance with AASHTO T97 and T177, respectively; or a compressive strength of 24.1 MPa (3500 psi) for cores taken at fourteen (14) days and tested in accordance with AASHTOT24.

Slump shall be determined using AASHTO T 119.

The designer shall consider the use of lean concrete (econocrete) mixtures using local materials or specifically modified conventional concrete mixes in base course and in the lower course composite, monolithic concrete pavements using a minimum of 75 mm (3 inches) of conventional concrete as the surface course.

The mix design shall be submitted to the Engineer for approval and shall be accompanied with certified test data from an approved laboratory demonstrating the adequacy of the mix design. A change in the source of materials during the progress of work may necessitate a new designmix.

Job mix adjustment of water content shall be allowed only on permission of the Engineer, provided that cement is also added to keep the original water-cement ratio of the designmix.

### **311.3 Construction Requirements**

#### **311.3.1 Quality Control of Concrete**

The Contractor shall be responsible for the quality control of all materials during the handling, blending, and mixing and placement operations.

The Contractor shall furnish the Engineer a Quality Control Plan detailing his production control procedures and the type and frequency of sampling and testing to insure that the concrete produces complies with the Specifications. The Engineer shall be provided free access to recent plant production records, and if requested, informational copies of mix design, materials certifications and sampling and testing reports. Experienced and qualified personnel shall perform all batching or mixing operation for the concrete mix, and shall be present at the plant and job site to control the concrete productions whenever the plant is in operation.

#### **311.3.2 Equipment**

Equipment and tools necessary for handling materials and performing all parts of the works shall be approved by the Engineer as to design, capacity and mechanical condition. The equipment shall be at the jobsite sufficiently ahead of the start of construction operations to be examined thoroughly and approved. In case of breakdown of such equipment in the process of paving activity, a standby substitute of the

same or equivalent must be available on site as not to hinder the progress of the work and to minimize waste of concrete batches.

The following equipment must be at the jobsite;

1.) Batching Plant and Equipment

- a) The batching shall include bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. If cement is used in bulk, a bin, hopper and separate scale for cement shall be included. The weighing hopper shall be properly sealed and vented to preclude dusting operation. The batch plant shall be equipped with a suitable non-resettable batch counter which will correctly indicate the number of batches proportioned.
- b) Bins and Hoppers. Bins with adequate separate compartments for fine aggregate and for each size of coarse aggregate shall be provided in the batching plant.
- c) Scales. Scales for weighing aggregates and cement shall be either the beam type or the springless-dial type. They shall be accurate within one-half percent (0.5%) throughout the range of use. Poises shall be designed to be locked in any position and to prevent unauthorized change. These scales shall be inspected and sealed as often as the Engineer may deem necessary to assure their continued accuracy.
- d) Automatic Weighing Devices. Unless otherwise allowed on the Contract, batching plants shall be equipped with automatic weighing devices of an approved type to proportion aggregates and bulk cement.

2.) Mixers

- a) General. Concrete may be mixed at the site of construction or at the central plant, or wholly or in part in truck mixers. Each mixers shall have a manufacturer's plate attached in a prominent place showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.
- b) Mixers at Site of Construction. Mixing shall be done in an approved mixer capable of combining the aggregates, cement and water into thoroughly mixed and uniform masses within the specified mixing period and discharging and distributing the mixture without segregation on the prepared grade. The mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum

has been charged and released it at the end of the mixing period. In case of failure of timing device, the mixer may be used for the balance of the day while it is being repaired, provided that each batch is mixed 90 seconds. The mixer shall be equipped with a suitable non-resettable batch counter which shall correctly indicate the number of the batches mixed.

- c) Truck Mixers and Truck Agitators. Truck mixers used for mixing and hauling concrete, and truck agitators used for hauling central-mixed concrete, shall conform to the requirements of AASHTOM157.
- d) Non-Agitator Truck. Bodies of non-agitating hauling equipment for concrete shall be smooth, mortar-tight metal containers and shall be capable of discharging the concrete at a satisfactory controlled rate without segregation.

### 3.) Paving and Finishing Equipment

The concrete shall be placed with an approved paver designed to spread, consolidate, screed and float finish the freshly placed concrete in one complete pass of the machine in such a manner that the minimum of hand finishing will be necessary to provide a dense and homogenous pavement in conformance with the Plans and Specifications.

The finishing machine shall be equipped with at least two (2) oscillating type transverse screed. Vibrators shall operate at a frequency of 8,300 to 9,000 impulses per minute under load at maximum spacing of 60 cm.

### 4.) Concrete Saw

The Contractor shall provide sawing equipment in adequate number of units and power to complete the sawing with a water-cooled diamond edge saw blade or an abrasive wheel to the required dimensions and at the required rate. The Contractor shall provide at least one (1) standby saw in good working condition and with an ample supply of saw blades.

### 5.) Forms

Forms shall be steel, of an approved section, and of depth equal to the thickness of the pavement at the edge. The base of the forms shall be of sufficient width to provide necessary stability in all directions. The flange braces must extend outward on the base to not less than 2/3 the height of the form.

All forms shall be rigidly supported on the bed of thoroughly compacted material during the entire operation

of placing and finishing the concrete. Forms shall be provided with adequate devices for secure setting so that when in place, they will withstand, without visible spring or settlement, the impact and vibration of the consolidation and finishing or paving equipment.

### **311.3.3 Preparation of Grade**

After the subgrade or base has been placed and compacted to the required density, the areas which will support the paving machine and the grade on which the pavement is to be constructed shall be trimmed to the proper elevation by means of a properly designed machine extending the prepared work areas compacted at least 60 cm beyond each edge of the proposed concrete pavement. If loss of density results from the trimming operations, it shall be restored by additional compaction before concrete is placed. If any traffic is allowed to use the prepared subgrade or base, the surface shall be checked and corrected immediately ahead of the placing of concrete.

The subgrade or base shall be uniformly moist when the concrete is placed.

### **311.3.4 Setting Forms**

The foundation under the forms shall be hard and true to grade so that the form when set will be firmly in contact for its whole length and at the specified grade. Any roadbed, which at the form line is found below established grade, shall be filled with approved granular materials to grade in lifts of three (3) cm. Variations above grade shall be corrected by tamping or by cutting as necessary.

Forms shall be set sufficiently in advance of the point where concrete is being placed. After the forms have been set to correct grade, the grade shall be thoroughly tamped, mechanically or by hand, at both the inside and outside edges of the base of the forms. The forms shall not deviate from true line by more than one (1) cm at any point.

The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete. Testing as to crown and elevation, prior to placing of concrete can be made by means of holding an approved template in a vertical position and moved backward and forward on the forms.

When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

### **311.3.5 Conditioning of Subgrade or Base Course**

When side forms have been securely set to grade, the subgrade or base course shall be brought to proper cross-section. High areas shall be trimmed to proper elevation. Low areas shall be filled and compacted to a condition similar to that of surrounding grade. The finished grade shall be maintained in a smooth and compacted condition until the pavement is placed.

Unless waterproof subgrade or base course cover material is specified, the subgrade or base course shall be uniformly moist when the concrete is placed. If it subsequently becomes too dry, the subgrade or base course shall be sprinkled, but the method of sprinkling shall not be such as to form mud or pools of water.

### **311.3.6 Handling, Measuring and Batching Materials**

The batch plant site, layout, equipment and provisions for transporting material shall be such as to assure a continuous supply of material to the work.

Stockpiles shall be built up in layers of not more than one (1) meter in thickness. Each layer shall be completely in place before beginning the next which shall not be allowed to "cone" down over the next lower layer. Aggregates from different sources and of different grading shall not be stockpiled together.

All washed aggregates and aggregates produced or handled by hydraulic methods, shall be stockpiled or binned for draining at least twelve (12) hours before being batched.

When mixing is done at the side of the work, aggregates shall be transported from the batching plant to the mixer in batch boxes, vehicle bodies, or other containers of adequate capacity and construction to properly carry the volume required. Partitions separating batches shall be adequate and effective to prevent spilling from one compartment to another while in transit or being dumped. When bulk cement is used, the Contractor shall use a suitable method of handling the cement from weighing hopper to transporting container or into the batch itself for transportation to the mixer, with chute, boot or other approved device, to prevent loss of cement, and to provide positive assurance of the actual presence in each batch of the entire cement contents specified.

Bulk cement shall be transported to the mixer in tight compartments carrying the full amount of cement required for the batch. However, if allowed in the Special Provisions, it may be transported between the fine and coarse aggregate. When cement is placed in contact with the aggregates, batches may be rejected unless mixed within 1-1/2 hours of such contact. Cement in original shipping packages may be transported on top of the aggregates, each batch containing the number of sacks required by the job mix.

The mixer shall be charged without loss of cement. Batching shall be so conducted as to result in the weight to each material required within a tolerance of one (1) percent for the cement and two (2) percent for aggregates.

Water may be measured either by volume or by weight. The accuracy of measuring the water shall be within a range of error of not over than one (1) percent. Unless the water is to be weighed, the water-measuring equipment shall include an auxiliary tank from which the measuring tank shall be equipped with an outside tap and valve to provide checking the setting, unless other means are provided for readily and accurately determining the amount of water in the tank. The volume of the auxiliary tank shall be at least equal to that of the measuring tank.

**311.3.7 Mixing Concrete**

The concrete may be mixed at the site of the work in a central-mix plant, or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time will be measured from the time all materials, except water, are in the drum. Ready-mixed concrete shall be mixed and delivered in accordance with requirements of AASHTO M 157, except that the minimum required revolutions at the mixing speed for transit-mixed concrete may be reduced to not less than that recommended by the mixer manufacturer. The number of revolutions recommended by the mixer manufacturer shall be indicated on the manufacturer's serial plate attached to the mixer.

The Contractor shall furnish test data acceptable to the Engineer verifying that the make and model of the mixer will produce uniform concrete conforming to the provision of AASHTO M 157 at the reduced number of revolutions shown on the serial plate.

When mixed at the site or in a central mixing plant, the mixing time shall not be less than fifty (50) seconds nor more than ninety (90) seconds, unless mixer performance tests prove adequate mixing of the concrete in a shorter time period.

Four (4) seconds shall be added to the specified mixing time if timing starts at the instant the skip reaches its maximum raised position. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

The mixer shall be operated at the drum speed as shown on the manufacturer's name plate attached on the mixer. Any concrete mixed less than the specified time shall be discarded and disposed of by the Contractor at his expense. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic meter, as shown on the manufacturer's standard rating plate on the mixer, except that an overload up to ten (10) percent above the mixer's nominal capacity may be permitted provided concrete test data for strength, segregation, and uniform consistency are satisfactory, and provided no spillage of concrete takes place.

The batches shall be so charged into the drum that a portion of the mixing water shall be entered in advance of the cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first fifteen (15) seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators or non-agitating truck specified in Subsection 311.3.2, Equipment. The time elapsed from the time water is added to the mix until the concrete is deposited in place at the Site shall not

exceed forty five (45) minutes when the concrete is hauled in non-agitating trucks, nor ninety (90) minutes when hauled in truck mixers or truck agitators, except that in hot weather or under other conditions contributing to quick hardening of the concrete, the maximum allowable time may be reduced by the Engineer.

Re-tempering concrete by adding water or by other means shall not be permitted, except that when concrete is delivered in truck mixers, additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements, if permitted by the Engineer, provided all these operations are performed within forty-five (45) minutes after the initial mixing operation and the water-cement ratio is not exceeded. Concrete that is not within the specified slump limits at the time of placement shall not be used.

Admixtures for increasing the workability or for accelerating the setting of the concrete will be permitted only when specifically approved by the Engineer.

#### **311.3.8 Limitation of Mixing**

No concrete shall be mixed, placed or finished when natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

During hot weather, the Engineer shall require that steps be taken to prevent the temperature of mixed concrete from exceeding a maximum temperature of 90°F ( 32°C)

Concrete not in place within ninety (90) minutes from the time the ingredients were charged into the mixing drum or that has developed initial set shall not be used. Re-tempering of concrete or mortar which has partially hardened, that is remixing with or without additional cement, aggregate, or water, shall not be permitted.

In order that the concrete may be properly protected against the effects of rain before the concrete is sufficiently hardened, the Contractor will be required to have available at all times materials for the protection of the edges and surface of the unhardened concrete.

#### **311.3.9 Placing Concrete**

Concrete shall be deposited in such a manner to require minimal rehandling. Unless truck mixers or non-agitating hauling equipment are equipped with means to discharge concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade in such a manner as to prevent segregation. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances.

When concrete is to be placed adjoining a previously constructed lane and mechanical equipment will be operated upon the existing lane, that

previously constructed lane shall have attained the strength for fourteen (14) day concrete. If only finishing equipment is carried on the existing lane, paving in adjoining lanes may be permitted after three (3) days.

Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies, by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than fifteen (15) seconds in any one location.

Concrete shall be deposited as near as possible to the expansion and contraction joints without disturbing them, but shall not be dumped from the discharge bucket or hopper into a joint assembly unless the hopper is well centered on the joint assembly. Should any concrete material fall on or be worked into the surface of a complete slab, it shall be removed immediately.

#### **311.3.10 Test Specimens**

As the work progresses, at least one (1) set consisting of three (3) concrete beam test specimens, 150 mm x 150 mm x 525 mm or 900 mm shall be taken from each 330 m<sup>2</sup> of pavement, 230 mm depth, or fraction thereof placed each day.

Test specimens shall be made under the supervision of the Engineer, and the Contractor shall provide all concrete and other facilities necessary in making the test specimens and shall protect them from damage by construction operations. Cylinder samples shall not be used as substitute for determining the adequacy of the strength of concrete.

The beams shall be made, cured, and tested in accordance with AASHTO T 23 and T 97.

#### **311.3.11 Strike-off of Concrete and Placement of Reinforcement**

Following the placing of the concrete, it shall be struck off to conform to the cross-section shown on the Plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement will be at the elevation shown on the Plans. When reinforced concrete pavement is placed in two (2) layers, the bottom layer shall be struck off and consolidated to such length and depth that the sheet of fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off and screeded. Any portion of the bottom layer of concrete which has been placed more than 30 minutes without being covered with the top layer shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be firmly positioned in advance of concrete placement or it may be placed at the depth shown on the Plans in plastic concrete, after spreading by mechanical or vibratory means.

Reinforcing steel shall be free from dirt, oil, paint, grease, mill scale and loose or thick rust which could impair bond of



**311.3.12 Joints**

Joints shall be constructed of the type and dimensions, and at the locations required by the Plans or Special Provisions. All joints shall be protected from the intrusion of injurious foreign material until sealed.

**1. Longitudinal Joint**

Deformed steel tie bars of specified length, size, spacing and materials shall be placed perpendicular to the longitudinal joints, they shall be placed by approved mechanical equipment or rigidly secured by chair or other approved supports to prevent displacement. Tie bars shall not be painted or coated with asphalt or other materials or enclosed in tubes or sleeves. When shown on the Plans and when adjacent lanes of pavement are constructed separately, steel side forms shall be used which will form a keyway along the construction joint. Tie bars, except those made of rail steel, may be bent at right angles against the form of the first lane constructed and straightened into final position before the concrete of the adjacent lane is placed, or in lieu of bent tie bars, approved two-piece connectors may be used.

Longitudinal formed joints shall consist of a groove or cleft, extending downward from and normal to, the surface of the pavement. These joints shall be effected or formed by an approved mechanically or manually operated device to the dimensions and line indicated on the Plans and while the concrete is in a plastic state. The groove or cleft shall be filled with either a premolded strip or poured material as required.

The longitudinal joints shall be continuous, there shall be no gaps in either transverse or longitudinal joints at the intersection of the joints.

Longitudinal sawed joints shall be cut by means of approved concrete saws to the depth, width and line shown on the Plans. Suitable guide lines or devices shall be used to assure cutting the longitudinal joint on the true line. The longitudinal joint shall be sawed before the end of the curing period or shortly thereafter and before any equipment or vehicles are allowed on the pavement. The sawed area shall be thoroughly cleaned and, if required, the joint shall immediately be filled with sealer.

Longitudinal pavement insert type joints shall be formed by placing a continuous strip of plastic materials which will not react adversely with the chemical constituent of the concrete.

**2. Transverse Expansion Joint**

The expansion joint filler shall be continuous from form to form, shaped to subgrade and to the keyway along the form. Preformed joint filler shall be furnished in lengths equal to the pavement width or equal to the width of one lane. Damaged or repaired joint filler shall not be used.

The expansion joint filler shall be held in a vertical position. An approved installing bar, or other device, shall be used if required to secure preformed expansion joint filler at the proper grade and alignment during placing and finishing of the concrete. Finished joint shall not deviate more than 6 mm from a straight line. If joint fillers are assembled in sections, there shall be no offsets between adjacent units. No plugs of concrete shall be permitted anywhere within the expansion space.

### 3. Transverse Contraction Joint/Weakened Joint

When shown on the Plans, it shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement and shall include load transfer assemblies. The depth of the weakened plane joint should at all times not be less than 50 mm, while the width should not be more than 6 mm.

- a. Transverse Strip Contraction Joint. It shall be formed by installing a parting strip to be left in place as shown on the Plans.
- b. Formed Groove. It shall be made by depressing an approved tool or device into the plastic concrete. The tool or device shall remain in place at least until the concrete has attained its initial set and shall then be removed without disturbing the adjacent concrete, unless the device is designed to remain in the joint.
- c. Sawed Contraction Joint. It shall be created by sawing grooves in the surface of the pavement of the width not more than 6 mm, depth should at all times not be less than 50 mm, and at the spacing and lines shown on the Plans, with an approved concrete saw. After each joint is sawed, it shall be thoroughly cleaned including the adjacent concrete surface.

Sawing of the joint shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually 4 to 24 hours. All joints shall be sawed before uncontrolled shrinkage cracking takes place. If necessary, the sawing operations shall be carried on during the day or night, regardless of weather conditions.

The sawing of any joint shall be omitted if crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discounted when a crack develops ahead of the saw. In general, all joints should be sawed in sequence. If extreme condition exist which make it impractical to prevent erratic cracking by early sawing, the contraction joint groove shall be formed prior to initial set of concrete as provided above.

### 4. Transverse Construction Joint

It shall be constructed when there is an interruption of more than 30 minutes in the concreting operations. No transverse joint shall be constructed within 1.50 m of an expansion joint, contraction joint, or

plane of weakness. If sufficient concrete has been mixed at the time of interruption to form a slab of at least 1.5 m long, the excess concrete from the last preceding joint shall be removed and disposed off as directed.

5. Load Transfer Device

Dowel, when used, shall be held in position parallel to the surface and center line of the slab by a metal device that is left in the pavement.

The portion of each dowel painted with one coat of lead or tar, in conformance with the requirements of Item 404, Reinforcing Steel, shall be thoroughly coated with approved bituminous materials, e.g., MC-70, or an approved lubricant, to prevent the concrete from binding to that portion of the dowel. The sleeves for dowels shall be metal designed to cover 50 mm plus or minus 5 mm (1/4 inch), of the dowel, with a watertight closed end and with a suitable stop to hold the end of the sleeves at least 25 mm (1 inch) from the end of the dowel.

In lieu of using dowel assemblies at contraction joints, dowel may be placed in the full thickness of pavement by a mechanical device approved by the Engineer.

**311.3.13 Final Strike-off (Consolidation and Finishing)**

1. Sequence

The sequence of operations shall be the strike-off and consolidation, floating and removal of laitance, straight-edging and final surface finish. Work bridges or other devices necessary to provide access to the pavement surface for the purpose of finishing straight-edging, and make corrections as hereinafter specified, shall be provided by the Contractor.

In general, the addition of water to the surface of the concrete to assist in finishing operations will not be permitted. If the application of water to the surface is permitted, it shall be applied as fog spray by means of an approved spray equipment.

2. Finishing Joints

The concrete adjacent to joints shall be compacted or firmly placed without voids or segregation against the joint material assembly, also under and around all load transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated as required in Subsection 311.3.9, Placing Concrete.

After the concrete has been placed and vibrated adjacent to the joints as required in Subsection 311.3.9, the finishing machine shall be brought forward, operating in a manner to avoid damage or misalignment of joints. If uninterrupted operation of the finishing machine, too over and beyond the joints causes segregation of

concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the front screed is approximately 20 cm (8 inches) from the joint. Segregated concrete shall be removed from in front of and off the joint. The front screed shall be lifted and set directly on top of the joint and the forward motion of the finishing machine resumed. When the second screed is close enough to permit the excess mortar in front of it to flow over the joint, it shall be lifted and carried over the joint. Thereafter, the finishing machine may be run over the joint without lifting the screeds, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

### 3. Machine Finishing

- a. Non-Vibratory Method. The concrete shall be distributed or spread as soon as placed. As soon as the concrete has been placed, it shall be struck off and screeded by an approved finishing machine. The machine shall go over each area of pavement as many times and at such intervals as necessary to give the proper compaction and leave a surface of uniform texture. Excessive operation over a given area shall be avoided. The tops of the forms shall be kept clean by an effective device attached to the machine and the travel of the machine on the forms shall be maintained true without wobbling or other variation tending to affect the precision finish.

During the first pass of the finishing machine, a uniform ridge of concrete shall be maintained ahead of the front screed in its entire length.

- b. Vibratory Method. When vibration is specified, vibrators for full width vibration of concrete paving slabs, shall meet the requirements in Subsection 311.3.2, Equipment. If uniform and satisfactory density of the concrete is not obtained by the vibratory method at joints, along forms, at structures, and throughout the pavement, the Contractor will be required to furnish equipment and method which will produce pavement conforming to the Specifications. All provisions in item (a) above not in conflict with the provisions for the vibratory method shall govern.

### 4. Hand Finishing

Hand finishing methods may only be used under the following conditions:

- a. In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade.
- b. In narrow widths or areas of irregular dimensions where operations of the mechanical equipment is impractical, hand methods may be used.

Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used. A second screed shall be provided for striking off the bottom layer of concrete if reinforcement is used.

The screed for the surface shall be at least 60 cm (2 feet) longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and constructed either of metal or other suitable material shod with metal.

Consolidation shall be attained by the use of suitable vibrator or other approved equipment.

In operation, the screed shall be moved forward on the forms with a combined longitudinal and transverse shearing motion, moving always in the direction in which the work is progressing and so manipulated that neither end is raised from the side forms during the striking off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross-section, and free from porous areas.

5. Floating

After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated by means of a longitudinal float, either by hand or mechanical method.

- a. Hand Method. The hand-operated longitudinal float shall be not less than 365 cm (12 feet) in length and 15 cm (6 inches) in width, properly stiffened to prevent flexibility and warping. The longitudinal float, operated from foot bridges resting on the side forms and spanning but not touching the concrete, shall be worked with a sawing motion while held in a floating position parallel to the road center line, and moving gradually from one side of the pavement to the other. Movement ahead along the center line of the pavement shall be in successive advances of not more than one-half the length of the float. Any excess water or soupy material shall be wasted over the side forms on each pass.
- b. Mechanical Method. The mechanical longitudinal float shall be of a design approved by the Engineer, and shall be in good working condition. The tracks from which the float operates shall be accurately adjusted to the required crown. The float shall be accurately adjusted and coordinated with the adjustment of the transverse finishing machine so that a small amount of mortar is carried ahead of the float at all times. The forward screed shall be adjusted so that the float will lap the distance specified by the Engineer on each transverse trip. The float shall pass over each area of pavement at least two times, but excessive operation over a given area will not be permitted. Any excess water or soupy material shall be wasted over the side forms on each pass.
- c. Alternative Mechanical Method. As an alternative, the Contractor may use a machine composed of a cutting and smoothing float or floats suspended from and guided by a rigid frame. The frame shall be carried by four or more visible wheels riding on, and constantly in contact with the side

forms. If necessary, following one of the preceding method of floating, long handled floats having blades not less than 150 cm (5 feet) in length and 15 cm (6 inches) in width may be used to smooth and fill in open-textured areas in the pavement. Long-handled floats shall not be used to float the entire surface of the pavement in lieu of, or supplementing, one of the preceding methods of floating. When strike off and consolidation are done by the hand method and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of the long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance shall be removed from the surface of the pavement by a 3-m straight- edge or more in length. Successive drags shall be lapped one-half the length of the blade.

6. Straight-edge Testing and Surface Correction

After the floating has been completed and the excess water removed, but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a 300 cm long straight-edge.

For this purpose, the Contractor shall furnish and use an accurate 300-cm straight-edge swung from handles 100 cm (3 feet) longer than one-half the width of the slab. The straight-edge shall be held in contact with the surface in successive positions parallel to the road center line and the whole area gone over from one side of the slab to the other as necessary. Advances along the road shall be in successive stages of not more than one-half the length of the straight-edge.

Any depressions found shall be immediately filled with freshly mixed concrete, struck off, consolidated and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straight-edge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straight-edge and the slab conforms to the required grade and cross-section.

7. Final Finish

If the surface texture is broom finished, it shall be applied when the water sheen has practically disappeared. The broom shall be drawn from the center to the edge of the pavement with adjacent strokes slightly overlapping. The brooming operation should be so executed that the corrugations produced in the surface shall be uniform in appearance and not more than 1.5 mm in depth.

Brooming shall be completed before the concrete is in such condition that the surface will be unduly roughened by the

operation. The surface thus finished shall be free from rough and porous areas, irregularities, and depressions resulting from improper handling of the broom. Brooms shall be of the quality size and construction and be operated so as to produce a surface finish meeting the approval of the Engineer. Subject to satisfactory results being obtained and approval of the Engineer, the Contractor will be permitted to substitute mechanical brooming in lieu of the manual brooming herein described.

If the surface texture is belt finished, when straight-edging is complete and water sheen has practically disappeared and just before the concrete becomes non-plastic, the surface shall be belted with 2-ply canvass belt not less than 20 cm wide and at least 100 cm longer than the pavement width. Hand belts shall have suitable handles to permit controlled, uniform manipulation. The belt shall be operated with short strokes transverse to the center line and with a rapid advances parallel to the center line.

If the surface texture is drag finished, a drag shall be used which consists of a seamless strip of damp burlap or cotton fabric, which shall produce a uniform of gritty texture after dragging it longitudinally along the full width of pavement. For pavement 5 m or more in width, the drag shall be mounted on a bridge which travels on the forms. The dimensions of the drag shall be such that a strip of burlap or fabric at least 100 cm wide is in contact with the full width of pavement surface while the drag is used. The drag shall consist of not less than 2 layers of burlap with the bottom layer approximately 15 cm wider than the layer. The drag shall be maintained in such condition that the resultant surface is of uniform appearance and reasonably free from grooves over 1.5 mm in depth. Drag shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags substituted.

Regardless of the method used for final finish, the hardened surface of pavement shall have a coefficient of friction of 0.25 or more. Completed pavement that is found to have a coefficient of friction less than 0.25 shall be ground or scored by the Contractor at his expense to provide the required coefficient of friction.

#### 8. Edging at Forms and Joints

After the final finish, but before the concrete has taken its initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, formed joints, transverse construction joints, and emergency construction joints, shall be worked with an approved tool and rounded to the radius required by the Plans. A well – defined and continuous radius shall be produced and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting the tool during the use.

At all joints, any tool marks appearing on the slab adjacent to the joints shall be eliminated by brooming the surface. In doing this, the rounding of the corner of the slab shall not be disturbed. All concrete on top of the joint filler shall be completely removed.

All joints shall be tested with a straight-edge before the concrete has set and correction made if one edge of the joint is higher than the other.

#### **311.3.14 Surface Test**

As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 3-m straight-edge or other specified device. Areas showing high spots of more than 3 mm but not exceeding 12 mm in 3 m shall be marked and immediately ground down with an approved grinding tool to an elevation where the area or spot will not show surface deviations in excess of 3 mm when tested with 3 m straight-edge. Where the departure from correct cross-section exceeds 12 mm, the pavement shall be removed and replaced by and at the expense of the Contractor.

Any area or section so removed shall be not less than 1.5 m in length and not less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 1.5 m in length, shall also be removed and replaced.

#### **311.3.15 Curing**

Immediately after the finishing operations have been completed and the concrete has sufficiently set, the entire surface of the newly placed concrete shall be cured in accordance with either one of the methods described herein. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or the lack of water to adequately take care of both curing and other requirements, shall be a cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than ½ hour between stages of curing or during the curing period.

#### **311.3.16 Removal of Forms**

Forms for concrete shall remain in place undisturbed for not less than twenty four (24) hours after concrete pouring. In the removal of forms, crowbars should be used in pulling out nails and pins. Care should be taken so as not to break the edges of the pavement. In case portions of the concrete are spalled, they shall be immediately repaired with fresh mortar mixed in the proportion of one part of Portland Cement and two parts fine aggregates. Major honeycomb areas will be considered as defective work, and shall be removed and replaced at the expense of the Contractor. Any area or section so removed shall not be less than the distance between weakened plane joint nor less than the full width of the lane involved.

#### **311.3.17 Sealing Joints**



Joint shall be sealed with asphalt sealant soon after completion of the curing period and before the pavement is opened to traffic, including the Contractor's equipment. Just prior to sealing, each joint shall be thoroughly cleaned of all foreign materials including membrane curing compound and the joint faces shall be clean and surface dry when the seal is applied.

The sealing material shall be applied to each joint opening to conform to the details shown on the plans or as directed by the Engineer. Material for seal applied hot shall be stirred during heating so that localized overheating does not occur. The pouring shall be done in such a manner that the material will not be spilled on the exposed surfaces of the concrete. The use of sand or similar material as a cover for the seal will not be permitted.

#### **311.3.18 Protection of Pavement**

The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by his own employees and agents. This shall include watchmen to direct traffic and the erection of and maintenance of warning signs, lights, pavement bridges or cross-overs, etc. The Plans or Special Provisions will indicate the location and type of device or facility required to protect the work and provide adequately for traffic.

All boreholes after thickness and/or strength determinations of newly constructed asphalt and concrete pavements shall be immediately filled/restored with the prescribed concrete/asphalt mix after completion of the drilling works.

Any damage to the pavement, occurring prior to final acceptance, shall be repaired or the pavement be replaced.

#### **311.3.19 Concrete Pavement – Slip Form Method**

If the Contract calls for the construction of pavement without the use of fixed forms, the following provisions shall apply:

##### **1. Grade**

After the grade or base has been placed and compacted to the required density, the areas which will support the paving machine shall be cut to the proper elevation by means of a properly designed machine. The grade on which the pavement is to be constructed shall then be brought to the proper profile by means of properly designed machine. If the density of the base is disturbed by the grading operation, it shall be corrected by additional compaction before concrete is placed. The grade should be constructed sufficiently in advance of the placing of the concrete. If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately before the placing of concrete.

##### **2. Placing Concrete**

The concrete shall be placed with an approved slip-form paver designed to spread, consolidate, screed and float-finish the freshly placed

concrete in one complete pass of the machine in such a manner that a minimum of hand finish will be necessary to provide a dense and homogenous pavement in conformance with the Plans and Specifications. The machine shall vibrate the concrete for the full width and depth of the strip of pavement being placed. Such vibration shall be accompanied with vibrating tubes or arms working in the concrete or with a vibrating screed or pan operating on the surface of the concrete. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The forms shall trail behind the paver for such a distance that no appreciable slumping of the concrete will occur, and that necessary final finishing can be accomplished while the concrete is still within the forms. Any edge slump of the pavement, exclusive of edge rounding, in excess of 6 mm shall be corrected before the concrete has hardened.

The concrete shall be held at a uniform consistency, having a slump of not more than 40 mm (1-12/ inches). The slip form paver shall be operated with as nearly as possible a continuous forward movement and that all operations of mixing, delivering and spreading concrete shall be coordinated so as to provide uniform progress with stopping and starting of the paver held to a minimum. If, for any reason, it is necessary to stop the forward movement of the paver the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

### 3. Finishing

The surface smoothness and texture shall meet the requirements of Subsections 311.3.13 and 311.3.14.

### 4. Curing

Unless otherwise specified, curing shall be done in accordance with one of the methods included in Subsection 311.3.15. The curing media shall be applied at the appropriate time and shall be applied uniformly and completely to all surfaces and edges of the pavement.

### 5. Joints

All joints shall be constructed in accordance with Subsection 311.3.12.

### 6. Protection Against Rain

In order that the concrete may be properly protected against rain before the concrete is sufficiently hardened, the Contractor will be required to have available at all times, materials for the protection of the edges and surface of the unhardened concrete.

Such protective materials shall consist of standard metal forms or wood planks having a nominal thickness of not less than 50 mm (2 inches) and a nominal width of not less than the thickness of the pavement at its edge for the protection of the pavement edges, and covering material such as burlap or cotton mats, curing paper or plastic sheeting materials for the protection of the surface of the pavement. When rain appears imminent, all paving operations shall stop and all available personnel

shall begin placing forms against the sides of the pavement and covering the surface of the unhardened concrete with the protective covering.

### 311.3.20 Acceptance of Concrete

The strength level of the concrete will be considered satisfactory if the averages of all sets of three (3) consecutive strength test results equal or exceed the specified strength,  $f_c'$  and no individual strength test result is deficient by more than 15% of the specified strength,  $f_c'$ . A set shall consist of a minimum of three (3) concrete beamspecimens.

Concrete deemed to be not acceptable using the above criteria may be rejected unless the Contractor can provide evidence, by means of core tests, that the quality of concrete represented by failed test results is acceptable in place. At least three (3) representative cores shall be taken from each member or area of concrete in place that is considered deficient. The location of cores shall be determined by the Engineer so that there will be at least impairment of strength of the structure. The obtaining and testing of drilled cores shall be in accordance with AASHTO T24.

Concrete in the area represented by the cores will be considered adequate if the average strength of the cores is equal to at least 85% of, and if no single core is less than 75% of, the specified strength,  $f_c'$ .

If the strength of control specimens does not meet the requirements of this Subsection, and it is not feasible or not advisable to obtain cores from the structure due to structural considerations, payment of the concrete will be made at an adjusted price due to strength deficiency of concrete specimens as specified hereunder:

Deficiency in Strength of Concrete Specimens, Percent (%)	Percent (%) of Contract Price Allowed
Less than 5	100
5 to less than 10	80
10 to less than 15	70
15 to less than 20	60
20 to less than 25	50
25 or more	0

### 1.3.21 Opening to Traffic

The Engineer will decide when the pavement may be opened to traffic. The road will not be opened to traffic until test specimens molded and cured in accordance with AASHTO T 23 have attained the minimum strength requirements in Subsection 311.2.12. If such tests are not conducted prior to the specified age the pavement shall not be operated to traffic until 14 days after the concrete was placed. Before opening to traffic, the pavement shall be cleaned and joint sealing completed.

**311.3.22 Tolerance and Pavement Thickness****1. General**

The thickness of the pavement will be determined by measurement of cores from the completed pavement in accordance with AASHTO T 148.

The completed pavement shall be accepted on a lot basis. A lot shall be considered as 1000 linear meters of pavement when a single traffic lane is poured or 500 linear meters when two lanes are poured concurrently. The last unit in each slab constitutes a lot in itself when its length is at least  $\frac{1}{2}$  of the normal lot length. If the length of the last unit is shorter than  $\frac{1}{2}$  of the normal lot length, it shall be included in the previous lot.

Other areas such as intersections, entrances, crossovers, ramp, etc., will be grouped together to form a lot. Small irregular areas may be included with other unit areas to form a lot. Each lot will be divided into five (5) equal segments and one core will be obtained from each segment in accordance with AASHTO T24.

**2. Pavement Thickness**

It is the intent of this Specification that the pavement has a uniform thickness as called for on the Plans for the average of each lot as defined. After the pavement has met all surface smoothness requirements, cores for thickness measurements will be taken.

In calculating the average thickness of the pavement, individual measurements which are in excess of the specified thickness by more than 5 mm will be considered as the specified thickness plus 5 mm and measurement which are less than the specified thickness by more than 25 mm shall not be included in the average. When the average thickness for the lot is deficient, the contract unit price will be adjusted for thickness in accordance with paragraph (3) below.

Individual areas within a segment found deficient in thickness by more than 25 mm shall be evaluated by the Engineer, and if in his judgment, the deficient areas warrant removal, they shall be removed and replaced by the Contractor with pavement of the specified thickness at his entire expense. However, if the evaluation of the Engineer is that the deficient area should not be removed and replaced, such area will not be paid.

When the measurement of any core is less than the specified thickness by more than 25 mm, the actual thickness of the pavement in this area will be determined by taking additional cores at no less than 5 m intervals parallel to the center line in each direction from the affected location until a core is found in each direction, which is not deficient in thickness by more than 25 mm. The area of slab for which no payment will be made shall be the product of the paving width multiplied by the distance along the center line of the road between transverse sections found not deficient in thickness by more than 25 mm. The thickness of the remainder of the segment to be used to get the average thickness of

each lot shall be determined by taking the average thickness of additional cores which are not deficient by more than 25mm.

### 3. Adjustment for Thickness

When the average thickness of the pavement per lot is deficient, payment for the lot shall be adjusted as follows:

Deficiency in the Average Thickness per lot (mm)	Percent (%) of Contract Price Per Lot
0 - 5	100 % payment
6 - 10	80 % payment
11 - 15	70 % payment
16 - 20	60 % payment
21 - 25	50 % payment
More than 25	Remove and replace/No payment

No acceptance and final payment shall be made on completed pavement unless core test for thickness determination is conducted, except for Barangay Roads where the implementing office is allowed to waive such test.

### 311.4 Method of Measurement

The area to be paid for under this Item shall be the number of square meters (m<sup>2</sup>) of concrete placed and accepted in the completed pavement with or without rebar or wire mesh reinforcement. The width for measurements will be the width from outside edge to outside edge of completed pavement as placed in accordance with the Plans or as otherwise required by the Engineer in writing. The length will be measured horizontally along the center line of each roadway or ramp. Any curb and gutter placed shall not be included in the area of concrete pavement measured.

### 311.5 Basis of Payment

The accepted quantity, measured as prescribed in Section 311.4, shall be paid for at the contract unit price for Portland Cement Concrete Pavement and Portland Cement Concrete Pavement (Reinforced with Wire Mesh) which price and payment shall be full compensation for preparation of roadbed and finishing of shoulders, unless otherwise provided by the Special Provisions, furnishing and placing all joint materials, for sawing weakened plane joints, for fitting the prefabricated center metal joint, for facilitating and controlling traffic, and for furnishing all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
311(1)f1	Portland Cement Concrete Pavement (PCCP Unreinforced) 0.30m thick	Square Meter
311(1)f2	Portland Cement Concrete Pavement (PCCP Unreinforced) 0.30m thick	Square Meter

# **PART F**

## **Bridge Construction**

**PART F BRIDGE CONSTRUCTION****ITEM 400 PILING****400.1 Description****400.1.1 Scope**

This Item shall consist of piling, furnished, driven or placed, cut and spliced in accordance with this Specification and in reasonably close conformity with the Plans. This also includes the construction of reinforced concrete piles, cast in bored holes and drilled with the use of special equipment. It shall include the excavation and drilling of holes, furnishing and placing of temporary steel casing and other incidentals necessary for the execution of the work. Pile construction shall be at locations, dimensions and lengths indicated in the Drawings.

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

**400.1.1.1 Working Drawings**

At least four (4) weeks prior to bored piling activities, the Contractor shall submit to the Engineer for approval a construction methodology for such construction of bored piles. The submittals shall include the following:

- a) List of proposed equipment to be used including cranes, drills, augers, bailing buckets, final cleaning equipment, desanding equipment, slurry pumps, sampling equipment, tremies or concrete pumps, casings, etc.
- b) Details of overall construction operation sequence of bored pile construction in bents or groups or singly.
- c) Details of pile excavation method.
- d) When slurry is required, details of the method, proposed mix, circulation and design of slurry.
- e) Details of methods to clean the pile excavation.
- f) Details of reinforcement placement including support and centralization methods.
- g) Details of concrete placement, curing and protection.
- h) Details of any required Load Tests (if called for in the Drawings) and;
- i) Other information shown on the Drawings or requested by the Engineer.

The Contractor shall not start construction of bored pile for which working drawings are required until the Engineer has approved such drawings.

obtained by use of these drawings or any of the other responsibilities under the Contract.

#### **400.1.2 TestPiles**

For his reference, the Contractor may drive the test piles at the location of the regular piles indicated on the Plans such test piles as he may consider necessary in addition to the test piles specified in the Contract and shall be considered as regular piles. When called for in the Bill of Quantities, a pile if required to be subjected to load test shall conform to the provision as provided in Subsection 400.1.3, LoadTests.

The Contractor shall furnish and drive the test piles of the dimensions and at the locations designated by the Engineer. They shall be of the material shown in the Bill of Quantities and shall be driven to refusal or to such tip elevation or approximate bearing value as the Engineer may request. Test Piles shall be driven with the same hammer that is used for driving foundationPiles.

#### **400.1.3 Load Tests**

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

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

##### **400.1.3.1 Static Testing**

Suitable approved apparatus for determining accurately the load on the 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 load static shall be applied by a hydraulic jack acting against suitable anchorage, transmitting the load directly to the pile, or other methods designated by the Plans or approved by the Engineer.

##### **400.1.3.2 Pile Testing**

Pile testing shall be done by Low-Strain Dynamic Method, High-Strain Dynamic Method or Cross-Hole Sonic Logging Method as required in



Dynamic Method or Cross-Hole Sonic Logging Method as required in the Plans or as directed by the Engineer.

#### 400.1.3.2.1 Low-Strain Dynamic Method

Pile integrity testing by Low-Strain Dynamic method shall conform to ASTM D-5882. It is a so-called Low Strain method, since it requires the impact of only a small hand-held hammer, and also referred to as a Non-Destructive Method.

#### 400.1.3.2.2 High-Strain Dynamic Method

Pile integrity testing by High-Strain Dynamic Method shall conform to ASTM D4945. 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 the sonic-type integrity testing of the cast-in-place piles. It is non-destructive relatively quick test and it is intended that the test shaft be left in a condition suitable for the use in production. The shaft used for the test will be instrumented and tested by the testing specialist, as approved by the Engineer, meeting requirements in accordance to ASTM D4945.

#### 400.1.3.2.3 Cross-Hole Logging of Bored Holes Method

This is done by sending ultrasonic pulses through the concrete from one probe to another (probes located in parallel tubes), the Cross-Hole Sonic Logging (CSL) procedure inspects the drilled shafts structural integrity, and extent and location of defects, if any. At the receiver probe, pulse arrival time and signal the concrete affects strength. 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.

### 400.1.4 Concrete and Steel Pile Bearing Values

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

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

$$R_u = \frac{2WH(W)}{(S+K)(W+W_p)}$$

$$R_a = \frac{R_u}{FS}$$

where:

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

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

$$R_u = \frac{efWH(W)}{S + 1/2(C_1 + C_2 + C_3)} \times \frac{(W + n^2W_p)}{(W + W_p)}$$

$$R_a = \frac{R_u}{FS}$$

where:

$R_u$	=	ultimate capacity of pile(KN)
$R_a$	=	capacity of pile(KN)
$ef$	=	efficiency of hammer (refer to table)
$W$	=	weight of ram(KN)
$W_p$	=	weight of pile(KN)
$H$	=	height of fall of ram(mm)
$S$	=	average penetration for last ten blows(mm)
$C_1$	=	temporary compression allowance for pile head and cap (refer to table)
$C_2$	=	$R_u L / A E_p$
$C_3$	=	range from 2.54mm to 5.08mm (0.1" to 0.2") for resilient soil to 0 for hard pan (rock, very dense sand and gravel)
$L$	=	length of pile
$A$	=	cross-sectional area of pile
$E_p$	=	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 six (6) meters. However, for exposed piles, the embedded length shall be equal or greater than the exposed length but not less than 6.0m.

Note: Formula for other pile hammers with suggested factor of safety should be as provided/recommended by their respective manufacturer. In all cases when the bearing power of concrete and steel piles is determined by formula, the piles shall be driven until the safe bearing power of each is computed to be not less than 27 tons..

#### 400.1.5 Safe Loads

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

**400.1.6 Jetted Piles**

The safe bearing power 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 testblows.

**400.2 Material Requirements**

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

**400.2.1 Concrete Piles**

Cast in place concrete materials for bored piles shall conform to the requirements of Item 405, Structural Concrete. Concrete shall be Class "AA1" with strength requirement of 28 Mpa (4,000psi), unless otherwise specified in the Plans.

Concrete shall be proportioned to achieved a range of 6" to 8" (150mm to 200mm) slump, self-compacting mix, or as directed by the Engineer.

The use of appropriate plasticizer/additives to assure mix fluidity and consistency shall be allowed and with the Engineer's approval. 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 404, Reinforcing Steel. Prestressing reinforcing steel shall be high-tensile steel wire conforming to AASHTO M 204 or other high-tensile metals conforming to AASHTO Standards.

Casings which are required to be incorporated as part of permanent work shall conform to AASHTO M183 (ASTM A-36) or JIS G3114 (SMA400W).

**400.2.2 Steel Shells****1. Shells Driven Without a Mandrel**

Unless otherwise called for on the Plans or Special Provisions, shells for cast-in-place concrete piles shall have a minimum 305mm diameter at cut off and a minimum 203mm diameter at tip: made from not less than 4.55mm in thickness plate stock conforming to AASHTO M 183. Shells may either be spirally welded or longitudinally welded and may 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 called for on the Plans or Special Provisions.

**400.2.3 Steel Pipes**

Filled Steel Pipes (filled with concrete) shall conform to the requirements of ASTM A 252, Grade 2, Welded and Seamless Pipe Piles. Closure

Plates for closed piles shall conform to the requirements of AASHTO M 183.

Unfilled Tubular Steel Piles shall conform to the requirements of ASTM A 252, Grade 2, with chemical requirements meeting ASTM Designation A 53, Grade B. The wall thickness shall not be less than 4.76 mm.

#### **400.2.4 Steel H-Piles**

Steel H-Piles shall be rolled steel sections of the weight and shape called for on the Plans. They shall be structural steel meeting the requirements of AASHTO M 183 provided that, where the Special Provisions called for copper-bearing structural steel, the steel shall not contain less than one-fifth percent nor more than zero point thirty five percent (0.35%) of copper, except that steel manufactured by the acid-Bessemer process shall not be used.

#### **400.2.5 Sheet Piles**

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

#### **400.2.6 Pile Shoes**

Pile shoes shall be as called for on the Plans.

#### **400.2.7 Splices**

Material for pile splices, when splicing is allowed, shall be of the same quality as the material used for the pile itself and shall follow the requirements given on the Plans.

#### **400.2.8 Paint**

It shall conform to Item 411, Paint.

### **400.3 Construction Requirements**

#### **400.3.1 Location and Site Preparation**

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

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

#### **400.3.2 Determination of Pile Length**

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

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

1. Piles in sand and gravel shall be driven to a bearing power determined by the use of the pile driving formula or as decided by the Engineer.
2. Piles in clay shall be driven to the depth ordered by the Engineer. However, the bearing power shall be controlled by the pile driving formula if called for by the Engineer.
3. Piles shall be driven to refusal on rock or hard layer when so ordered by the Engineer.

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

#### 400.3.3 Pile Driving

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

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

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

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

Water jets shall be used only when permitted in writing by the Engineer. When water jets are used, the number of jets and the nozzle volume and pressure shall be sufficient to erode freely the material adjacent to the pile. The plant shall have sufficient capacity to deliver at all time a pressure equivalent to at least 690 KPa at two 19mm (3/4 inch) jet nozzles. The jets

shall be shut off before the required penetration is reached and the piles shall be driven solely by hammers to final penetration as required by the Engineer.

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

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

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

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

Piles shall not be driven within 7 m of concrete less than 7 days old.

#### **400.3.4 Precast Concrete Piles**

Precast concrete piles shall be of the design shown on the Plans. Prestressed concrete piles shall be prestressed as prescribed in Item 406, Prestressed Concrete Structures.

The piles shall be cast 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 25mm chamfer strip shall be used in all corners. Form shall be watertight and shall not be removed until at least twenty-four (24) hours after the concrete is placed.

Piles shall be cured and finished in accordance with Items 405, Structural Concrete and 406, Prestressed Concrete Structures.

Cylinder specimens shall be made and tested in accordance with Item 405. Piles shall not be moved until the tests indicate that the concrete has attained a compressive strength of at least 80 percent (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 fourteen (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.

#### **400.3.5 Cast-in-place Concrete Piles**

##### **1. Drilled Holes**

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

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

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

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

Casing, if used in drilling operations, may be left in place or removed from the hole as concrete is placed. The bottom of the casing shall be maintained not more than 1.5m nor less than 0.3m 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 meters 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 5mm. 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 1.5m 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 6m thereof until at least 7 days have elapsed.

### 3. Drilled Shafts

Drilled shafts are 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 are 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 are enlarged (i.e., belled or under reamed) 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 should be considered and delineated, when necessary, the general method of construction to be followed to ensure the expected performance. 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 must be considered an inherent aspect of the design.

Drilled shafts are normally sized in 15.24 cm (6-inch diameter increments with a minimum diameter of 45.72 cm (18"). The diameter of a shaft socketed into rock should be a minimum of 15.24 cm (6") 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 (30").

Drilled shafts constructed in dry noncaving 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 shaft 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 should 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 should 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 caving 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) construction of the pile or shaft in a wet condition while the walls of the excavation are stabilized by hydrostatic pressure of water or mineral slurry until the concrete is placed by tremie methods for the full length of the pile.

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 caving of the hole.

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 will be required when specified. No excavated slurry pits will be allowed when slurry tanks are required on the project without written permission of the Engineer. Adequate desanding equipment will 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 the following table.

**Range of Values (At 20° or [68°F])**

Property (Units)	Time of Slurry Introduction	Time of Concreting (In Hole)	Test Method
Density (KN/m <sup>3</sup> ) (pcf)	10.10 to 10.86 64.3 to 69.1	10.10 to 11.79 64.3 to 75.0	Density Balance
Viscosity (sec. per quart)	28 to 45	28 to 45	Marsh Cone
pH	8 to 11	8 to 11	pH Paper or Meter

Note:

- 1) Increase density values by  $0.314 \text{ KN/m}^3$  (2 pcf) in saltwater.
- 2) If desanding is required; sand content shall not exceed 4 percent (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.

Prior to placing shaft concrete, slurry samples shall be taken from the bottom and at intervals not exceeding 3.05m (10 feet) 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 after final cleaning.

The base of the shaft excavation may be cleaned using a cleaning bucket followed by airlifting. 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 percent 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 AASHTO M 270 (ASTM A 709) 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 will 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.

### **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 and 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 non-corrosive spacing devices shall be used at sufficient intervals not exceeding 1.50 meters along the shaft to insure concentric location of the cage within the shaft excavation. When the size of the longitudinal reinforcing steel exceeds 25mm, such spacing shall not exceed 3.0 meters.

### **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 meters in diameter, the elapsed time from the beginning of concrete placement in the shaft to the completion of placement shall not exceed 2 hours. For piles 2.50 meters and greater in diameter, the concrete placing rate shall not be less than 9.0 meters 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 meters of concrete shall be vibrated or rodded to a depth of 1.5 meter 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 Sub-section 407.3.8 – Curing Concrete.

For at least 48 hours 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;

- a. 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.
- b. The vertical alignment of the shaft excavation shall not vary from the plan alignment by more than 20.83 mm/m (1/4 inch per foot) of depth.
- c. After 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 15.24 cm below plan position.
- d. 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 (24") or less, and not more than 2.54 cm (1 inch) less than the diameter shown on the plans for diameters greater than 60.96 cm (24").
- e. 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.
- f. The top elevation of the shaft shall be within 2.54 cm (1 inch) of the plan top of shaft elevation.
- g. The bottom of the shaft excavation shall be normal to the axis of the shaft within 62.5 mm/m (3/4 inch per foot) of shaft diameter.

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

**400.3.6 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 will 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.

**400.3.7 Unfilled Tubular Steel Piles**

The tubular steel piles should be or as specified by the Engineer.

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

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

**6.5.1 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 pile 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.
- b. By cutting away the concrete at the end of the pile, leaving the reinforcing steel exposed for a length of 40 bar diameters for corrugated or deformed bars and 60 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 404, Reinforcing Steel, and the necessary formwork shall be placed, care being taken to prevent leakage along the pile. The concrete shall be of the same quality as that used in the pile. Just prior to placing concrete, the top of the pile shall be wetted thoroughly and covered with a thin coating of neat cement, retempered mortar, or other suitable bonding material to the satisfaction of the Engineer. The forms shall remain in place not less than seven (7) days. The pile shall not be driven until the safe design has been reached.
- c. 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. Pre-stressed Piles**

Splicing of pre-stressed 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 will 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 power, 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.

#### **400.3.9 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 300mm of undamaged pile can be embedded in the structure above. If a pile is damaged below this level, the Contractor shall repair the pile to the satisfaction of the Engineer. The longitudinal reinforcement of the piles shall be embedded in the structure above to a length equal to at least 40 times the diameter of the main reinforcing corrugated bars (60 diameters for plain bars). The distance from the side of any pile to the nearest edge of the cap shall not be less than 200mm.

When the cut off elevation for a precast pile or for the steel shell or pile for a cast in place concrete pile is below the elevation of the bottom of the pile cap, the pile may be built-up from the butt of the pile to the elevation of the bottom of the cap by means of reinforced concrete extension constructed in accordance with Subsection 400.3.8 or as approved by the Engineer.

Cut-offs of structural steel piles shall be made at right angles to the axis of the pile. 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.

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

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

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

**400.3.11 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 403, Metal Structures. This protection shall extend from the elevation shown on the Plans to the top of the exposed steel.

**400.3.12 Pile Records**

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

Driven Piles	Cast-in-Place Piles
<ol style="list-style-type: none"> <li>1. Pile type and dimension</li> <li>2. Date of casting and concrete quality (for concrete piles)</li> <li>3. Date of driving</li> <li>4. Driving equipment: type, weight &amp; efficiency of hammer, etc.</li> <li>5. Description of cushion on pile head</li> <li>6. Depth driven and tip elevation</li> <li>7. Final set for the last 20 blows (for every 10 piles and when the Engineer so requires the penetration along the whole depth driven shall be recorded)</li> <li>8. For gravity and single-acting hammers: the height of drop</li> <li>9. For double acting-hammers --- the frequency of blows</li> <li>10. Details of any interruption in driving</li> <li>11. Level of pile top immediately after driving and the level when all piles in the group are driven</li> <li>12. Details of re-driving</li> </ol>	<ol style="list-style-type: none"> <li>1. Date of boring or driving (For steel shell) &amp; casting</li> <li>2. Pile type and nominal dimension</li> <li>3. Length of finished pile and tip elevation</li> <li>4. Details of penetration during boring or driving of steel shell (driving records as for driven piles)</li> <li>5. Concrete quality and consistency</li> <li>6. Time interval between boring or driving and concreting</li> <li>7. Volume of concrete placed in concrete</li> </ol>

**400.4 Method of Measurement****400.4.1 Timber, Steel and Precast Concrete Piles****1. Piles Furnished**

The quantity to be paid for will be the sum of the lengths in meters of the piles of several types and lengths ordered in writing by the Engineer, furnished in compliance with these Specifications and stockpiled in good condition at the project site by the Contractor and accepted by the Engineer. The length to be paid for will include test and tension piles ordered by the Engineer, but not those furnished by the Contractor at his option. No allowance will 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 sitework.

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

**2. Piles Driven**

The quantity to be paid for will 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 the pile caps, footings or bottom of concrete superstructure in the case of pile bents. Measurement will not include additional piles or test piles driven that maybe 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 will not be measured directly but will be considered subsidiary to Pay Items.

**400.5 Basis of Payment**

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

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
400 (23)a11	Bored Piles Cast (1.80m diameter)	Meter
400 (23)a9	Bored Piles Cast (2.00m diameter)	Meter
400 (24)k1	Permanent Casing, (1.80m dia x 12mm thick)	Meter
400 (24)m1	Permanent Casing, (1.80m dia x 12mm thick)	Meter



**ITEM 400(27)b PILE INTEGRITY TESTING****400(27)b.1 IntegrityTesting**

The completed bored pile shall be subjected to non-destructive testing to determine the extent of any defects that may be present in the pile. Integrity-testing method to be adopted shall be low-strain, by either the Pulse Echo Method (PEM) or Transient Response Method (TRM) in accordance with ASTM D 5882, subject to the approval of the Engineer.

The testing shall be carried out by the material engineer of the Contractor with specialized experience in this field and shall be approved by the Engineer. Prior to integrity testing, all apparatus shall be calibrated to ensure that precise and reliable data will be obtained. Certificate of calibration shall be submitted by the Contractor unless otherwise waived by the Engineer.

**400(27)b.2 Report**

The Contractor shall submit a report on the integrity testing containing vital information necessary for the pile evaluation, prescribed in ASTM D5882. Such report shall be submitted within seven days after the completion of each test.

**400(27)b.3 Final IntegrityEvaluation**

If and when necessary as determined after evaluation of the integrity of the pile subjected to the test, the Engineer may require further test or dictate pile repair or replacement, depending on the seriousness of the defect that may be established

For piles that need to be repaired, the Contractor shall submit for approval of the Engineer, remedial measures he intends to implement.

For rejected piles, the Contractor shall make a proposal for review and approval of the Engineer. Such proposal shall include the necessary design calculations, the methodology he intends to implement, equipment and other items as may be necessary. Approval of these proposals however does not relieve the Contractor of his contractual responsibilities for any defects as a result of the proposals. The cost of further tests required, remedial measures and replacement of rejected piles shall be borne by the Contractor.

**400(27)b.4 Method ofPayment**

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

not otherwise described hereto are considered subsidiary to the work item and shall not be paid for separately.

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

#### **400(27)b.5 Basis of Payment**

The accepted quantity as provided in Section 400(27)b.4 shall be paid at the contract unit price in the Bill of Quantities. The price and payment shall constitute full compensation of the cost of Integrity Pile Testing, including tools, apparatus, testing and reporting and all labor and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
400 (27)b	Load Test (Low Strain Dynamic Method, PIT)	Each

### **ITEM 400(28) PILE DYNAMIC TESTING**

#### **400(28).1 Description**

High-Strain Dynamic Testing is performed by obtaining and analyzing record of shaft force and velocity under weights impact for evaluation of shaft load carrying capacity, structural integrity, and load-movement and shaft-soil load transfer relationships

Testing of drilled and cast-in-place shafts closely resembles testing of driven piles during re-strike. The following are specifications and instructions for high-strain dynamic testing of drilled and cast-in-place foundation shafts.

The work shall consist of furnishing all materials, equipment, and labor necessary for conducting high-strain dynamic tests on drilled and cast-in-placed shafts (hereinafter noted as test shaft). The Contractor shall not conduct the test himself but shall appoint an Independent Specialist to conduct all testing. The Contractor will be required to supply materials, equipment and labor, hereinafter as specified including prior to, during, and after the load test. High-strain Dynamic Testing is a non-destructive quick test and it is intended that the test shaft be left in a condition suitable for use in production. Testing procedures shall conform to the ASTM D4945-89 specification unless as otherwise noted below. The shaft used for the test will be instrumented and tested by the Independent Specialist, as approved by the Engineer, meeting requirements outlined in the ASTM D4945-89 specification as well as those outlined below.

#### **400(28).2 Equipment and Material Requirements**

The Contractor shall supply all labor, materials and equipment required to prepare the test shaft, dynamically load the shaft, and return the shaft to a condition suitable for use in the finished structure. Equipment to be supplied by the Contractor required to perform the test includes but is not limited to:

- 1) If a permanent casing is not used to construct the shaft, then a shaft top extension consisting of a thin walled casing or equivalent shall be used to extend the shaft by length that is at least equal to two and a half (2 ½) pile diameters such that the extended pile head is readily accessible by the testing engineer at the time of the test. If the shaft top is below grade, then the Contractor must have equipment available to remove surrounding soil (creating a safe working environment) so as to expose the concrete.
- 2) Means to ensure flat, level (axial to shaft) and sound concrete shaft top. Concrete should be on level with, or above the casing. Prior to the test, four "windows" approximately sized 6 by 6 inches (150 by 150mm) shall be provided at each quadrant of the casing
- 3) A drop weight in the range of one and half to two percent (1.5% to 2%) of the anticipated pile capacity, or as determined by the Engineer.
- 4) A guide allowing variable drop heights typically between 2 to 3m, or as determined by the Engineer.
- 5) A shaft top cushion consisting of new sheets of plywood with total thickness between 2 to 6 inches (50 to 150 mm), or as determined by the Engineer.
- 6) A steel striker plate with a thickness of at least 2 inches (50 mm) and an area between 70 to 90% of shaft top area but not less than the area of the impacting surface of the drop weight shall be placed on top of the plywood cushion.
- 7) If protruding reinforcing bars are present, the Contractor has the option to incorporate the reinforcing steel in the test area. Upon successful completion of the dynamic test, the surrounding concrete can then be removed as to make the pile suitable for use in the structure. If the Contractor selects not to incorporate the steel in such a manner as described above, 20% of the shaft cross sectional area shall be supplied with sufficient length, such that the ram impact will not interface with the reinforcing bars. Steel striker plates and plywood cushion must also be sized so that they cover as much as the impact area as possible.
- 8) One (1) k of 200 Volt AC Power.
- 9) Surveyor's transit, laser light or equivalent for measurement of pile set under each impact.

#### **400(28).3 Dynamic Testing Firm**

Testing is to be performed by an accredited Independent Specialist from a firm with a minimum of four (4) year experience in dynamic load testing. The actual test shall be conducted and/or supervised by a practicing Geotechnical Engineer with at least five (5) years of dynamic testing experience or who has achieved basic or better level experience on the foundation QA examination as Provider of PDA Testing services. The firm selected by the Contractor must be approved by the Engineer.

The Independent Specialist must supply the following testing instrumentation in addition to instrumentation outlined in ASTM specification D4945-89 Section 5:

- a) Pile Driving Analyzer(PDA)
- b) Calibrated Strain Transducers
- c) Calibrated Accelerometer

#### **400(28).4 Reporting Results**

The Independent Specialist appointed by the Contractor shall submit a timely report of the testing results to the Engineer for approval. The field results from at least one (CAPWAP) analysis (case Pile Wave Analysis Program) shall be submitted. The CAPWAP analysis shall be performed by an engineer that has achieved an advanced or better level on the foundation QA examination as providers of PDA Testing Services. The report must also provide the following:

- a) Wave Equation analysis results obtained prior to testing
- b) CAPWAP analysis result.
- c) For each impact the maximum measured force, maximum calculated tension force, transferred energy to the gage location, corresponding stresses, and the Case Method bearing capacity.
- d) Assessment of the test result with respect to both pile capacity and integrity.

#### **400(28).5 Method of Payment**

The quantity of the load tests to be paid for shall be the number of bored piles tested and accepted. Any item indicated and not otherwise described hereto shall be considered subsidiary to the work item and shall not be paid for separately.

#### **400(28).6 Basis of Payment**

The accepted quality as provided in Section 400(28).5 shall be paid at the contract unit price shown below. The payment shall constitute full compensation for the cost of Pile Dynamic Testing, the cost of appointing an Independent Specialist, all instrumentation, testing and testing equipment, analysis and reporting, tools, labor and all other incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
400(28)	Load Test (Pile Dynamic Method, PDA)	Each

### **ITEM 401 RAILINGS**

#### **401.1 Description**

This Item shall consist of furnishing or fabricating and/or placing railings, for bridges and other structures of the material or combination of materials shown on the plans, constructed in reasonably close conformity with this Specification and to the lines, grades and dimensions shown in the Plans. Railing shall be classified as

concrete, steel, aluminum or timber in accordance with the predominating material contained in each.

**401.2 Material Requirements****401.2.1 Concrete**

It shall conform to the applicable requirements prescribed in Item 405, Structural Concrete.

**401.2.2 Reinforcing Steel**

It shall conform to the requirements of Item 404, Reinforcing Steel and Wire Rope.

**401.2.3 Steel**

Structural steel consisting of steel and iron plates, shapes, pipes, fittings and castings shall conform to the requirements of Item 403, Metal Structures.

**401.2.4 Aluminum**

It shall conform to the requirements of AASHTO M 193, ASTM B 221 or ASTM B 308 or as called for on the Plans.

**401.2.5 Paint**

It shall conform to the requirements of Item 411, Paints.

**401.3 Construction Requirement****401.3.1 General**

Railings shall be constructed to the lines and grades shown on the plans and shall not reflect any unevenness in the structure. All railing post shall be set plumb in hand or mechanically dug holes, unless driving is permitted. In the latter case, the manner of driving shall be in such as to avoid battering or distorting of post. Postholes shall be backfilled with acceptable material placed in layers and thoroughly compacted. When it is necessary to cut post holes in existing pavement, all loose materials shall be removed and the paving replaced in kind. Bridge railings shall not be constructed on a span until centering or falsework has been removed, rendering the spanself-supporting.

Rail elements shall be erected according to plans and in a manner resulting in smooth, continuous installation with laps in the direction of traffic flow. All bolts except adjustment bolts shall be drawn tight. Bolts shall be sufficient length to extend beyond the nuts by more than 25mm.

Where painting of the railing component is specified, any damaged to the shop coat of paint shall be corrected by an application of an approved rust-inhibitive primer prior to painting. Ungalvanized surfaces inaccessible to painting after erection shall be field painted before erection. The railing components shall be given specified number of coats of paint uniformly applied by thorough brushing or by approved pressure spray.

Galvanized surfaces which have been abraded so that the base metal is exposed, threaded portions of all fittings and fasteners and cut ends of bolts shall be painted with two (2) coats of zinc-dust and zinc oxide paint.

#### 401.3.2 Concrete Railing

##### 1. Railing Cast-In-Place

The portion of the railing or parapet which is to be cast-in-place shall be constructed in accordance with the requirements of Item 405, Structural Concrete. Special care shall be exercised to secure smooth and tight fitting forms which can be rigidly held in line and grade and removed without injury to the concrete. Forms shall either be of single width boards or shall be lined with suitable material to have a smooth surface, which shall meet the approval of the Engineer or as shown on the Plans.

All moldings, panel work and bevel strips shall be constructed according to the detailed Plans with metered joints, and all corners in the finished work shall be true, sharp and clean-cut and shall be free from cracks, spalls and other defects.

##### 2. Precast Railings

Moist tamped mortar precast members shall be removed from the molds as soon as practicable and shall be kept damp for a period of least ten (10) days. Any member that shows checking of soft corners of surfaces shall be rejected.

Expansion joint shall be constructed as to permit freedom of movement. After all work is completed, all loose or thin shells of mortar likely to spall under movement shall be carefully removed from all expansion joints by means of sharp chisel.

#### 401.3 Method of Measurement

The quantity to be paid for shall be the number linear meters of specified railing actually completed and accepted measured from center to center of end posts.

#### 401.4 Basis of Payment:

The accepted quantity measured as prescribed in Section 401.4, shall be paid for at the contract unit price for Railing, which price and payment shall be full compensation for furnishing and placing all materials including all labor, equipment, tools and incidentals necessary to complete this item.

Payments will be made under:

Pay Item Number	Description	Unit of Measurement
401(2)c	Reinforced Concrete Railing, Painted	Linear Meter

**ITEM 404 REINFORCING STEEL****404.1 Description**

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

**404.2 Material Requirements**

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

**404.3 Construction Requirements**

Should the Contractor propose to use reinforcing bar complying with JIS Standards, the Contractor shall, before materials are ordered, furnish the Engineer for approval Drawings annotated in English of the reinforcement arrangement of each affected structure, showing clearly any revised spacing or diameters of bars required to ensure that the design strength of the structure is maintained. The design strength shall be defined as the product of yield strength of reinforcing bar and the area of reinforcing bar provided in the section. Any expense incidental to the revisions of materials furnished in accordance with such Drawings shall be borne by the Contractor.

**404.3.1 Order Lists**

Before materials are ordered, the Contractor shall furnish all order lists and bending diagrams to the Engineer for approval. The approval of the order lists and bending diagrams by the Engineer shall in no way relieve the Contractor off responsibility for the correctness of such lists and diagrams.

Any expense incident to the revisions of materials furnished in accordance with such lists and diagrams to make them comply with the Plans shall be borne by the Contractor.

**404.3.2 Rebar Fabrication and Installation**

Fabrication and installation of rebar shall be done by a competent steel man to ensure good workmanship. There shall be proper supervision by the Contractor for the "cutting and bending" of reinforcing bars and frequent checking of bar schedule and clearances, from the beginning until the rebars are installed.

**404.3.3 Protection of Materials**

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 steelspecified.

#### 404.3.4 Bar Bending, Splicing, Placing andFastening

The Contractor shall submit to the Engineer for approval, the shop drawings indicating the bending, cutting, splicing and installation of all reinforcing bars.

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

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

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

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

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



Splice Type	Grade 40	Grade 60	But not less than
Tension	24 bardia	36 bardia	300mm
Compression	20 bardia	24 bardia	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.

#### 404.4 Method of Measurement

The quantity of reinforcing steel to be paid for will be the final quantity placed and accepted in a 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 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.

Quantities to be paid for shall be the calculated theoretical number of kilograms of reinforcing steel bars, mesh or mats as determined from the net length of the steel as shown on the drawings, incorporated in concrete and accepted.

Reinforcing steel bars shall not be measured and paid separately where structures are paid in unit, as they are deemed included in the unit pay items of the structures.

The weight of plain or deformed bars or bar-mat information to AASHTO Specifications will be computed from the theoretical weight of plain round bars of the same nominal size as shown on the following table:

Bar Designation	Size (mm)	Unit Weight (kg/m)
#2	6	0.222
#3	10	0.616
#4	12	0.888
#5	16	1.579
#6	20	2.466
#8	25	3.854
#9	28	4.833
#10	32	6.313
#11	36	7.991

The weight of reinforcing steel conforming to JIS Standards will be computed from an equivalent table appropriate to JIS Standards and approved by the Engineer.

#### 404.5 Basis of Payment

The accepted quantity, measured as prescribed in Section 404.4, shall be paid for at the contract 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.

Payments will be made under:

Pay Item Number	Description	Unit of Measurement
404(1)a	Reinforcing Steel Bar, (Grade 40)	Kilogram
404(1)b	Reinforcing Steel Bar, (Grade 60)	Kilogram

### ITEM 405 STRUCTURAL CONCRETE

#### 405.1 Description

##### 405.1.1 Scope

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

##### 405.1.2 Classes and Uses of Concrete

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

The classes of concrete will generally be used as follows:

Class A – All superstructures and heavily reinforced substructures. The important parts of the structure included are slabs, beams, girders, columns, arch ribs, box culverts, reinforced abutments, retaining walls, and reinforced footings.

Class B – Footings, pedestals, massive pier shafts, pipe bedding, and gravity walls, unreinforced or with only a small amount of reinforcement.

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

Class P – Prestressed concrete structures and members.

Seal – Concrete deposited in water.

## 405.2 Material Requirements

### 405.2.1 Portland Cement

It shall conform to all the requirements of Subsection 311.2.1.

### 405.2.2 Fine Aggregate

It shall conform to all the requirements of Subsection 311.2.2.

### 405.2.3 Coarse Aggregate

It shall conform all the requirements of Subsection 311.2.3 except that gradation shall conform to Table 405.1.

**Table 405.1 – Grading Requirements for Coarse Aggregate**

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	3/4"	35 – 70	-	100	-	-
12.5	1/2"	-	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

### 405.2.5 Reinforcing Steel

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

### 405.2.6 Admixtures

Admixtures shall conform to the requirements of Subsection 311.2.7

### 405.2.7 Curing Materials

Curing materials shall conform to the requirements of Subsection 311.2.8.

### 405.2.8 Expansion Joint

Expansion joint materials shall be:

1. Preformed Sponge Rubber and Cork, conforming to AASHTO M 153.
2. Hot-Poured Elastic Type, conforming to AASHTO M173.
3. Preformed Fillers, conforming to AASHTO M213.

#### **405.2.9 Elastomeric Compression JointSeals**

These shall conform to AASHTO M 220.

#### **405.2.10 Elastomeric BearingPads**

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

#### **405.2.11 Storage of Cement andAggregates**

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

### **405.3 Sampling and Testing of StructuralConcrete**

As work progresses, at least one (1) sample consisting of three (3) concrete cylinder test specimens, 150 x 300mm (6 x 12 inches), shall be taken from each seventy-five (75) cubic meters of each class of concrete or fraction thereof placed each day.

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

Sampling of fresh concrete	T141
Weight per cubic meter and air content (gravi- Metric) of concrete	T121
Sieve analysis of fine and coarse aggregates	T 27
Slump of Portland Cement Concrete	T 119
Specific gravity and absorption of fine aggregate	T 84

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

Making and curing concrete compressive and flexural tests specimens in the field	T 23
Compressive strength of molded concrete Cylinders	T 22

### **405.4 ProductionRequirements**

#### **405.4.1 Proportioning and Strength of StructuralConcrete**

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 forSelecting

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 <sup>3</sup>  kg (bag <sup>**</sup> )	Maximum Water/ Cement Ratio  kg/kg	Consistency Range in Slump  mm (inch)	Designated Size of Coarse Aggregate  Square Opening Std. mm	Minimum Compressive Strength of 150x300mm Concrete Cylinder Specimen at 28 days, MN/m <sup>2</sup> (psi)
A	364 (9.1 bags)	0.53	50 – 100 (2 – 4)	37.5 – 4.75 (1-1/2" – No. 4)	20.7 (3000)
B	320 (8 bags)	0.58	50 – 100 (2 – 4)	50 – 4.75 (2" – No. 4)	16.5 (2400)
C	380 (9.5 bags)	0.55	50 – 100 (2 – 4)	12.5 – 4.75 (1/2" – No. 4)	20.7 (3000)
P	440 (11 bags)	0.49	100 max. (4 max.)	19.0 – 4.75 (3/4" – No. 4)	37.7 (5000)
Seal	380 (9.5 bags)	0.58	100 – 200 (4 - 8)	25 – 4.75 (1" – No. 4)	20.7 (3000)

\*The measured cement content shall be within plus or minus 2 mass percent of the design cement content.

\*\*Based on 40 kg/bag

#### 405.4.2 Consistency

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

#### 405.4.3 Batching

Measuring and batching of materials shall be done at a batching plant.

##### 1. Portland Cement

Either sacked or bulk cement may be used. No fraction of a sack of cement shall be used in a batch of concrete unless the cement is weighed. All bulk cement shall be weighed on an approved weighing device. The bulk cement weighing hoppers 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 2 mass percent maximum tolerance for the required materials.

4. Bins and Scales

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

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

5. Batching

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

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

6. Admixtures

The Contractor shall follow an approved procedure for adding the specified amount of admixture to each batch and will be responsible for its uniform operation during the progress of the work. He shall provide separate scales for the admixtures which are to be proportioned by weight, and accurate measures for those to be proportioned by volume.

Admixtures shall be measured into the mixer with an accuracy of plus or minus three (3) percent.

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

#### **405.4.4 Mixing and Delivery**

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

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

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

For batch mixing at the site of construction or at a central point, a batch mixer of an approved type shall be used. Mixer having a rated capacity of less than a one-bag batch shall not be used. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity as shown on the manufacturer's standard rating plate on the mixer except that an overload up to 10 percent above the mixer's nominal capacity may be permitted, provided concrete test data for strength, segregation, and uniform consistency are satisfactory and provided no spillage of concrete takes place. The batch shall be so charge into the drum that a portion of the water shall enter in advance of the cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first 15 seconds of the mixing period. Mixing time shall be measured from the time all materials, except water, are in the drum. Mixing time shall not be less than 60 seconds for mixers having a capacity of 1.5m<sup>3</sup> or less. For mixers having a capacity greater than 1.5m<sup>3</sup>, the mixing time shall not be less than 90 seconds. If timing starts, the instant the skip reaches its maximum raised position, 4 seconds shall be added to the specified mixing time. Mixing time ends when the discharge chute opens.

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

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

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

1. Mixing Concrete: General

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

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

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

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

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



percent for cement, 1-1/2 mass percent for any size of aggregate, or one (1) mass percent for the total aggregate in any batch.

## 2. Mixing Concrete at Site

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

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

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

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

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

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

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

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

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

3. Mixing Concrete at Central Plant

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

4. Mixing Concrete in Truck

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

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

Mixing shall begin within 30 minutes after the cement has been added either to the water or aggregate, but when cement is charged into a mixer drum containing water or surface wet aggregate and when the temperature is above 32°C, this limit shall be reduced to 15 minutes. The limitation in time between the introduction of the cement to the aggregate and the beginning of the mixing may be waived when, in the 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 guaranteed capacity. They shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

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

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

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

#### **6. Delivery of Mixed Concrete**

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

#### **405.5 Method of Measurement**

The quantity of structural concrete to be paid for will be the final quantity placed and accepted in the completed structure. No deduction will be made for the volume occupied by pipe less than 100mm in diameter or by reinforcing steel, anchors, conduits, weep holes or expansion joint materials.

#### **405.6 Basis of Payment**

The accepted quantities, measured as prescribed in Section 405.4 shall be paid for in the contract unit price for each of the Pay item listed below that is included in the Bill of Quantities.

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

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
405(1)a3	Structural Concrete Class "A", (Drainage Structures)	Cubic Meter
405(1)b2	Structural Concrete Class "A", ( $f_c' = 27.58 \text{ Mpa}$ ) 14 days	Cubic Meter
405(1)b3	Structural Concrete Class "A", ( $f_c' = 27.58 \text{ Mpa}$ ) 28 days	Cubic Meter

## ITEM 406 PRESTRESSED CONCRETE STRUCTURES

### 406.1 Description

This Item shall consist of prestressed concrete structures and the prestressed concrete portions of composite structures, constructed in reasonably close conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer and in accordance with this Specification. It shall also include the furnishing and installing of any appurtenant items necessary for the particular prestressing system to be used, including but not limited to ducts, anchorage assemblies and grouts used for pressure grouting ducts.

### 406.2 Material Requirements

#### 406.2.1 Concrete and Grout

The materials for concrete and grout shall conform to Item 405, Structural Concrete. The concrete shall be Class P as shown in Table 405.2, unless otherwise shown on the Plans or specified in the Special Provisions. The proportions of the grout will be as set out in Subsection 406.3.11, Bonding Steel.

#### 406.2.2 Prestressing Reinforcing Steel

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

#### 406.2.3 Prestressing Steel

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

All prestressing steel shall be protected against physical damage and rust or other results of corrosion at all times from manufacture to grouting. Prestressing steel that has sustained physical damage at any time shall be rejected.

#### 406.2.4 Packaging, Storing and Shipping

Prestressing steel shall be packed in containers or other shipping forms for the protection of the steel against physical damage and corrosion during shipping and storage. A corrosion inhibitor which prevents rust or other results of corrosion shall be placed in the package or form, or when permitted by the Engineer, may be applied directly to the steel. The corrosion

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inhibitor shall have no deleterious effect on the steel or concrete or bond

strength of concrete to steel. Packaging or forms damaged from any cause shall be immediately replaced or restored to original condition.

This shipping package or form shall be clearly marked with a statement that the package contains high-strength prestressing steel and the care to be used in handling, and the type, kind and amount of corrosion inhibitor used, including the date when placed, safety orders and instructions for use.

#### **406.2.5 Elastomeric Bearing Pads**

This shall conform to Item 412(1), Elastomeric Bearing Pads.

#### **406.2.6 Water**

It shall conform to the requirements of Subsection 311.2.4, Water.

#### **406.2.7 Enclosures**

Duct enclosures for pre-stressing steel shall be galvanized ferrous metal or of a type approved by the Engineer, mortar tight and accurately placed at the locations shown on the Plans or approved by the Engineer. Transition couplings connecting said ducts to anchoring devices need not be galvanized.

#### **406.2.8 Sampling and Testing**

All wire, strand, anchorage assemblies or bars to be shipped to the site shall be assigned a lot number and tagged for identification purposes.

All samples submitted shall be representative of the lot to be furnished and in the case of wire or strand, shall be taken from the same master roll.

All of the materials specified for testing shall be furnished free of cost and shall be delivered in time for tests to be made well in advance of anticipated time of use.

The Contractor shall furnish for testing the following samples selected from each lot, if ordered by the Engineer. The selection of samples will be made at the manufacturer's plant by the Engineer or his representative.

1. For pre-tensioning work-samples at least 2 m long shall be furnished of each size of wire or strand proposed.
2. For post-tensioning work-samples of the following lengths shall be furnished of each size of wire proposed.
  - a. For wire requiring heading, 2m.
  - b. For strand to be furnished with fittings, 1.50 m between near ends of fittings.
  - c. For bars to be furnished with thread ends and nuts, 1.5 m between threads at ends.
3. Anchorage assemblies – If anchorage assemblies are not attached to reinforcement samples, two (2) anchorage assemblies shall be

furnished, completed with distribution plates of each size and type to be used.

When prestressing system has been previously tested and approved for similar projects by an agency acceptable to the Engineer, complete tendon samples need not be furnished, provided there is no change whatsoever in the materials, design or details previously approved.

### **406.3 Construction Requirements**

#### **406.3.1 General**

Prestressed concrete structural members shall be constructed in accordance with the requirements of Item 405, Structural Concrete and Reinforcing Steel shall be placed in accordance with the requirements of Item 404, Reinforcing Steel, subject to the modifications and amendments contained herein.

#### **406.3.2 Prestressing Method**

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.

#### **406.3.3 Prestressing Equipment**

Hydraulic jacks used to stress tendons shall be equipped with either a pressure gauge or a load cell for determining the jacking stress. The pressure gauge, if used, shall have an accurate reading dial at least 154 mm (6 inches) in diameter and each jack and its gauge shall be calibrated as a unit with the cylinder extension in the approximate position that it will be at final jacking force, and shall be accompanied by a certified calibration chart. The load cell, if used, shall be calibrated and shall be provided with an indicator by means of which the prestressing force in the tendon may be determined. The range of the load cell shall be such that the lower ten (10) percent of the manufacturer's rated capacity will not be used in determining the jacking stress.

Safety measures shall be taken by the Contractor to prevent accidents due to possible breaking of the prestressing steel or the slipping of the grips during the prestressing process.

#### **406.3.4 Casting Yard**

The precasting of prestressed concrete structural members may be done at a location selected by the Contractor, subject to the approval of the Engineer.

**406.3.5 Placing Enclosures**

Enclosures for prestressed reinforcement shall be accurately placed at locations shown on the Plans or approved by the Engineer.

**406.3.6 Placing Steel**

Steel units shall be accurately placed at the position shown on the Plans and firmly held during the placing and setting of the concrete.

Ducts may be fabricated with either welded or interlocked seams. Galvanizing of the welded steel will not be required. Ducts shall have sufficient strength to maintain their correct alignment and shape during placing of concrete. Joints between sections of ducts shall be positive metallic connections which do not result in angle changes at the joints. Waterproof tape shall be used at the connections.

All ducts or anchorage assemblies shall be provided with pipes or other suitable connections for the injection of grout after prestressing.

Ducts for pre-stressing steel shall be securely fastened in place to prevent movement.

After installation in the forms, the end of ducts shall at all times be covered as necessary to prevent the entry of water or debris.

All ducts for continuous structures shall be vented over each intermediate support, and at additional locations as shown on the Plans. Vents shall be 12.7 mm (1/2 inch) minimum diameter standard pipe. Connections to ducts shall be made with metallic structural fasteners. The vents shall be mortar tight, taped as necessary, and shall provide means for injection of grout through the vents and for sealing the vents. Ends of vents shall be removed 25.4 mm (1 inch) below the roadway surface after grouting has been completed.

Distances from the forms shall be maintained by stays, blocks, ties, hangers or other approved supports. Blocks for holding units from contact with the forms shall be precast mortar blocks of approved shape and dimensions. Layers of units shall be separated by mortar blocks or other equally suitable devices. Wooden blocks shall not be left in the concrete.

When acceptable prestressing steel for post-tensioning is installed in ducts after completion of concrete curing, and if stressing and grouting are completed within ten (10) calendar days after the installation of the prestressing steel, rust which may form during said ten (10) days will not be caused for rejection of the steel. Prestressing steel, installed, tensioned and grouted in this manner, all within ten (10) calendar days, shall be subject to all the requirements in this Item pertaining to corrosion protection and rejection because of rust.

No welds or grounds for welding equipment shall be made on the forms or on the steel in the manner after the prestressing steel has been installed.

Wires, wire groups, parallel-lay cables and any other prestressing elements shall be straightened to insure proper positioning in the enclosures.



Suitable horizontal and vertical spacers shall be provided, if required, to hold the wires in place in true position in the enclosures.

#### **406.3.7 Pretensioning**

The prestressing elements shall be accurately held in position and stressed by jacks. A record shall be kept of the jacking force and the elongations produced thereby. Several units may be cast in one continuous line and stressed at one time. Sufficient space shall be left between ends of units to permit access for cutting after the concrete has attained the required strength. No bond stress shall be transferred to the concrete, nor end anchorages released until the concrete has attained a compressive strength, as shown by cylinder tests, of at least 28 MPa unless otherwise specified. The elements shall be cut or released in such an order that lateral eccentricity or prestress will be a minimum.

#### **406.3.8 Placing Concrete**

Concrete shall not be deposited in the forms until the Engineer has inspected the placing of the reinforcement, enclosures, anchorages and prestressing steel and given his approval thereof. The concrete shall be vibrated with care and in such a manner as to avoid displacement of reinforcement, conduits, or wires.

Prior to placing concrete, the Contractor shall demonstrate to the Engineer that all ducts are unobstructed.

#### **406.3.9 Curing**

Steam curing process may be used as an alternative to water curing. The casting bed for any unit cured with steam shall be completely enclosed by a suitable type of housing, tightly constructed so as to prevent the escape of steam and simultaneously exclude outside atmosphere. Two to four hours after placing concrete and after the concrete has undergone initial set, the first application of steam or radiant heat shall be made unless retarders are used, in which case the waiting period before application of the steam or radiant heat shall be increased to from four to six hours.

During the waiting period, the temperature within the curing chamber shall not be less than 10.0°C (50°F) and live steam or radiant heat may be used to maintain the curing chamber at the proper minimum temperature. The steam shall be at 100 percent relative humidity to prevent loss of moisture and to provide moisture for proper hydration of the cement. Application of the steam shall not be directly on the concrete. During application of the steam, or of radiant heat, the ambient air temperature shall increase at a rate not to exceed 4.41°C per hour until the curing temperature is reached. The maximum curing temperature within the enclosure shall not exceed 71.1°C. The maximum temperature shall be held until the concrete has reached the desired strength. Detensioning shall be accomplished immediately after the steam curing or the heat curing has been discontinued and additional curing is not required after detensioning.

##### **1. Curing with Low Pressure Steam**

Application of live steam shall not be directed on the concrete forms as to cause localized high temperatures.

2. Curing with RadiantHeat

Radiant heat may be applied by means of pipes circulating steam, hot oil or hot water, or by electric heating elements. Radiant heat curing shall be done under a suitable enclosure to contain the heat and moisture loss shall be minimized by covering all exposed concrete surfaces with plastic sheeting or by applying an approved liquid membrane curing compound to all exposed concrete surfaces. Top surface of concrete members to be used in composite construction shall be clear of residue of the membrane-curing compound so as not to reduce bond below design limits.

If the Contractor proposes to cure by any other special method, the method and its details shall be subject to the approval of the Engineer.

**406.3.10 Post-tensioning**

Tensioning of the prestressing reinforcement shall not be commenced until tests on concrete cylinders, manufactured of the same concrete and cured under the same conditions, indicate that the concrete of the particular member to be prestressed has attained compressive strength of at least 28 MPa unless otherwise specified.

After all concrete has attained the required strength, the prestressing reinforcement shall be stressed by means of jacks to the desired tension and the stress transferred to the end anchorage.

Cast-in-place concrete shall not be post-tensioned until at least ten (10) days after the last concrete has been placed in the member to be the post-tensioned and until the compressive strength of said placed concrete has reached the strength specified for the concrete at the time of stressing.

All side forms for girders shall be removed before post-tensioning. The falsework under the bottom slab supporting the superstructure shall not be released until a minimum of 48 hours have elapsed after grouting of the post-tension tendons nor until all other conditions of the Specifications have been met. The supporting falsework shall be constructed in such a manner that the super restructure will be free to lift off the falsework and shorten during post-tensioning. Formwork left inside box girders to support the roadway slab shall be detailed in such a manner so as to offer minimum resistance to girder shortening due to shrinkage and post-tensioning.

The tensioning process shall be so conducted that the tension being applied and the elongation of the prestressing elements may be measured at all times. The friction loss in the element, i.e., the difference between the tension of the jack and the minimum tension, shall be determined in accordance with Article 1.6.7 of AASHTO Standard Specifications for Highway Bridges.

Suitable shims or other approved devices shall be used to ensure that the specified anchor set loss is attained.

Prestressing tendons in continuous post-tensioned members shall be tensioned by jacking at each end of the tendon. Such jacking of both ends

need not be done simultaneously.

A record shall be kept of gage pressure and elongation at all times and submitted to the Engineer for his approval.

#### **406.3.11 Bonding Steel**

Prestressing steel shall be bonded to the concrete by filling the void space between the duct and the tendon with grout

Grout shall consist of Portland Cement, water and an expansive admixture approved by the Engineer.

Water shall be potable.

No admixture containing chlorides or nitrates shall be used.

Water shall first be added to the mixer followed by cement and admixture.

The grout shall be mixed in mechanical mixing equipment of a type that will produce uniform and thoroughly mixed grout. The water content shall be not more than 19 litres (5 gallons) per sack of cement. Retempering of grout will not be permitted. Grout shall be continuously agitated until it is pumped.

Grouting equipment shall be capable of grouting at a pressure of at least 0.6894 MPa (100 psi).

Grouting equipment shall be furnished with a pressure gauge having a full-scale reading of not more than 2.07 MPa (300 psi).

Standby flushing equipment capable of developing a pumping pressure of 1.72 MPa (250 psi) and of sufficient capacity to flush out any partially grouted ducts shall be provided.

All ducts shall be clean and free of deleterious materials that would impair bonding of the grout or interfere with grouting procedures. All grout shall pass through a screen with a 2 mm (0.0787 inch) maximum clear openings prior to being introduced into the grout pump.

Grout injection pipes shall be fitted with positive mechanical shutoff valves. Vents and ejection pipes shall be fitted with valves, caps or other devices capable of withstanding the pumping pressures. Valves and caps shall not be removed or opened until the grout has set.

Post-tensioned steel shall be bonded to the concrete. All prestressing steel to be bonded to the concrete shall be free of dirt, loose rust, grease or other deleterious substances.

Immediately after completion of the concrete pour, the metal conduit shall be blown out with compressed oil free air to the extent necessary to break up and remove any mortar in the conduit before it hardens. Approximately 24 hours after the concrete pour, the metal conduits shall be flushed out with water and then blown out with compressed oil free air.

Prior to placing forms for roadway slabs of box girder structures, the Contractor shall demonstrate to the satisfaction of the Engineer that all ducts

are unobstructed and if the prestressing reinforcement has been placed, that the steel is free and unbonded in the duct.

After the tendons have been stressed to the required tension, each conduit encasing the prestressing steel shall be blown out with compressed oil free air. The conduit shall then be completely filled from the low end with grout under pressure. Grout shall be pumped through the duct and continuously wasted at the outlet until no visible slugs of water or air are ejected and the efflux time of ejected grout is not less than 11 seconds. All vents and openings shall then be closed and the grouting pressure at the injection end shall be raised to a minimum of 0.6894 MPa (100 psi) and held for a minimum of 10seconds.

If aluminum powder is used to expand the grout, it shall be added as follows:

From 2 to 4 grams of the unpolished variety (about 1 to 2 teaspoons) shall be added for each sack of cement used in the grout. The exact amount of aluminum powder will be designated by the Engineer. The dosage per batch of grout shall be carefully weighed. A number of weighings may be made in the laboratory and doses placed in glass vials for convenient use in the mix. The aluminum powder shall be blended with pumicite or other inert powder in the proportion of one (1) part powder to fifty (50) parts pumicite (or other inert powder) by weight. The blend shall be thoroughly mixed with the cement. The amount of the blend used should vary from 120 g (4-1/2 ounces) per sack of cement for concrete having a temperature of 21.1°C to 190 g (7 ounces) for a temperature of 4.44°C after all ingredients are added, the batch shall be mixed for 3 minutes. Batches of grout shall be placed within 45 minutes aftermixing.

#### **406.3.12 Unbonded Steel**

Where the steel is not to be bonded to the concrete, it shall be carefully protected against corrosion by a coating of tar or other waterproofing material, in addition to any galvanizing, which may be specified in addition to the requirements of ASTM A 416 (AASHTO M 203) and ASTM A 421 (AASHTO M204.)

#### **406.3.13 Handling**

Extreme care shall be exercised in handling and moving precast prestressed concrete mortar members. Precast girders and slabs shall be transported in an upright position and the points of support and directions of the reactions with respect to the member shall be approximately the same during transportation and storage as when the members are in their final position. If the Contractor deems it expedient to transport or store precast units in other than this position, it shall be done at his own risk after notifying the Engineer of his intention to do so.

Prestressed concrete girders shall not be shipped until tests on concrete cylinders, manufactured of the same concrete and cured under the same conditions as the girders, indicate that the concrete of the particular girder has attained a compressive strength equal to the specified design

compressive strength of the concrete in the girder and has attained a minimum age of 14 days.

#### **406.3.14 Composite Slab Construction**

The manufacturing tolerances for pre-cast members shall not exceed those given for length, cross-section and straightness on the Plans, as specified in the Contract or as approved by the Engineer. In addition, where beams are laid side by side in a deck:

1. The difference on soffit level between adjacent units before the in-situ concrete is placed shall not exceed 5 mm for units up to 10 mm for longer units.
2. The width of the deck soffit shall be within  $\pm 25$ mm.
3. In adjacent span, the continuity of the outside beams shall be maintained.
4. The width of gap between individual beams shall not exceed twice the nominal gap.
5. The alignment of transverse holes shall permit the reinforcement or prestressing cables to be placed without distortion.

#### **406.4 Method of Measurement**

##### **406.4.1 Structural Members**

The quantity to be measured for payment will be the actual number of precast pre-stressed concrete structural members, except piling, of the several types and sizes, installed in place, completed and accepted. Each member will include the concrete, reinforcement and pre-stressing steel, anchorages, plates, nuts, elastomeric bearing pads, and other such material contained within or attached to the unit.

Piling will be measured as provided in Item 400.

##### **406.4.2 Other Items**

The quantities of other Contract items which enter into the completed and accepted structure will be measured for payment in the manner prescribed for the several items involved.

#### **406.5 Basis of Payment**

The accepted quantities, measured as prescribed in Section 406.4 shall be paid for at the contract unit price for each of the particular item listed below that is included in the Bill of Quantities, which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
406(1)d4	Prestressed Structural Concrete Members(Type III, L= 15.2m, I-Girders)	Each

## ITEM 407 CONCRETE STRUCTURES

### 407.1 Description

This item shall consist of general description of the materials, equipment, workmanship and construction requirements of concrete structures and concrete portions of composite structures conforming to the alignment , grades, design, dimensions and details shown on the Plans and in accordance with the Specifications for piles reinforcing steel, structural steel, structural concrete and other items which constitute the completed structure. The class of concrete to be used in the structure or part of the structure shall be as specified in Item 405, Structural Concrete.

### 407.2 Material Requirements

#### 1. Concrete and Concrete Ingredients

Concrete and concrete materials shall conform to the requirements in Item 405, Structural Concrete. Unless otherwise shown on the Plans or specified in the Special Provisions, concrete shall be Class A.

#### 2. Reinforcing Steel

Reinforcing steel shall conform to the requirements in Item 404, Reinforcing Steel.

#### 3. Structural Steel

Structural steel shall conform to the requirements of corresponding materials in Item 403, Metal Structures.

#### 4. Bridge Bearing (Elastomeric Bearing Pad)

Elastomeric bearing pads shall conform to Item 412, Elastomeric Bearing Pads.

5. Paints

Paints shall conform to the requirements in Item 411, Paint.

6. Waterproofing and Damp-proofing.

Unless otherwise shown on the Plans and indicated in Special Provisions, materials for waterproofing and damp-proofing shall conform to the requirements of the following specifications;

- a. AASHTO M 115 Asphalt for damp-proofing and waterproofing.
- b. AASHTO M 116 Primer for the use with Asphalt in damp-proofing and waterproofing.
- c. AASHTO M 117 Woven cotton fabrics saturated with bituminous substances for use in waterproofing.
- d. AASHTO M 118 Coal-Tar pitch for roofing, damp-proofing and waterproofing.
- e. AASHTO M 121 Creosote for priming coat with coal-tar pitch damp-proofing and waterproofing.
- f. AASHTO M 159 Woven burlap fabric saturated with bituminous substances for use in waterproofing.
- g. AASHTO M 166 Numbered cotton duck and array duck.
- h. AASHTO M 239 Asphalt for use in waterproofing membrane construction.

7. Concrete Curing Compound

Curing compound shall conform to the requirements of AASHTO M 148 Liquid membrane-forming compounds for curing concrete.

8. Joint Filler

Unless otherwise shown in the Plans or in Special Provisions, materials for expansion joint filler shall conform to the requirements of AASHTO M 33, AASHTO M 153, AASHTO M 173, ASHTO M 213 and ASHTO M 220.

**407.2.1 Proportioning and Strength of Structural Concrete**

This shall be in accordance with Item 405 Structural Concrete.

**407.2.2 Sampling and Testing**

This shall be in accordance with Item 405, Structural Concrete.

**407.3 Construction and Requirements**

**407.3.1 Handling and Placing Concrete: General**

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

If lean concrete is required in the Plan or as directed by the Engineer prior to placing of reinforcing steel bar, the lean concrete should have a minimum compressive strength of 13.8 MPa (2,000 psi)..

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

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

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

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

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

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

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

#### **407.3.1.1 Placing Concrete by Pneumatic Means**

Pneumatic placing of concrete will be permitted only if specified in the Special Provisions or authorized by the Engineer. The equipment shall be so arranged that vibration will not damage freshly placed concrete.

Where concrete is conveyed and placed by pneumatic means, the equipment shall be suitable in kind and adequate in capacity for the work. The machine shall be located as close as practicable to the work. The discharge lines shall



be horizontal or inclined upwards from the machine. The discharge end of the line shall not be more than 3 m from the point of deposit.

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

#### **407.3.1.2 Placing of Concrete by Pumping**

The placing of concrete by pumping will be permitted only if specified or if authorized by the Engineer. The equipment shall be so arranged that vibration will not damage freshly placed concrete.

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

#### **407.3.1.3 Placing Concrete in Water**

Concrete shall not be placed in water except with approval of the Engineer and under his immediate supervision. In this case the method of placing shall be hereinafter specified.

Concrete deposited in water shall be Class A concrete with a minimum cement content of 400 kg/m<sup>3</sup> of concrete. The slump of the concrete shall be maintained between 10 and 20 cm. To prevent segregation, concrete shall be carefully placed in a compact mass, in its final position, by means of a tremie, a bottom-dump bucket, or other approved means, and shall not be disturbed after being placed.

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

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

#### **407.3.2 Compaction of Concrete**

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

The compaction shall be done by mechanical vibration. The concrete shall be vibrated internally unless special authorization of other methods is given by the Engineer or is provided herein. Vibrators shall be of a type, design, and frequency approved by the Engineer. The intensity of vibration shall be such as to visibly affect a mass of concrete with a 3 cm slump over a radius of at least 50 cm. A sufficient number of vibrator shall be provided to properly compact each batch immediately after it is placed in the forms. Vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcement and embedded fixtures and into the corners and angles of the forms and shall be applied at the point of placing and in the area of freshly placed concrete. The vibrators shall be inserted into and withdrawn from the concrete slowly. The vibration shall be of sufficient duration and intensity to compact the concrete thoroughly but shall not be continued so as to cause segregation and at any one point to the extent that localized areas of grout are formed. Application of vibrators shall be at points uniformly spaced, and not farther apart than twice the radius over which the vibration is visibly effective. Vibration shall not be applied directly or thru the reinforcement to sections or layers of concrete that have hardened to the degree that the concrete ceases to be plastic under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms of troughs or chutes.

#### **407.3.3 Casting Sections and Construction Joints**

The concrete in each form shall be placed continuously. Placing of concrete in any such form shall not be allowed to commence unless sufficiently inspected and approved materials for the concrete is at hand, and labor and equipment are sufficient to complete the pour without interruption.

Joints in the concrete due to stopping work shall be avoided as much as possible. Such joints, when necessary, shall be constructed to meet the approval of the Engineer.

When the placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to retain its shape, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. Where a "faster edge" might be produced at a construction joint, as in the sloped top surface of a wingwall, an inset formwork shall be used to produce an edge thickness of not less than 15 cm in the succeeding layer. Work shall not be discontinued within 50 cm of the top of any face, unless provision has been made for a coping less than 50 cm thick, in which case if permitted by the Engineer, the construction joint may be made at the underside of coping.

Immediately following the discontinuance of placing concrete, all accumulations of mortar splashed upon the reinforcing steel and the surfaces

of forms shall be removed. Dried mortar chips and dust shall not be puddled into the unset concrete. Care shall be exercised, during the cleaning of the reinforcing steel, not to injure or break the concrete-steel bond at and near the surface of the concrete.

#### **407.3.4 Casting Box Culverts**

In general, the base slab of box culverts shall be placed and allowed to set before the remainder of the culvert is constructed. In the construction of box culverts the side walls and top slab may be constructed as a monolith.

If the concrete in the walls and top slab is placed in two separate operations, special care shall be exercised in order to secure bonding in the construction joint and appropriate keys shall be left in the sidewalls for anchoring the top slab. Each wingwall shall be constructed, if possible, as a monolith. Construction joints where unavoidable, shall be horizontal and so located that no joints will be visible in the exposed face of the wingwall above the ground line.

Vertical construction joints shall be at right angles to the axis of the culverts.

#### **407.3.5 Casting Columns, Slabs and Girders**

Concrete in columns shall be placed in one continuous operation, unless otherwise directed. The concrete shall be allowed to set for at least 20 hours before the caps are placed.

Unless otherwise permitted by the Engineer, no concrete shall be placed in the superstructure until the column forms have been stripped sufficiently to determine the condition of the concrete in the column. The load of the superstructure shall not be allowed to come upon the bents until they have been in place at least 14 days, unless otherwise permitted by the Engineer.

Concrete in slab spans shall be placed in one continuous operation for each span unless otherwise provided.

Concrete in T-Beam or deck girder spans shall be placed in one continuous operation unless otherwise directed. If it is permitted to place the concrete in two separate operations, each of the operations, shall be continuous: first, to the top of the girder stems, and second, to completion. In the latter case, the bond between stem and slab shall be secured by means of suitable shear keys which may be formed by the use of timber blocks approximately 50 mm x 100 mm in cross-section having a length of 100 mm less than the width of the girder stem. These key blocks shall be placed along the girder stems as required, but the spacing shall not be greater than 300 mm center to center. The blocks shall be beveled and oiled in such a manner as to insure their ready removal, and they shall be removed as soon as the concrete has set sufficiently to retain its shape. If the contractor wishes to place the concrete in two separate operations, he shall, with his request for permission to do so, submit plans and proposals of the required changes to the reinforcement, which plans and proposals shall be subject to the approval of the Engineer.

In box girders, the concrete in the bottom slab be poured first, as a separate operation.

The concrete in the webs and the top slab shall be placed in one continuous operation unless otherwise specified. If it is permitted to place the concrete in more than one operation, the requirements for T-beam shall apply.

#### **407.3.6 Construction Joints**

Construction joints shall be made only where shown on the Plans or called for in the pouring schedule, unless otherwise approved by the Engineer. Shear keys or reinforcement shall be used, unless otherwise specified, to transmit shear or to bond the two sections together.

Before depositing new concrete on or against concrete which has hardened, the forms shall be retightened. The surface of the hardened concrete shall be roughened as required by the Engineer, in a manner that will not leave loose particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned of foreign matter and laitance. When directed by the Engineer, the surface of the hardened concrete which will be in contact with new concrete shall be washed with water to the satisfaction, and to insure an excess of mortar at the juncture of the hardened and the newly deposited concrete, the cleaned and saturated surfaces, including vertical and inclined surfaces shall first be thoroughly covered with a coating of mortar of the same proportion of sand and cement as the class of concrete used against which the new concrete shall be placed before the grout or mortar has attained its initial set.

The placing of concrete shall be carried continuously from joint to joint. The face edges of all joints which are exposed to view shall be carefully finished true to line and elevation.

#### **407.3.7 Concrete Surface Finishing**

Surface finishing shall be classified as follows:

- Class 1, Ordinary Finish
- Class 2, Rubbed Finish
- Class 3, Floated Finish

All concrete shall be given Class 1, Ordinary Finish and additionally any further finish as specified.

Unless otherwise specified, the following surfaces shall be given a Class 2, Rubbed Finish.

1. The exposed faces of piers, abutments, wing walls, and retaining walls.
2. The outside faces of girders, T-beams, slabs, columns, brackets, curbs, headwalls, railings, arch rings, spandrel walls and parapets.

Excluded, however, are the tops and bottoms of floor slabs and sidewalks, bottoms of beams and girders, sides of interior beams and girders, backwalls above bridge seats or the underside of copings. The surface finish on piers and abutments shall include all exposed surfaces below the bridge seats to 20 cm below low water elevation or 50 cm below finished ground level when such ground level is above the water surface. Wing walls shall be finished from the top to 50 cm below the finished slope lines on the outside face and

shall be finished on top and for a depth of 20 cm below the top on the back sides.

Unless otherwise specified, the surface of the traveled way shall be Class 3, Floated Finish.

### **Class 1, Concrete Ordinary Finish**

Immediately following the removal of forms, all fins and irregular protection shall be removed from all surface except from those which are not to be exposed or are not to be waterproofed. On all surfaces the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges and other defects shall be thoroughly cleaned, and after having been kept saturated with water for a period of not less than three hours shall be carefully pointed and made true with a mortar of cement and fine aggregate mixed in the proportions used in the grade of the concrete being finished. Mortar used in pointing shall not be more than one hour old. The mortar patches shall be cured as specified under Subsection 407.3.8. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with a clean and true edges.

The resulting surface shall be true and uniform. All repaired surfaces, the appearance of which is not satisfactory to the Engineer, shall be "rubbed" as specified below.

### **Class 2, Concrete Rubbed Finish**

After removal of forms, the rubbing of concrete shall be started as soon as its condition will permit. Immediately before starting this work, the concrete shall be kept thoroughly saturated with water for a minimum period of three hours. Sufficient time shall have elapsed before the wetting down to allow the mortar used in the pointing of road holes and defects to thoroughly set. Surfaces to be finished shall be rubbed with a minimum coarse carborundum stone using a small amount of mortar on each face. The mortar shall be composed of cement and fine sand mixed in the proportions used in the concrete being finished. Rubbing shall be continued until all form marks, protections and irregularities have been removed, all voids have been filled, and a uniform surface has been obtained. The face produced by this rubbing shall be left in place at this time.

After all concrete above the surface being created has been cast, the final finish shall be obtained by rubbing with a fine carborundum stone and water. This rubbing shall be continued until the entire surface is of smooth texture and uniform color.

After the final rubbing is completed and the surface has dried, it should be rubbed with burlap to remove loose powder and shall be left free from all unsound patches, paste, powder and objectionable marks.

### **Class 3, Concrete Floated Finish**

After the concrete is compacted as specified in Subsection 407.3.2, Compaction of Concrete, the surface shall be carefully struck off with a strike board to conform to the cross-section and grade shown on the Plans. Proper allowance shall be made for camber if required. The strike board may be operated longitudinally or transversely and shall be moved forward with a combined longitudinal and transverse motion, the manipulation being such that neither is raised from the side forms during the process. A slight excess of concrete shall be kept in front of the cutting edge at all times.

After striking off and consolidating as specified above, the surface shall be made uniform by longitudinal or transverse floating or both. Longitudinal floating will be required except in places where this method is not feasible.

The longitudinal float, operated from foot bridges, shall be worked with a sawing motion while held in a floating position parallel to the road centerline and passing gradually from one side of the pavement to the other. The float shall then be moved forward one-half of each length and the above operation repeated. Machine floating which produces an equivalent result may be substituted for the above manual method.

The transverse float shall be operated across the pavement by starting at the edge and slowly moving to the center and back again to the edge. The float shall then be moved forward one-half of each length and the above operation repeated. Care shall be taken to preserve the crown and cross-section of the pavement.

After the longitudinal floating has been completed and the excess water removed, but while the concrete is still plastic, the slab surface shall be tested for trueness with a straight-edge. For the purpose, the Contractor shall furnish and use an accurate 3 m straight-edge swing handle 1 m longer than one half the width of the slab.

The straight-edge shall be held in successive positions parallel to the road centerline and in contact with the surface and the whole area gone over from one side of the slab to the other as necessary. Advancement along the deck shall be in successive stages of not more than one-half the length of the straight-edge. Any depression found shall be immediately filled with freshly mixed concrete, struck off, consolidated and refinished. The straight-edge testing and refloating shall continue until the entire surface is found to be free from observable departure from the straight-edge and the slabs have the required grade and contour, until there are no deviations of more than 3 mm under the 3 m straight-edge.

When the concrete has hardened sufficiently, the surface shall be given a broom finish. The broom shall be an approved type. The strokes shall be square across the slabs from edge to edge, with adjacent strokes slightly overlapped, and shall be made by drawing the broom without tearing the concrete, but so as to produce regular corrugations not over 3 mm in depth. The surface as thus finished shall be free from porous spots, irregularities, depressions and small pockets or rough spots such as may be caused by accidental

disturbing, during the final brooming of particles of coarse aggregate embedded near the surface.

#### Concrete Surface Finish for Sidewalk.

After the concrete has been deposited in place, it shall be compacted and the surface shall be struck off by means of strike board and floated with a wooden or cork float. An edging tool shall be used on all edges and at all expansion joints. The surface shall not vary more than 3 mm under a 3 m straight-edge. The surface shall have a granular or matted texture which will not slick when wet.

### 407.3.8 Curing Concrete

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

#### 1. Water Method

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

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

#### 2. Curing Compound

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

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

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

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

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

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

Curing compound may be sampled by the Engineer at the source of supply and on the Site.

### 3. Waterproof Membrane Method

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

Waterproof paper and plastic sheeting shall conform to the specification of AASHTO M 171.

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

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

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

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

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

### 4. Forms-In-Place Method



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

#### 5. Curing Cast-In-Situ Concrete

All newly placed concrete for cast-in-situ structures, other than highway bridge deck, shall be cured by the water method, the forms-in-place method, or as permitted herein, by the curing compound method, all in accordance with the requirements of Subsection, 407.3.8 Curing Concrete.

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

The top surface of highway bridge decks shall be cured by either the curing compound method or the water method. The curing compound shall be applied progressively during the deck finishing operations. The water cure shall be applied not later than 4 hours after completion of the deck finishing.

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

#### 6. Curing Pre-Cast Concrete (except piles)

Pre-cast concrete members shall be cured for not less than 7 days by the water method or by steam curing. Steam curing for pre-cast members shall conform to the following provisions:

- a. After placement of the concrete, members shall be held for a minimum 4-hour pre-steaming period.
- b. To prevent moisture loss on exposed surfaces during the pre-steaming period, members shall be covered immediately after casting or the exposed surface shall be kept wet by fog spray or wet blankets.
- c. Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good condition and secured in such a manner to prevent the loss of steam and moisture.
- d. Steam at jets shall be low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam, the temperature rise within the enclosure shall not exceed 20°C per hour. The curing temperature throughout the enclosure shall not exceed 65°C and shall be maintained at a constant level for a sufficient time necessary to develop the required compressive strength. Control cylinders shall be

covered to prevent moisture loss and shall be placed in a location where temperature of the enclosure will be the same as that of the concrete.

- e. Temperature recording devices that will provide an accurate continuous permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 50 m of continuous bed length will be required for checking temperature.
- f. Curing of pre-cast concrete will be considered completed after the termination of the steam curing cycle.

#### 7. Curing Pre-cast Concrete Piles

All newly placed concrete for pre-cast concrete piles, conventionally reinforced or prestressed shall be cured by the "Water Method" as described in Subsection 407.3.8, Curing Concrete, except that the concrete shall be kept under moisture for at least 14 days. At the option of the Contractor, steam curing may be used in which case the steam curing provisions of Subsection 407.3.8 (6), Curing Pre-Cast Concrete (except piles) shall apply except that the concrete shall be kept wet for at least 7 days including the holding and steaming period.

### 407.3.9 Falsework Design and Drawings

Detailed working drawings and supporting calculations of the false work shall be furnished by the Contractor to the Engineer. No falsework construction shall start until the Engineer has reviewed and approved the design. The Contractor shall provide sufficient time for the Engineer to complete this review. Such time shall be proportionate to the complexity of the falsework design and in no case be less than two weeks.

The Contractor may review the falsework drawings at any time provided sufficient time is allowed for the Engineer's review before construction is started on the revised portion.

Assumptions used in design of the falsework shall include but not be limited to the following:

1. The entire superstructure cross-section, except for the railing, shall be considered to be placed at one time, except when in the opinion of the Engineer, a portion of the load is carried by members previously cast and having attained a specified strength.
2. The loading used on timber piles shall not exceed the bearing value for the pile and shall in no case exceed 20 tonne per pile.
3. Soil bearing values and soil condition (wet and dry) shall be designated by the Contractor on the falsework drawings. Falsework footings shall be designed to carry the loads imposed upon them without exceeding estimated soil bearing values or allowable settlements.
4. The maximum loadings and deflections used on jacks, brackets, columns and other manufactured devices shall not

exceed the manufacture's recommendations. If requested by the Engineer, the Contractor shall furnish catalogue or other data verifying these recommendations.

5. If the concrete is to be prestressed, the falsework shall be designed to support any increased or readjusted loads caused by the prestressing forces.
6. Joints supporting slabs and overhangs shall be considered as falsework and designed as such.

For the construction of falsework over and adjacent to roadways where falsework openings are required for maintaining traffic, the Contractor shall provide any additional features for the work needed to insure that the falsework will be stable if subjected to impact by vehicles.

The falsework design at the locations where said openings are required shall include but not be limited to the following minimum provisions:

- a. Each exterior stringer in a span shall be securely anchored to the following cap or framing.
- b. Adequate bracing shall be used during all stages of falsework construction and removal over or adjacent to public traffic.
- c. Falsework members shall be at least 300 mm clear of temporary protective railing members.

The falsework drawings shall include a superstructure placing diagram showing proposed concrete placing sequence and construction joint locations, except that where a schedule for placing concrete is shown on the Contract Plans, no deviation will be permitted there from unless approved in writing by the Engineer.

The falsework drawings shall show pedestrian openings which are required through the falsework.

Anticipated total settlements of falsework and forms shall be indicated by the Contractor on the falsework drawings. These should include falsework footing settlements over 20 mm will not be allowed unless otherwise permitted by the Engineer. Deck slab forms between girders shall be constructed with no allowance for settlement relative to the girders.

Detailed calculations by the Contractor showing the stresses, deflections, and camber necessary to compensate for said deflections in all load supporting members shall be supplied.

After approving the Contractor's falsework deflection camber, the Engineer will furnish to the Contractor the amounts of camber necessary to compensate for vertical alignment or anticipated structure deflection, if these are not shown on the drawings. The total camber used in constructing falsework shall be the sum of the aforementioned cambers.

**407.3.10 Falsework Construction**

The falsework shall be constructed to conform to the falsework drawings. The materials used in the falsework construction shall be of the quantity and quality necessary to withstand the stresses imposed. The workmanship used in falsework shall be of such quality that the falsework will support the loads imposed on it without excessive settlement or take-up beyond that shown on the falsework drawings.

When falsework is supported on piles, the piles shall be driven to a bearing value equal to the total calculated pile loading as shown on the falsework drawings.

Suitable jacks or wedges shall be used in connection with falsework to set the forms to their required grade and to take up any excessive settlement in the falsework either before or during the placing of concrete.

The Contractor shall provide tell-tales attached to the soffit forms easily readable and in enough systematically-placed locations to determine the total settlement of the entire portion of the structure where concrete is being placed.

Should unanticipated events occur, including settlements that deviate more than  $\pm 20$  mm from those indicated on the falsework drawings, which in the opinion of the Engineer would prevent obtaining a structure conforming to the requirement of the Specification, the placing of concrete shall be discontinued until corrective measures satisfactory to the Engineer are provided. In the event satisfactory measures are not provided prior to initial set of the concrete in the affected area, the placing of concrete shall be discontinued at a location determined by the Engineer. All unacceptable concrete shall be removed.

**407.3.11 Removing Falsework**

Unless otherwise shown on the drawings, or permitted by the Engineer, falsework supporting any span of a supported bridge shall not be released before 14 days after the last concrete, excluding concrete above the bridge deck, has been placed. Falsework supporting any span of a continuous or rigid frame bridge shall not be released before 14 days after the last concrete excluding concrete above the bridge deck, has been placed in that span and in the adjacent portions of each adjoining span for a length equal to at least half the length of the span where falsework is to be released.

Falsework supporting deck overhangs and deck slabs between girders shall not be released until 7 days after the deck concrete has been placed.

In addition to the above requirements, no falsework for bridges shall be released until the supported concrete has attained a compressive strength of at least 80% of the required 28-day strength. Falsework for cast-in place prestressed portion of structure shall not be released until after the prestressing steel has been tensioned.

All falsework materials shall be completely removed. Falsework piling shall be removed at least 50 cm below the surface of the original ground or stream bed. When falsework piling is driven within the limits of ditch or channel

excavation areas, the falsework piling within such areas shall be removed to at least 50 cm below the bottom and side slopes of said excavated areas.

All debris and refuse resulting from work shall be removed and the site left in a neat and presentable condition.

#### **407.3.12 Formwork Design and Drawings**

The Contractor shall prepare drawings and materials data for the formwork and shutters to be submitted to the Engineer for approval unless otherwise directed.

The requirements for design of formwork are the same as described under Section 407.3.9.

#### **407.3.13 Formwork Construction**

Concrete forms shall be mortar-tight, true to the dimensions, lines and grades of the structure and with the sufficient strength, rigidity, shape and surface smoothness as to leave the finished works true to the dimensions shown on the Plans or required by the Engineer and with the surface finish as specified.

Formwork and shutters are to be constructed in accordance with the approved Plans.

The inside surfaces of forms shall be cleaned of all dirt, mortar and foreign material. Forms which will later be removed shall be thoroughly coated with form oil prior to use. The form oil shall be of commercial quality form oil or other approved coating which will permit the ready release of the forms and will not discolor the concrete.

Concrete shall not be deposited in the forms until all work in connection with constructing the forms has been completed, all materials required for the unit to be poured, and the Engineer has inspected and approved said forms and materials. Such work shall include the removal of all dirt, chips, sawdust and other foreign material from the forms.

The rate of depositing concrete in forms shall be such to prevent bulging of the forms or form panels in excess of the deflections permitted by the Specification.

Forms for all concrete surfaces which will not be completely enclosed or hidden below the permanent ground surface shall conform to the requirements herein for forms for exposed surfaces. Interior surfaces of underground drainage structures shall be completely enclosed surfaces.

Formwork for concrete placed under water shall be watertight. When lumber is used, this shall be planed, tongued and grooved.

Forms for exposed concrete surface shall be designed and constructed so that the formed surface of the concrete does not undulate excessively in any direction between studs, joists, form stiffeners, form fasteners, or wales. Undulations exceeding either 2 mm or 1/270 of the center to center distance between studs, joists, form stiffeners, form fasteners, or wales will be considered to be excessive. Should any form of forming system, even

though previously approved for use, produce a concrete surface with excessive undulations, its use shall be discontinued until modifications satisfactory to the Engineer have been made. Portions of concrete structures with surface undulations in excess of the limits herein specified may be rejected by the Engineer.

All exposed surfaces of similar portions of a concrete structure shall be formed with the same forming material or with materials which produce similar concrete surface textures, color and appearance.

Forms for exposed surfaces shall be made of form materials of even thickness and width and with uniform texture. The materials shall have sharp edges and be mortar-tight.

Forms for exposed surfaces shall be constructed with triangular fillets at least 20 mm wide attached so as to prevent mortar runs and to produce smooth straight chamfers at all sharp edges of the concrete.

Form fasteners consisting of form bolts, clamps or other devices shall be used as necessary to prevent spreading of the forms during concrete placement. The use of ties consisting of twisted wire loops to hold forms in position will not be permitted.

Anchor devices may be cast into the concrete for later use in supporting forms or for lifting precast members. The use of driven types of anchorage for fastening forms of form supports to concrete will not be permitted.

#### 407.3.14 Removal of Forms and Falseworks

Forms and falsework shall not be removed without the consent of the Engineer. The Engineer's consent shall not relieve the Contractor of responsibility for the safety of the work. Blocks and bracing shall be removed at the time the forms are removed and in no case shall any portion of the wood forms be left in the concrete.

Falsework removal for continuous or cantilevered structures shall be as directed by the Engineer or shall be such that the structure is gradually subjected to its working stress.

When concrete strength tests are used for removal of forms and supports, such removal should not begin until the concrete has attained the percentage of the specified design strength shown in the table below.

	Minimum Time	Minimum Percentage Design Strength
Centering under girders, beams frames or arches	14 days	80%
Floor slabs	14 days	70%
Walls	1 day	70%
Columns	2 days	70%
Sides of beams and all other vertical surfaces	1 day	70%

In continuous structures, falsework shall not be released in any span until the first and second adjoining spans on each side have reached the strength specified herein, or in the Special Specifications. When cast-in-place post

tensioned bridges are constructed, falsework shall remain in place until all post tensioning has been accomplished.

Falsework under all spans of continuous structures shall be completely released before concrete is placed in railings and parapets. In order to determine the condition of column concrete, forms shall be removed from columns before releasing supports from beneath beams and girders.

Forms and falsework shall not be released from under concrete without first determining if the concrete has gained adequate strength without regard to the time element. In the absence of strength determination, the forms and falsework are to remain in place until removal is permitted by the Engineer.

The forms for footings constructed within cofferdams or cribs may be left in place when, in the opinion of the Engineer, their removal would endanger the safety of the cofferdam or crib, and when the forms so left intact will not be exposed to view in the finished structure. All other forms shall be removed whether above or below the ground line or water level.

All forms shall be removed from the cells of concrete box girders in which utilities are present and all formwork except that necessary to support the deck slab shall be removed from the remaining cells of the box girder.

To facilitate finishing, forms used on ornamental work, railing, parapets and exposed vertical surfaces shall be removed in not less than 12 nor more than 48 hours, depending upon weather conditions. In order to determine the condition of concrete in columns, forms shall always be removed from them before the removal of shoring from beneath beams and girders.

Falsework and centering for spandrel-filled arches not be struck until filling at the back of abutments has been placed up to the spring line. Falsework supporting the deck of rigid frame structure shall not be removed until fills have been placed back to the vertical legs.

#### **407.4 Method of Measurement**

The quantity of structural steel, structural concrete, reinforcing steel, or other Contract Pay Items shall constitute the completed and accepted structure which shall be measured for payment in the manner prescribed in the several items involved..

#### **407.5 Basis of Payment**

The accepted quantities measured as prescribed in Section 407.4 Method of Measurement, shall be paid for at the contract unit price for each of the several pay items listed below that are included in the Bill of Quantities. The price and payment shall be full compensation for furnishing, preparing, fabricating, placing, and curing and for all labor, equipment, tools and incidentals necessary to complete the Item. Such payment shall constitute full payment for the completed concrete structure ready for use.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
407(8)	Lean Concrete (Class B, $f'_c=16.50$ Mpa)	Cubic Meter

**ITEM 412 ELASTOMERIC BEARING PADS****412.1 Description****412.1.1 Scope**

This Item shall consist of the requirement for elastomeric bearing pads whose main function is to transfer loads or accommodate relative movement between a bridge superstructure and its supporting structure, or both while avoiding damaging strain and additional tension. Elastomeric bearings shall include unreinforced pads (consisting of elastomer only) and reinforced bearings with steel laminates.

**412.1.2 General Requirements**

All bearings shall be designed in accordance with specifications contained in the latest edition of the AASHTO Standard Specification for Highway Bridges, 15<sup>th</sup> Edition, 1992.

**412.1.3 Classification and Use**

The following are the types of elastomeric bearings:

- a. Plain Elastomeric Bearing Pad
- b. Plain Elastomeric Sandwich Bearing
- c. Steel-Laminated Elastomeric Bearing without External Load Plates
- d. Steel-Laminated Elastomeric Bearing with External Load Plate(s)

A laminated bearing pad is required when the thickness of the plain pad is more than 31.75 mm and the compressive strain is more than 15%.

**412.2 Material Requirements**

The elastomer for the manufacture of the bearing is furnished in two types as follows:

- 1) Type CR-Chloroprene Rubber
- 2) Type NR-Natural Rubber

The elastomer compound used in the construction of a bearing shall contain only either natural rubber or a chloroprene rubber as the raw polymer. No reclaimed rubber shall be used.

Steel laminates used for reinforcement shall be made from rolled mild steel conforming to ASTM A 36, A 570 or equivalent, unless otherwise specified by the Engineer. The laminates shall have a minimum nominal thickness of 20 gages.



**412.2.1 Physical Requirements**

A. The elastomer compound shall meet the minimum requirement of Table 1.

B. Dimensions and Permissible Variations

All elastomeric layers, for example, plain bearing pads, laminates, and covers, shall be of uniform thickness unless otherwise specified in the contract or purchase order.

All internal steel laminates shall be of uniform thickness. When specified in the contract or purchase order, the thickness of the outer steel laminates may differ if not adjacent to an external loadplate.

The minimum thickness of internal steel laminates shall be 1.5 mm or 0.060 in (16 gage) when the greater of the length or width of a rectangular bearing or diameter of a circular bearing is less than 450 mm or 18 in. In all other cases, the minimum thickness shall be 2 mm or 0.075 inch (14 gage).

Bearing dimensions and elastomer layer thicknesses shall satisfy the tolerances in Table 2, in which D is the length, width or diameter as appropriate, and T is the total elastomer thickness.

Variation from a plane parallel to a design surface shall not exceed an average slope of 0.005 for the upper surface and 0.006 for a side surface.

**Table 1 – Quality Control Properties of Elastomer**

	Natural Rubber (NR)		Chloroprene Rubber (CR)	
Grade (Durometer)	60	70	60	70
Physical Properties:				
A. Before Aging				
Tensile Strength, MPa (D412)	15.5 (min.)	15.5 (min.)	15.5 (min.)	15.5 (min.)
Elongation, % (D412)	400 (min.)	300 (min.)	350 (min.)	300 (min.)
Durometer Hardness, Shore Pts. (D2240)	60±5	70±5	60±5	70±5
Tear Resistance, N/mm (D624)	31.5 (min.)	31.5 (min.)	31.5 (min.)	31.5 (min.)
Compression Set, % (D395)	25 (max.)	25 (max.)	35 (max.)	35 (max.)
Method B, Temperature, °C	70	70	100	100
B. After Aging				
Temperature of the Test, °C	70	70	100	100
Aging Time, Hours	168	168	70	70
Tensile Strength, % (D573)	-25(max.)	-25(max.)	-15(max.)	-15(max.)
Elongation, %	-25(max.)	-25(max.)	-40(max.)	-40(max.)
Durometer Hardness, Shore Pts.	+10(max.)	+10 (max.)	+15 (max.)	+15 (max.)
Other Properties:				
Ozone Resistance(D1149)				
Partial Pressure, MPa	25	25	100	100
Duration, Hours	48	48	100	100

Tested at 20% strain 37.7 °C ± 1 °C Mounting procedure D518	-	-	No cracks	No cracks
Procedure A Brittleness D2137, low temp. Brittleness at -40 °C	Pass	Pass	Pass	Pass
Shear Modulus Nominal Hardness Shear Modulus at 23 °C, MPa	0.85-1.1	1.13-1.84	0.85-1.1	1.13-1.84

Plain pads and laminated bearings shall be manufactured to the design dimensions and these specifications with the tolerances listed in Table 2, unless other tolerances are shown on the design drawings.

Table 2 – Tolerances

Design Dimensions/Parts	Mm
Overall vertical dimensions	
Design thickness 32 mm (1 ¼ in) or less	-0, +3
Design thickness over 32 mm (1 ¼ in)	-0, +6
Overall horizontal dimensions	
914 mm (36 in) and less	-0, +6
Over 914 mm (36 in)	-0, +12
Thickness of individual layers of elastomer (laminated bearing only) at any point within the bearing	±20 percent of design value but no more than ±3 mm (1/8 in)
Variation from a plane parallel to the theoretical surface: (as determined by measurements at the edge of the bearings)	
Top	Slope relative to the bottom of no more than 0.005 radian
Sides	6
Position of exposed connection members	3
Edge cover of embedded laminated connection members	-0, +3
Size of holes, slots or inserts	±3
Position of holes, slots, or inserts	±3

### 412.3 Construction Requirements

#### 412.3.1 Handling, Transport, Storage and Installation

During handling, transport, storage, and installation, bearings shall be kept clean and protected from mechanical damage, heat, contaminants and other deleterious effects.

Bearings shall be placed on surfaces that are plane to within 1.6 mm and unless the bearings are placed in opposing pairs, horizontal to within 0.01 radians.

Any lack of parallelism between the top of bearing and the underside of the girder that exceeds 0.01 radians shall be corrected either grinding of the surface, grout pack bearing seats or modification of the bearing such that the intended bearing placement is as originally designed with the least amount of bearing modification, or as otherwise directed by the Engineer.

Exterior plates of the bearing shall not be welded unless at least 38.1 mm of steel exists between the weld and the elastomer.

Each completed bearing shall have its components clearly identified, be securely bolted, straffed or otherwise fastened to prevent any relative movement and marked on its top as to location and orientation in each structure in the projects conformity with the plans.

Dismantling at the site shall not be done unless absolutely necessary for inspecting or installation.

#### **412.3.2 Sampling**

Sampling, testing and acceptance consideration will be made on a lot basis. A lot shall be further defined as the smallest number of bearings as determined by the following criteria:

- a. A lot shall not exceed a single contract or project quantity.
- b. A lot shall not exceed 50 bearings.
- c. A lot shall consist of those bearings of the same type regardless of load capacity.

For acceptance purposes, bearing from within the lot shall be selected at random as samples for inspection and testing.

A minimum of three bearings shall be taken from the lot for testing. If the number of bearings in the lot exceeds 50 then for each additional 50 or part thereof, one additional bearing shall be taken for testing.

#### **412.3.3 Acceptance Requirements**

1. If lack of elastomer to steel bond is indicated, the bearing shall be rejected.
2. If laminate placement faults are observed which results in elastomer layer thickness that exceed the tolerances in Table 2, the bearing shall be rejected.
3. If there are at least three separate surface cracks which are each at least 2 mm wide and 2 mm deep. The bearing shall be rejected.
4. Record the median compressive stiffness (K) of the bearing of median stiffness. The compressive stiffness of each bearing tested shall not differ from (K) by more than 10%.

5. For each bearing that fails to meet the requirements in (1), two additional bearings may be sampled and shall meet the requirements in (1) or the lot shall be rejected.
6. If the lot is not rejected, the bearing of median stiffness (K) shall be subjected to the elastomeric material tests in (2).

#### 412.4 Method of Measurement

The quantity of elastomeric bearing pad to be paid for will be the final quantity placed and accepted in the completed structure. The dimensions of elastomeric bearing pads will be the quantity placed in accordance with the Plans or as otherwise directed by the Engineer.

#### 412.5 Basis of Payment

The accepted quantity, measured as prescribed in Section 412.4, shall be paid for at the contract unit price for Elastomeric Bearing Pads 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
412 (1)	Elastomeric Bearing Pads, DURO 60	Each

### ITEM 507 – RUBBLE CONCRETE

#### 507.1 Description

This item shall consist of the construction of rubble concrete in accordance with this specification and in conformity with the lines, grades, slopes and dimensions shown in the Plans or established by the Engineer.

#### 507.2 Material Requirements

##### 507.2.1 Stone

The stone shall be cleaned, hard, and durable and shall be subject to the Engineer's approval. Adobe stone shall not be used unless otherwise specified. Stones to be used shall be more than 0.015 cubic metre in volume and not less than 75 percent of the total volume of rock embankment and shall consist of stones 0.03 cubic metre in volume as described in Item 506.2. Stones obtained from excavation performed under this contract may be used.

##### 507.2.2 Concrete Class "B"

Concrete shall be Class "B" in accordance with Item 405, Structural Concrete.

**507.3 Construction Requirements****507.3.1 Preparation of Foundation Bed**

The foundation bed shall be excavated to the lines and grades as shown in the plans as directed by the Engineer, and shall be thoroughly compacted in accordance with Item 104.3.3.

**507.3.2 Falsework and Formwork Construction**

Falsework/formwork shall be constructed so as to withstand the stresses imposed.

Formwork used shall be constructed with sufficient strength, rigidity and shape as to leave the finished works true to the dimensions shown on the Plans and with the surface finished as specified.

The inside surface of the forms shall be cleaned of all dirt, water and foreign materials. Forms shall be thoroughly coated with form oil prior to use. The form oil shall be commercial quality form oil or other approved coating which will permit the ready release of forms and will not discolor the concrete.

**507.3.3 Placing**

One layer of concrete Class "B" shall be placed at the prepared bed prior to placing of stones. Clearance between stones shall not be less than 2-1/2 inches or the maximum size of concrete aggregate for Class "B".

Concrete Class "B" shall be placed after each layer of stone and shall be thoroughly consolidated by means of a vibrator inserted in each layer of concrete. In no case shall the vibrator be operated longer than 10 seconds in any location.

After removal of forms, any cavities, voids and honeycomb spots shall be filled up with mortar composed of one part cement and two parts sand.

All debris and refuse resulting from work shall be removed and the site left in a neat and presentable condition.

**507.3.4 Weepholes**

It shall conform to the requirements of Item 504, Riprap and Grouted Riprap under Subsection 504.3.4, Weepholes.

**507.4 Method of Measurement**

The quantity to be paid for shall be the number of cubic meters of rubble concrete complete in place and accepted. In computing the quantity of payment the dimension used shall be those shown on the plans or ordered in writing by the Engineer. No reduction shall be made for weepholes.

**507.5 Basis of Payment**

The quantity of rubble concrete determined as provided in the preceding section 507.4, Method of Measurement, shall be paid for at the contract unit price per cubic

meter for rubble concrete, which price and payment shall be full compensation for the preparation of the bed, furnishing, necessary excavations, falsework, and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
507 (1)	Rubble Concrete	Cubic Meter

## ITEM 508 HAND-LAID ROCK EMBANKMENT

### 508.1 Description

This Item shall consist of hand-laid rock embankment, as designated in the Bid Schedule, constructed in accordance with this Specification and in conformity with the lines and grades shown on the plans or established by the Engineer.

### 508.2 Material Requirements

Stones to be furnished and used shall be sound, clean, hard, and durable and in a wellbalanced range of sizes that would meet the requirements herein. Stones shall be approved by the Engineer. Unless otherwise specified on the Drawings, all stones shall be more than 0.015 cubic meter in volume and not less than 75 percent of the total volume of rock embankment shall consist of stone 0.03 cubic meter in volume. Stones obtained from excavation performed under this Contract may be used and shall be approved by the Engineer. Adobe stone shall not be used for the construction of rock embankment, unless otherwise specified. Broken concrete pieces 300 mm maximum size may be used with the approval of the Engineer.

### 508.3 Method of Measurement

The quantities to be measured and paid for shall be the number of cubic metre of hand laid rock embankment as indicated in the Bill of Quantities including stones furnished, place laid in position, completed and accepted by the Engineer.

### 508.4 Basis of Payment

The quantities determined in Section 508.3 Method of Measurement, will be paid for at the contract unit per cubic meter which price and payment shall constitute full compensation for excavation and preparation of bed, furnishing, selecting and transporting of stones, for placing stones by hand, backfilling or filling and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
508(1)	Hand-Laid Rock Embankment	Cubic Meter

**517.1 Description**

This Item shall consist of furnishing and installing drain pipes, fastened with steel straps that are either bolted to pier copings, welded or fastened to girders in various locations of the bridge, or as indicated in accordance with this Specification and in conformity with the lines, and grades and dimensions shown in the Plans or as established by the Engineer.

Longitudinal drainage for bridges shall be provided by scuppers (catch basin) or drainpipe, which is of sufficient size and number to drain the storm water in the gutter adequately. Downspouts, where required, shall be made of rigid corrosion-resistant material not less than 150 mm in least dimension and should be provided with cleanouts. The details of drains shall such as to prevent the discharge of drainage water against any portion of the structure or on moving traffic below and to prevent erosion at the outlet of the downspout. Downspout shall be provided with pipe supports, where required on the Drawings.

The Contractor shall submit working drawings to the Engineer for his review. All working drawings shall show full detailed dimensions, sizes for all component parts of the structure. The required grade of steel for each individual steel fabrication shall be clearly indicated.

**517.2 Material Requirements**

Polyvinyl Chloride (PVC) pipe shall meet the requirements specified in one of the following specifications: ASTM 3034, D 2241, D 1785, D 2665, D 2680, F 789, F 679 or AASHTO M 304M (D2729).

Galvanized iron pipe shall meet the requirements specified in one of the following specifications: ASTM A53, AASHTO M 36 or M 218.

Steel strap shall meet the requirements of Item 712, Structural Metal; Item 409, Welded Structural Steel and Item 411, Paint, DPWH Standard Specifications, Volume II, Highways, Bridges and Airports.

Anchor bolts and bolts fasteners shall meet the requirement of Item 712, Structural Metal, DPWH Standard Specifications, Volume II, Highways, Bridges and Airports. 2013 edition.

Drain pipes for all bridges other than steel girder bridges shall be of standard galvanized iron pipe conforming to ASTM A501 with the diameter of 150 mm or as shown on the Drawing.

**517.3 Construction Requirements**

Drain pipes shall be constructed in accordance with the lines, dimensions and details shown on the Drawings or as directed by the Engineer. Drain pipe extension, if needed shall be attached to the ends of existing drain pipes either using pipe sleeves or pipe with bell sockets. The length of the extension shall depend on the existing drain pipe condition and the location as shown in the Plans and shall be lower than the required vertical clearance or as directed by the Engineer.

Pipes and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. Pipes installed shall be as uniform as commercially practical in color, opacity, density and other physical properties.

Fabrication of steel straps shall conform to the dimensions shown in the Plans and must be galvanized. Steel strap, unless otherwise specified, shall be coated with two shop coats of red lead paint and two field coats of paint as specified under Item 411, paint, DPWH Standard Specifications, Volume II, highways, bridges and Airports.

Anchor bolts shall be placed as provided under Item 403, metal Structures.

Welded connections shall conform to the requirements of Item 409, Welded Structural Steel, DPWH Standard specification, Volume II. Highways, bridges and Airports.

**517.4 Measurement and Payment**

Drain pipes shall be measured and paid on a linear meter basis, completed and accepted.

The quantities measured shall be paid for at the contract price for the Pay Items which price and payment shall be full compensation for furnishing and placing all materials and for all labor, equipment, tools, testing, supervision, transportation, shipping and storage costs, test assembly and all incidentals and appurtenances necessary to complete the work.

The payment shall be deemed to include full compensation for all additional materials and work not shown on the Drawings or specified, which are necessary to complete the installation.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
517(1)a	Drain Pipe 100 mm Diameter, Galvanized Pipe including Pipe Fittings	Linear Meter



**ITEM BRIDGE-001 PREMOLDED EXPANSION JOINT FILLER WITH SEALANT**

Premolded expansion joint filler with sealant for concrete paving and structural construction shall conform to the applicable requirements of AASHTO M153.

# **PART G**

## **Drainage and Slope Protection Structures**

**ITEM 500 PIPE CULVERTS AND STORM DRAINS****500.1 Description**

This Item shall consist of the construction or reconstruction of pipe culvert and storm drains, hereinafter referred to as "conduit" in accordance with this Specification and in conformity with the lines and grades shown on the plans or as established by the Engineer.

**500.2 Material Requirements**

Material shall meet the requirement specified in the following specifications: Reinforced concrete culvert, storm drain and sewer pipe – AASHTO M 170

Joint Mortar – Joint mortar for concrete pipe shall consist of 1 part, by volume of Portland Cement and two (2) parts of approved sand with water as necessary to obtain consistency.

**500.3 Construction Requirements****500.3.1 Excavation**

Trenches shall be excavated in accordance with the requirement of Item 103, Structure Excavation, to a width sufficient to allow for proper jointing of the conduit and thorough compaction of the bedding and backfill materials under and around the conduit.

**500.3.2 Bedding**

The minimum thickness of bedding material beneath the pipe shall be 100 mm. The bedding material shall be sand or selected sandy soil all of which a 9.5 mm sieve and not more than 10 percent of which passes a 0.075 mm sieve.

**500.3.3 Backfilling**

Materials for backfilling on each side of the conduit for the full trench width and to an elevation of 300 mm above the top of the conduit shall be fine, readily compactible soil or granular material selected from excavation or from an approved source, and shall not contain stones that would be retained on a 50 mm sieve, chunks of highly plastic clay, or other objectionable material. Granular backfill material shall have not less than 95% passing a 12.5 mm sieve and not less than 95 % retained on a 4.75 mm sieve. Over size material, shall be removed from the backfill, except as directed by the Engineer.

**500.4 Method of Measurement**

The quantities to be paid for, for each class and diameter of new pipe culverts, shall be the lengths of pipes between the outside faces of the headwalls, measured along the axis of the pipes as, installed in place, completed and accepted.

**500.5 Basis of Payment**

The accepted quantities of conduit, determined as provided for in Section 500.4, Method of Measurement shall be paid for at the Contract unit price per linear meter for the conduit of the types and sizes specified and completed in place. The price and payment shall be full compensation for furnishing and placing all materials, including granular bedding and backfill and all labor, equipment, tools and incidentals necessary to complete the item.

Excavation for culverts, including excavation below flow line grade and for imperfect trench, shall be measured and paid for as provided in Item 103, Structure Excavation.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
500(1)a1	Pipe Culvert, 300mm diameter Class II, Type B (RCPC)	Linear Meter
500(1)a2	Pipe Culvert, 610mm diameter Class II, Type B (RCPC)	Linear Meter
500(1)a3	Pipe Culvert, 910mm diameter Class II, Type B (RCPC)	Linear Meter
500(1)a4	Pipe Culvert, 1070mm diameter Class II, Type B (RCPC)	Linear Meter
500(1)a5	Pipe Culvert, 1220mm diameter Class II, Type B (RCPC)	Linear Meter

**ITEM 502 MANHOLES, INLETS AND CATCH BASINS****502.1 Description**

This Item shall consist of the construction of manholes, inlets and catch basins in accordance with this Specification and to the lines, grades, dimensions and locations shown on the Drawings or as established by the Engineer.

**502.2 Material Requirement**

Unless otherwise indicated on the Drawings, concrete for these structures shall be concrete Class "A" and shall be in accordance with item 405, Structural Concrete, and reinforcing steel AASHTO M 31.

**502.3 Method of Measurement**

Excavation for manholes, inlets and catch basins will be measured and paid for as provided in item 103 Structure Excavation. No payment shall be made on areas over cut or excavated outside the specified section as shown in the

Plan detail shall be paid

**502.4 Basis of Payment**

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
502 (1)a	Manhole (1.0m x 1.0m) for 460mm diameter RCPC	Each
502 (1)a3	Manhole for 910mm diameter RCPC	Each
502 (1)a4	Manhole for 1070mm diameter RCPC	Each
502 (1)a5	Manhole for 1220mm diameter RCPC	Each
502 (4)a	Manhole for RCBC	Each
502 (3)	Catch Basin	Each

**502.8 Hand Laid Rocks****502.8.1 Description**

This Item shall consist of stone masonry in minor structures, in headwall for culverts, in retaining walls at the toes of slope, and at other places called for on the plans, constructed on the prepared foundation bed, in accordance with this Specification and to the lines, grades and dimensions shown on the Drawings. This work also includes construction of weepholes.

**502.8.2 Material Requirements****502.8.2.1 Stone**

Stones shall be clean, hard and durable and shall be subject to the approval of the Engineer. Unless otherwise specified on the Drawings or as directed by the Engineer, stones for masonry shall be Class A as described in Item 504, Riprap and Grouted Riprap. Stones shall have roughly similar blunted ends.

**502.8.2.2 Mortar**

The mortar for stone masonry shall be composed of one (1) part Portland cement to two (2) parts of sand by volume and sufficient water to obtain the required consistency and shall conform to the requirements of materials under Item 405, Structural Concrete.

**502.8.3 Construction Requirement****502.8.3.1 Selection and Placing**

Care shall be taken to prevent the bunching of small stone or stones of the same size. Large stones shall be used in the corners.

All stones shall be cleaned thoroughly and wetted immediately before being set, and the bed shall be cleaned and moistened before the mortar is spread. They shall be laid with their longest faces horizontal in full beds of mortar, and the joint shall be flushed with mortar.

**502.8.3.2 Weepholes**

It shall conform to the requirement of item 504, Riprap and Grouted Riprap.

**502.8.3.3 Cleaning Exposed Faces**

Immediately after being laid, all outside face stone shall be thoroughly cleaned of mortar stains and shall be kept clean until the work is completed.

**502.3.4 Method of Measurement**

Stone Masonry shall be measured by the number of cubic meter in place, completed and accepted by the Engineer in accordance with the Drawings. Only accepted work will be measured for payment and the computation of the quantity thereof will be based on the volume within the limiting dimensions designated on the Drawings or as determined by the Engineer. No separate measurement shall be made for filter materials.

**502.3.5 Basis of Payment**

The quantities measured as provided under Sub-Section 506.4, Method of Measurement shall be paid for at the Contract unit price as listed in the Bill of Quantities, which price and payment shall be full compensation for excavation and preparation of the bed, for furnishing and placing all materials including weep holes, filter materials, backfill, and additional fill to bring the riprap bed to the line, grades and dimension as shown on the Drawings and for all labor, equipment, tools and incidentals necessary to complete the work item.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
502(8)	Hand Laid Rocks	Cubic Meter

# **PART J**

## **Streetlights and Area Lightings**

**PART J – STREETLIGHTS AND AREA LIGHTINGS****ITEM LIGHTING-001 CONSTRUCTION OF CONCRETE PEDESTAL**

All electrical light pole footings shall be reinforced concrete with dimensions as indicated on the Plans. Concrete shall be Class “A” and together with the reinforcing steel shall conform to the requirements of the DPWH Standard Specifications for Public Works and Highways, 2013 Edition: Volume II Highways, Bridges and Airports.

**ITEM LIGHTING-002 SUPPLY AND INSTALL SINGLE ARM POST, WITH STREET LIGHT (INCLUDING LIGHTING CONTROL PANEL)****ITEM LIGHTING-003 SUPPLY AND INSTALL SINGLE ARM POST, WITH STREET LIGHT (INCLUDING LIGHTING CONTROL PANEL)****Description**

The item shall consist of furnishing and installing the street lighting system as required by the Plans and as described in this Specification. The work shall include the following:

- a. Electrical services, including all conduits, junction boxes, fittings, and wiring from the Power Utility Company supply and meter to lighting panel boards, and poles with luminaires.
- b. Lighting panels
- c. Complete street luminaires
- d. Lighting Standard poles and foundation
- e. Cable trench, excavation and backfilling

**Material/Product Requirements****1. General Requirements**

All materials and equipment to be used and to be installed shall be new and of the approved type bearing the stamp of approval of the Underwriter's Laboratories, Inc.

From General Notes, power service voltage or Utility transformer shall be provided by Others, not by the contractor, estimate a “service lateral towards nearest utility handhole which shall be not more than 30 meters away.

But primary distribution line, poles and pole line hardware are for the Contractor's scope of works.

**Fungus Control**

No substitute will be accepted, unless the materials and equipment specified herein are not available. Locally manufactured and/or any other substitute



materials and equipment may be accepted, provided they are better or the full equivalent in design, quality and size of materials and workmanship, and provided further they carry the written approval before they are installed.

All electrical equipment and materials except otherwise specified shall be treated to resist moisture and fungus. Electrical components such as switches, breakers, fuses, contacts, and heater elements shall not be treated. Other materials and components, which are inherently fungus – resistant or protected by hermitically sealing, need to be treated.

All other circuit elements that have a temperature rise of not more than 30° C when operating at full load shall be coated with a fungus-resistant varnish. Circuit elements include but are not limited to cables, wires, connectors, panels, terminals and terminal junction block capacitors and coils.

### **Circuit Breakers**

The molded case circuit breakers shall be of the thermal magnetic type having inverse-time tripping characteristics on overload and instantaneous trip on short circuits, shall be equipped with arc quenchers, shall have quick-make and quick-break toggle mechanism, shall have trip-free operating handles. Each multi-pole breaker shall have a common trip so that an overload on one pole will automatically cause all poles of the breaker to open. The circuit breakers shall have an interrupting rating of not less than 10,000 symmetrical amperes at 400 volts.

## **2. Street Lighting Poles and Luminaries**

### **Pole**

Provide Lighting Standard Poles designated for wind loading of 100 kilometers per hour determined in accordance with AASHTO LTS-2 while supporting luminaries having effective projected areas indicated. Poles shall be anchor-base type designated for use with underground supply conductors. Galvanizing shall be in accordance with the requirements of ASTM A-120 for the poles and A-153 for the fittings. Effective height shall be 12.0m, mast length equals 3.0m, round tapering.

### **Luminaires**

Technical Specifications, 120Watts, LED Road Lighting, Operating Voltage 100-277VAC Volts, 100 lumens per watt or higher; 12,000 lumens; IP66; Lumen maintenance: 50,000 Hrs; Upgradeable Multi-layer Optics; UV treated; Thermally hardened tempered glass cover; Auto Dimming Function with a dimming percentage of 40.00%; High pressure die-cast aluminum with heat management system; Power Factor: 0.90 or higher; Electrical Insulation: Class 1; Surge Protection: 10kV; Color Temperature: 3500k to 4000k Maintenance: Replaceable Gear Tray, upgradeable / replaceable LED modules, SPD and driver, tool less luminaire opening and gear tray change; Warranty: 5 years warranty for LED system (LED / driver / optics / luminaire). Rectangular in shape.

As per the Electrical Drawings, Riser/Lighting Panel Wiring Diagram specified that the Roadway Luminaires are manually control on individual circuit breaker; LTG Control Options: Standalone Dimming Program, Telemanaged City Touch, Star Sense and AmpLight compatible. NEMA and D2 Type PE Cell must be provided by the Contractor. This feature is already included in the

Modern LED Lighting Luminairepackage.

**Compliance with the Energy Efficient LED Streetlight Specifications and with the following LED Quality Industry Standards compliance requirements:**

1. EN 61347-1: general and safetyrequirements;
2. EN 61347-2-13: particular requirements for DC or AC supplied electronic control gear for LEDmodules;
3. EN 62384: DC or AC supplied electronic control gear for LED modules performance requirements;
4. EN 55015: 2006 and 2007-Limits and methods of radio disturbance characteristics of electricallighting;
5. EN 61547: 1995/+A1: 2000- Equipment for general lighting purpose EMC immunityrequirements;
6. EN 61000-3-2:2006 - Limitation of harmonic currentemission;
7. EN 61000-3-2:2008 - Limitation of voltage fluctuation andflicker;
8. IEC 60598-1(Ed7) general requirements for luminaries, incorporating electric light sources for operation from supply voltages up to 1000V;
9. IEC 60598-2-3 (Ed 2) - Electric Insulation Classl;
10. IEC 62471 photo-biological safety of lamps and lampsystems;

**Compliance with the Test Reports and Certifications from laboratories that are accredited according to ISO/IEC 17025 and qualified for pertinent testing of LED products particularly for roadway lighting by a recognized national or regional accreditation body (ILAC/APLAC) and to be submitted prior to delivery ofstreetlights.**

1. Technical Data of luminaire anddriver.
2. LM-70 Test Report (for luminaire electrical/photometricproperties);
3. LM-80 Test Report (for LED chipproperties);
4. Lumen Depreciation Test Report at 1000, 2000 and 3000 burning hours;
5. IEC 60598 TestReport;
6. Vibration TestReport;
7. EMC TestReport;
8. Salt Spray TestReport;
9. Factory ISO Certificate (ISO 9001: 2008/ISO 14001: 2004/ISO 18001: 2007);and
10. Lux Meter TestResults.

## **ENERGY EFFICIENT LED STREETLIGHT SPECIFICATIONS**

### **1. LED Streetlight LuminaireHousing**

The luminaire shall have a full die cast housing to provide adequate

rigidity and strength and also ensure proper heat dissipation. The luminaire housing shall have separate Driver and LED lamp cavity to ensure cooler operation of LED lamps and good electrical separation.

The optical LED compartment shall have a thermally hardened glass cover and high quality silicon gasket system. The glass cover shall be tightly secured with the housing. The complete luminaire shall be rated for IP 66 (IngressProtection).

## **2. Optics**

Specially designed lens system with unique inner and outer profile for high efficiency LED to ensure maximum spacing between the poles and cover higher road widths. Multi-layer optics designed to ensure adequate luminance and illuminance uniformity in the unlikely event of individual LED failure. The luminaire should offer choice of narrow beam, medium beam and wide beam light distribution.

The luminaire shall offer a composite system efficiency of at least 100 Lumen/Watt and a lumen package of no less than 12,000 lumens. The luminaire shall use high efficiency LED and optics system to achieve at least 50% energy savings compared to present High Pressure Sodium road-lighting system (including ballast).

## **3. Future Compatibility**

The luminaire shall be fully compatible with future LED upgrades when they become available. It shall have a modular design to upgrade / replace with new LED modules or LED drivers at site. All electronic components/drivers shall be mounted on a separate gear tray with tool-less access and replacement. The luminaire shall have space available inside for communications antenna or equipment to be integrated into the luminaire for future telemanagement control system implementation. Evidence showing telemanagement capability shall be provided.

## **4. Surge Protection**

The proposed luminaire shall have an in-built 2-stage surge protection system to protect (1st stage) the electronic driver and (2nd stage) the LED module with a minimum surge protection rating of 10KV.

## **5. Ingress Protection (IP) & ImpactResistance**

The luminaire shall have Full IP 66 protection to ensure long reliable performance and to minimize maintenance requirement and an Impact resistance of IK 08. No chemical glue is to be used as it may cause breakdown of water-proof and dust-proof seal.

## **6. Maintenance**

The driver compartment cavity and gear tray shall be designed with tool-less access for maintenance and replacement.

## **7. Mounting**

The mounting of the luminaire will be in axial orientation through Ø 48-60mm sidearm.

## **8. ThermalManagement**

Managing thermal properties in LED luminaires are most critical to ensure optimum performance of LEDs and reliability of the system.

The housing shell under the circuit board (PCB) should be specially designed to ensure perfect contact between the board and the luminaire housing for efficient heat dissipation. The PCB shall be designed to maximize heat transfer and should be mounted on the housing using a highly efficient thermal interface material. Use of Silicon glue is not acceptable.

The housing over the Driver compartment cavity shall have adequate surface area to ensure fast heat dissipation.

## **9. Color Rendering Index and ColorTemperature**

The luminaire should have a minimum color rendering index (Ra) of 70+/- 10 and a color temperature of 4000K. The LED shall have a color consistency preferably within 5 SDCM at a maximum of 7 SDCM (standard deviation of color matching) as defined by McAdam. The color temperature variation of the LEDs should be restricted as per ANSI C78.377A with CCT variation limiting within 500K for nominal CCT of 4000K.

## **10. Useful LifeHours**

The LED luminaire shall be designed for lumen maintenance of L70 or 70% at the end of useful life at ambient temperature of 35 degree Celsius. The complete luminaire shall have a useful life of 50,000 burning hours. The luminaire including the driver will include a warranty of 5 years against manufacturing defects.

## **11. Standards Conformity**

The luminaire should fully conform to the following specifications (please submit certificate or test report for each):

IEC 60598-2-3 - Part 2: Particular requirements: Sec. Three-Luminaires for road & streetlighting

62471 – Photo-biological safety of lamps and lamp systems

IEC 62493 – Assessment of lighting equipment related to human exposure to Electromagnetic Fields

EN 55015: 2006 and 2007 – Limits and methods of radio disturbance characteristics of electrical lighting.

EN 61547:1995 / +A1:2000 – Equipment for general lighting purpose EMC immunity requirements. EN 61000-3-2:2006 – Limitation of harmonic current emission.

EN 61000-3-3:2008 – Limitation of voltage fluctuation and flicker.

## **12. LED Driver Specifications**

The LED driver shall be designed to operate large array of high power LEDs through current controlled output. The driver shall be suitable for nominal 220V-240V 50/60Hz mains supply.

The LED driver shall incorporate multiple control interfaces for dimming capability. It shall enable DALI, & 1-10V DC interface dimming control. It shall also have a programmable feature to allow pre-programming of step dimming lighting levels based on the ONtime.

The LED driver shall fully conform to following specifications (please submit certificate or test report for each):

IEC61347-1 - General and safety requirements.

IEC61347-2-13 - Particular requirements for DC or AC supplied electronic control gear for LEDmodules.

IEC62384 - DC or AC supplied electronic control gear for LED modules

### **13. AmbientTemperature**

The luminaire shall be suitable for ambient temperature range of between -40 to 55 degrees Celsius. 3rd party IEC60598 Test Report shall be measured/corrected for Ta = 35 degreesCelsius.

### **14. LightingSimulation**

To support and establish the performance of the luminaire relative to the road, a lighting simulation showing compliance to Luminance measurement of 1 cd/m<sup>2</sup> should be submitted. Overall uniformity measurements shall not be less than0.40.

#### **a.) Conduit**

PVC Conduit shall conform to ANSI Standards. Fittings of types approved by the Engineer shall be provided as required for connection to junction, pull and outlet boxes and toequipment.

#### **b.) Insulated Conductors**

Conductors in raceway shall be copper with moisture and heat-resistant rubber or thermoplastic insulation. Wires and cables shall be type THW with nylon jacket for all wires. All types shall be PAS approved and shall conform to NEMA Standard Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy. Phelps Dodge brand or approved equal shall be used. For circuit ground wire, use TW type thermoplastic heat and moisture resistant.

#### **c.) Grounding Installation**

All street lighting poles and panel boards shall be effectively grounded. Conductor and ground wires shall be bare copper as shown and sizes as indicated in the plans. All connections shall be mechanically and

electrically sound and secured by insulating tape of approved type. Grounding wire shall be made of bare copper stranded, soft drawn wire and shall be installed in one continuous length without splices or joints.

Ground rods shall be made of copper-clad steel and shall be driven full length into the earth, sizes of which shall be as indicated on the plans for grounding details. Connection to the grounding rod shall be done exothermic weld.

**d.) Backfilling Materials**

Backfilling materials should be a suitable soil material and free from any objectionable matters and approved by the Engineer.

**e.) Power House Building**

The Contractor shall propose for the Power House Building Plan with an area as specified in the specifications as 4.0m x 6m and shall be for approval of the Engineer. Installation and construction of the Fuel Day tank is part of the Power House Building Construction

**f.) Pedestrian Lamp Post (on Landscaped Sections)**

Concrete Pedestal & Ground Rod with Clamp is part of the Contractor's scope of work. The Contractor shall provide for all interconnected wirings, conduits and necessary lighting control panel.

**Construction Methods**

**1. General**

**a. Codes and Regulations**

All works shall be done in accordance with the requirement of the latest edition of the PHILIPPINE ELECTRICAL CODE and the NATIONAL SAFETY CODE, with the applicable ordinances of the local government, and with the requirements of the local power company that will eventually furnish the service. Nothing contained herein or shown on the plans shall be constructed as to conflict with the requirements of these codes, which are hereby made part of the work of this item.

**b. Contractor Submittals**

The Contractor shall be required to submit shop drawings which shall include outline dimensions, mounting connections and clearance, ratings, elementary wiring diagrams, interconnection wiring diagrams, together with catalogs and descriptive data for the following:

- a. Lighting panels
- b. Streetlights, including lighting standard poles
- c. Photocell switch
- d. Manufacturer's Data.

When data that described more than one type, size, model, or item is submitted, clearly mark the data to indicate which type, size, model, or item is being provided. Data shall be sufficient to show conformance to specified requirements:

1. Luminaires
2. Lighting Standard Poles

e. Shop Drawings:

**Luminaires:** Include dimension, accessories and installation and construction details. Photometric data, including Zonal lumen data, average and minimum ratio aiming diagram and computerized candlepower distribution data shall accompany shop drawings.

**Poles:** Include dimensions, wind load determined in accordance with AASHTO LTS-1, pole deflection, pole class, and other applicable information and pole design calculations.

f. Certified Test Reports:

**Luminaires:**

1. Computerized horizontal illumination levels in foot-candles or lux at ground level, taken every 3 meters. Include average maintained foot-candle level and maximum ratio. Distribution data according to IES classification type of M-S-III as defined in IES Lighting Handbook. Luminaires not conforming to this standard are not acceptable.

## 2. Test Guarantee

When the installation is reported as completed and ready for acceptance, the Contractor, at his own expense, in the presence of the Engineer, shall make test as directed.

The Contractor shall supply all apparatus, materials and labor required for making the tests.

The Contractor shall furnish a guarantee covering all labor and materials for a period of one year from the date of final acceptance of his work and he shall agree to repair and make good at his expense any and all defects which may develop during that time, if in the opinion of the Engineer such defects had raised from defective workmanship or materials.

## 3. Installation

### a.) Lighting Panels

The Contractor shall install the panel boards at the locations in proper position and shall be completely wired and ready for operation. All power and control wire and cables shall enter the control equipment enclosure through conduits.

### b.) Conduit

Electrical conduits and fittings shall be installed in their correct positions and locations as shown on the plans. Conduit and fittings to be embedded in concrete shall be held securely in position while the concrete is being placed. All threaded conduit connections shall be painted with red lead sealing compound or glypical varnish.

All conduit bends shall be of standard radii bent without heating and shall be free from kinks, indentions, or other deformations, which reduce the cross-sectional area. Burrs and sharp edges at the end of each piece of conduit shall be removed with a taper reamer. Bend shall not exceed more than 4 quarter bend in laying conduit from boxes to boxes.

Bushing shall be installed on the ends of conduits at boxes or cabinets to protect conductors from abrasion, and locknuts and bond nuts shall be installed to provide tight grounded connections between conduits and boxes.

Conduits emerging from concrete surfaces shall be terminated with conduit coupling and pipe plugs.

During construction, ends of conduits shall be plugged at all outlets or boxes to keep the conduits dry and prevent the entrance of foreign matter into the conduits.

Locknuts and bond nuts shall be installed to provide tight ground connections between conduits and boxes, control board and cabinets. The ends, if conduits are terminating at cabinets, control boards or outdoor boxes, shall be sealed with an approved sealing to prevent air circulation from the conduit into the panel cabinet boxes.

### **c.) Concrete Foundations**

Comply with details for reinforcement and for anchor bolts, nuts, and washers. Verify anchor-bolt template by comparing with actual pole bases furnished.

### **d.) Pole Installation**

Use web fabric slings (not chain or cable) to raise poles. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer. Secure poles with level, plumb and square. Grout void between pole base and foundation. Use non-shrinking or expanding concrete grout firmly packed in entire void space. Use a short piece of 13mm diameter pipe to make a drain hole through grout.

### **e.) Luminaire Attachment**

Fasten to indicate structural supports.

Lamp luminaries with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

### **f.) Field Quality Control**

Testing and commissioning shall be in accordance with the manufacturer's recommendations.

Provide necessary testing tools and equipment and to include the following:



- Measure light intensities at night if specific illumination performance is indicated. Use photometers with calibration referenced to NIST standards, or approved equal.
- Check intensity and uniformity of illumination.
- Check excessive noisy ballast.

**g.) Excavation and Backfilling**

Prior to excavation, all necessary clearance shall be secured in advance for all underground facilities that can be found along cable trench.

Backfilling shall be done in approved manner using suitable excavated materials free from any objectionable matter and place in layers to be compacted thoroughly and evenly using mechanical tamper to a maximum density.

**h.) Conduit under Roadway**

Installation shall be such as to avoid pocket in the conduit run. All run shall be straight as possible and shall be installed in a neat and workmanlike manner. Conduits under roadway shall be encased in reinforced concrete.

**i.) Electrical Conductors and Grounding**

Electrical conductors and ground wires shall be furnished and installed by the Contractor. All insulating tape and compounds, solder, flux and connectors for making grounding connections shall be mechanically and electrically tight and secure.

All grounding connectors shall be furnished by the Contractor. The Contractor shall install electrical conductors and shall make all required connections as shown on wiring diagrams to be furnished or as directed by the Engineer. The conductors shall be installed so that there will be no cuts or abrasions in the insulations or protective covering of the conductor. No splices shall be made in conductors, except at boxes, outlets or cabinets.

**SPL 1100.1.3 Method of Measurement**

The works under this item will be paid for each of the items provided in the Bill of Quantities. Payments shall be full compensation for all materials, labor, plant, equipment, tools and incidentals, including all necessary tests and electrical permits that may be required and all other incidentals necessary to complete the whole electrical lighting system installation and each individual luminaire as detailed in the project drawings.

**SPL 1100.1.4 Basis of Payment**

The accepted quantities, measured as prescribed in Method of Measurement, shall be paid for at the contract unit price for Part J- Streetlights and Area Lightings for which the price and payment shall be full compensation for furnishings, and installation 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:

<b>Pay Item Number</b>	<b>Descripti on</b>	<b>Unit of Measurement</b>
LIGHTING-001	Construction of Concrete Pedestal	Sets
LIGHTING-002	Supply and Install Single Arm Post, with Street Light (including lighting control panel)	Sets
LIGHTING-003	Supply and Install Double Arm Post, with Street Light (including lighting control panel)	Sets

# **PART K**

## **Miscellaneous Structures**

**PART K MISCELLANEOUS STRUCTURES****ITEM 600 CURB AND GUTTER****600.1 Description**

This Item shall consist of the construction of curb and gutter either Precast or Cast in place, made of concrete in accordance with this Specification at the location, and in conformity with the lines, grades, dimensions and design, shown on the Plans or as required by the Engineer.

**600.2 Material Requirements****600.2.1 Material for Bed Course**

Bed course materials as shown on the plans shall consist of cinder, sand, slag, gravel, crushed stone, or other approved porous material of such grading that all the particles will pass through 12.5 mm sieve.

**600.2.2 Concrete**

Concrete shall be of the class indicated on the Plans and shall conform to the requirements of Item 405, Structural Concrete.

**600.2.3 Expansion Joint Filler**

Expansion joint shall conform to the requirements of AASHTO M 153/Item 705.

**600.2.4 Cement Mortar**

Cement mortar shall consist of one part of Portland cement and two parts of fine aggregates with water added as necessary to obtain the required consistency. The mortar shall be used within 30 minutes of preparation.

**600.2.5 Bonding Compound**

Where bonding compound is used, it shall conform to AASHTO M 200.

**600.3 Construction Requirements****600.3.1 Bedding**

Excavation shall be made to the required depth and the base upon which the curb and/or gutter is to be set shall be compacted to a firm and even surface. All soft and unsuitable material shall be removed and replaced with suitable material.

Bed course material shall be placed and compacted to form a bed of the required thickness as shown on the Plans.

**600.3.2 Cast in Place Curb and Gutter**

**600.3.2.1 Placing**

Forms shall conform to the requirements of Item 407, Concrete Structures. Metal forms shall be of an approved section.

Forms to hold the concrete shall be built and set-in-place as described in Item 407, Concrete Structures. Forms for at least 50 m of curb and gutter shall be in-place and checked for alignment and grade before concrete is placed. Curbs and gutters constructed on curves shall have forms of either wood or metal and they shall be accurately shaped to the curvature shown on the Plans.

Mixing, Placing, Finishing and curing of concrete shall conform to the requirements of Item 405, Structural Concrete, as modified by the requirements below.

The concrete shall be placed in the forms in layers of 100 or 125 mm each, and to the depth required. It shall be tamped and spaded until mortar entirely covers the top and surfaces of the forms. The top of the concrete shall be finished to a smooth and even surface and the edges rounded to the radii shown on the Plans. Before the concrete is given the final finishing, surface of the gutter shall be tested with a 3-m straight-edge and any irregularities of more than 10 mm in 3 m shall be corrected.

The curb and gutter shall be constructed in uniform section of not more than 50 m in length except where shorter sections are required to coincide with the location of weakened planes or contraction joints of 2 m long. The sections shall be separated by sheet templates set perpendicular to the face and top of the curb and gutter. The templates shall be approximately 5 mm in thickness and of the same width as that of the curb and/or gutter and not less than 50 mm deeper than the depth of the curb and/or gutter. Templates shall be set carefully and held firmly during the placing of the concrete and shall remain in place until the concrete has set sufficiently to hold its shape but shall be removed while the forms are still in place. A preformed joint filler approved by the Engineer may be used in lieu of the sheet template mentioned above. In this event the fiber board shall be pre-cut to the shape of the curb so that its outer edge will be flushed with the abutting curb and/or gutter.

Expansion joint shall be formed at intervals shown on the Plans. Where a curb is placed next to a concrete pavement, expansion joints in the curb shall be located opposite expansion joints in the pavement.

The form shall be removed within 24 hours after the concrete has been placed. Minor defects shall be repaired with mortar containing one part of Portland cement and two parts of fine aggregate. Plastering shall not be permitted and all rejected portions shall be removed and replaced at the Contractor's expense. The exposed surface shall be wetted with soft brick or wood until they are smooth. The surfaces shall be wetted thoroughly, either by dipping the brick or wood in water, or by throwing water on the surfaces with a brush. After the concrete has been rubbed smooth using water, it shall

then be rubbed with a thin grout containing one part of Portland cement and one part of fine aggregates. Rubbing with grout shall continue until uniform color is produced. When completed, the concrete shall be covered with suitable material may be applied as provided in Item 405, Structural Concrete. The concrete shall be suitably protected from the weather until thoroughly hardened.

After the concrete has set sufficiently, the spaces on the back of the curb which were excavated for placing the curb shall be refilled to the required elevation with suitable material which shall be tamped in layers of not more than 150 mm until consolidated.

### **600.3.3 Precast Curb and Gutter**

#### **600.3.3.1 Placing**

The precast concrete curb and gutter shall be set in 20 mm of cement mortar as specified in Subsection 600.2.4 to the line level and grade as shown on the approved Plans.

The precast curb shall not be more than 20 cm in width at the top portion and not be more than 25 cm at the base. The precast curb and gutter shall be 1.0 m in length and shall be put side consecutively with joint in between.

Joints between consecutive curb and gutter shall be filled with cement mortar to the full section of the curb and gutter. Expansion joints shall be formed at intervals shown on the Plans. Where a curb and gutter is placed next to a concrete pavement, expansion joints in the curb and gutter shall be located opposite expansion joints in the pavement.

Minor defects shall be repaired with mortar containing one part of portland cement and two parts of fine aggregates. Plastering shall not be permitted and all rejected portions shall be removed and replaced at the contractor's expense. The exposed surface shall be finished by rubbing the surfaces with a wetted soft brick or wood until they are smooth. The surfaces shall be wetted thoroughly, either by dipping the brick or wood in water, or by throwing water on the surfaces with a brush. After the concrete has been rubbed smooth using water, it shall then be rubbed with a thin grout containing one part of Portland cement and one part of fine aggregate. Rubbing with grout shall continue until uniform color is produced.

#### **600.3.3.2 Handling Precast Curb and Gutter**

1. In preparation for the handling of precast curb and gutter, all fabricated curb and gutter of one (1) meter in length shall be provided or inserted with 2(25 mm) Ø PVC pipes for fitting at their required locations. The PVC pipes shall be placed 25 mm from both edge during the plastic state of fresh concrete.

2. Precast curb and gutter shall be lifted on upright position and not at the points of support and shall be the same during transporting and storage.
3. Extreme care shall be exercised in handling and moving precast curb and gutter to avoid cracking.
4. No precast curb and gutter shall be used that does not reach its final position in the forms with the required time stipulated prior to installation.
5. Precast curb and gutter shall be transferred to the construction site. Fresh curb and gutter shall not be placed against in-situ concrete which has been in a position for more than 30 minutes.
6. Precast curb and gutter may only be transported to the delivery point in truck agitators truck mixer operating at the speed designated by the manufacturer of the equipment, provided that the consistency and workability of the mix concrete upon discharge at the delivery point is suitable for adequate placement.

#### 600.4 Method of Measurement

The length of curb and gutter to be paid shall be the number of linear meters of curb and gutter (cast in place) or the number of pieces of precast curb and gutter of the required dimension shown on the Plans measured along its front face in-place, completed and accepted. No deductions shall be made for flattening of curbs at entrances and no additional allowances shall be made for curbs and gutters constructed on curves.

#### 600.5 Basis of Payment

The length of curb and gutter determined in Subsection 600.4, Method of Measurement, shall be paid for at the contract unit price per linear meter for curb and gutter which price and payment shall constitute full compensation for furnishing and placing all materials for concrete, forms for drainage openings, excavation for curb and gutter, backfilling, dumping and disposal of surplus materials, and for all labor, equipment, tools and incidentals necessary to complete the item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
600(2)	Concrete Curb and Gutter (D1)	Linear Meter
600(3)	Concrete Curb and Gutter (D2)	Linear Meter

**ITEM 605 ROAD SIGNS****605.1 Description**

This item shall consist of furnishing and installing road signs in accordance with this Specification, at the locations, and in conformity with the lines and grades shown on the Plans, or as required by the Engineer.

Road sign shall be classified as standard or non-standard. Standard signs consist of all warning signs, regulatory signs and informative signs with the exception of direction signs, place identification signs and the line. Non-standard signs consists of all informatory signs which are not classified as standard signs.

**605.2 Materials Requirement****605.2.1 Sign Panels**

Sign panels for warning, regulatory, and informatory signs shall be manufactured from aluminum sheeting at least 3 mm thick.

**605.2.2 Reflective Sheeting****Table 605.1 – Reflective Brightness of Traffic Signs Surfaces**

Color	Angle of Incidence	Angle of Divergence	Minimum Reflective Brightness Value Compared with MgO
Red	-4°	0.5°	15
	20°	0.5°	10
	50°	0.5°	3
White	-4°	0.5°	75
	20°	0.5°	70
	50°	0.5°	70
Yellow	-4°	0.5°	35
	20°	0.5°	35
	50°	0.5°	10
Blue	-4°	0.5°	6
	20°	0.5°	4.5
	50°	0.5°	0.5
Green	-4°	0.5°	6
	20°	0.5°	4.5
	50°	0.5°	0.5



**605.2.3 Post and Frames**

Posts for road signs shall be either G.I. pipe conforming to ASTM A 283 Grade D. In lieu of wide flange steel posts, the Contractor may use tubular steel posts conforming to ASTM A 501. All posts shall be thoroughly cleaned, free from grease, scale and rust and shall be given one coat of rust inhibiting priming paint and two coats of gray paint in accordance with Item 411, Paint.

Other structural steel members shall conform to ASTM A 283 Grade D.

**605.2.4 Nuts and Bolts**

Nuts, bolts, washers and other metal parts shall be hot-dip galvanized after fabrication in accordance with the requirements of AASHTO M 111.

**605.2.5 Concrete Foundation Blocks**

The concrete for the foundation blocks shall be class A in accordance with item 405, Structural Concrete and shall be of the size shown on the plans.

The exposed portions of the fastening hardware on the face of the signs shall be painted with enamel matching the background color.

**605.3 Construction Requirements****605.3.1 Excavation and Backfilling**

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

Backfilling shall be carried out by using suitable material approved by the Engineer and shall be compacted in layers not exceeding 150mm in depth. Surplus excavated material shall be disposed of by the Contractor as directed by the Engineer.

**605.3.2 Erection of Posts**

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

**605.3.3 Sign Panel Installation**

Sign panels shall be installed in accordance with the details shown on the Plans. Any chipping or bending of the sign panels shall be considered as sufficient cause to require placement of the panels at the Contractor's expense.

The exposed portion of the fastening hardware on the face of the signs shall be painted with enamels matching the backgroundcolor.

All newly erected traffic road signs shall be covered until ordered removed by the Engineer.

#### **605.4 Method of Measurement**

The quantities of standard reflective warning and regulatory signs shall be the number of such signs of the size specified, including the necessary posts and supports erected and accepted.

#### **605.5 Basis of Payment**

The accepted quantities of road signs, determined in Subsection 605.4 Method of Measurement, shall be paid for at the contract unit price per unit for the type specified, completed in place.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
605 (2)r2	Regulatory Signs	Each

### **ITEM 610 – SODDING**

#### **610.1 Description**

This Item shall consist of furnishing and laying of live sod on the shoulders, slopes, ditches, or other locations as designated, construction of sod ditch checks or similar appurtenances, as shown on the Plans or as ordered and laid out in the field by the Engineer, all in accordance with this Specification.

#### **610.2 Material Requirements**

The sod shall consist of healthy, dense, well-rooted growth of permanent and desirable grasses indigenous to the general locality where it is to be used and shall be free from weeds or undesirable grasses. At the time the sod is cut, the grass on the sod shall have a length of approximately 50 mm (if longer, the grass shall be cut to approximately this length) and the sod shall have been raked free from debris.

The sod shall be cut into uniform squares approximately 300 mm x 300 mm, but not larger than is convenient for handling and transporting. The thickness of the sod shall be uniform as possible approximately 40 mm or more depending on the nature of the sod, so that practically all of the dense root system of the grasses will be retained, but exposed, in the sod strip and that the sod can be handled without undue tearing or breaking. In the event the sod to be cut is in a dry condition as to cause scrambling or breaking during cutting operations, the Contractor, at his own expense, shall apply water in sufficient quantities at least 12 hours before cutting to provide a well moistened condition of the sod to the depth to which it is to be cut. Sods shall be subject to the approval of the Engineer.

#### **610.3 Construction Requirements**

**610.3.1 Preparation of the Earth Bed**

The area to be sodded shall be constructed to the required cross-section and contour, and the tops and bottoms of the slopes shall be rounded as shown in the typical roadway sections. The areas to be sodded shall be free from stones, roots or other undesirable foreign materials. The soil on the area to be sodded shall be loosened and brought to a reasonably fine texture to a depth of not less than 30 mm by means of equipment on hand methods adapted for the purpose.

**610.3.2 Placing the Sod**

The earth bed upon which the sod is to be placed shall be moistened to the loosened depth, if not naturally sufficiently moist, and the sod shall be placed thereon within 24 hours after the same has been cut. Unless otherwise required, the sod on slopes shall be laid on horizontal strips beginning at the bottom of the slope and working upwards. When placing sod in ditches, or in the construction of sod ditch checks or similar appurtenances, the length of the strips shall be laid at right angles to the direction of the flow of the water.

Sod shall be laid so that the joints caused by abutting ends of sod strip are not continuous. Each sod strip shall be so laid as to abut snugly against the strip previously laid.

As the sod is being laid it shall be lightly tamped with suitable wooden or metal tampers sufficiently to set or press the sod into the underlying soil. At points where it is anticipated that water may flow over a sodded area, the upper edges of the sod strips shall be turned into the soil to be below the adjacent area and a layer of earth place over this juncture and thoroughly compacted. At the limits of sodded areas, the end strips shall be turned in and treated similarly.

**610.3.3 Staking the Sod**

On all slopes steeper than one vertical to four horizontal, sod shall be pegged with stakes 200-300 mm in length, spaced as required by the nature of the soil and steepness of slope. Stakes shall be driven into the sod at right angles to the slope until flush with the bottom of the grass blades.

**610.3.4 Top Dressing**

After staking has been completed, the surface shall be cleared of loose sod, excess soil or other foreign material, whereupon a thin layer of topsoil shall be scattered over the sod as a top dressing and the areas shall then be thoroughly moistened by sprinkling with water.

**610.3.5 Watering**

The Contractor shall regularly water and maintain sodded areas in a satisfactory condition for the duration of the Contract and until final acceptance of the work by the Engineer.

**610.4 Method of Measurement**

Sodding shall be measured by the square meter and the quantity to be measured for payment shall be the actual number of square meters of area on which sod has been

placed in accordance with this Specification and within the limits of construction as designated on the Plans or as ordered by the Engineer.

**610.5 Basis of Payment**

The quantity as determined in Subsection 610.4, Method of Measurement, shall be paid for at Contract unit price per square meter for Sodding which price and payment shall be full compensation for preparing the earth bed, for furnishing, placing, staking, top dressing and watering the sod, and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
610	Sodding	Square Meter

**ITEM 612 REFLECTIVE THERMOPLASTIC STRIPPING MATERIAL (SOLID FORM)**

**612.1 Description**

This standard specifies the requirement for reflectorized thermoplastic pavement stripping material conforming to AASHTO M249 that is applied to the road surface in a molten state by mechanical means with surface application of glass beads at a rate of not less than 350 g/L of glass beads having a size range of drop-in type and will produce an adherent reflectorized stripe of specified thickness and width capable of resisting deformation by traffic.

**612.2 Material Requirements**

1. Reflectorized Thermoplastic Pavement Material shall be homogeneously composed of pigment, filler, resins and glass reflectorizing spheres.
2. Glass Beads (Pre-Mix) shall be uncoated and shall comply with the following requirements:  
Refractive Index, min. - 1.50  
Spheres, Percent, min. - 90

Gradation:

Sieve, mm	Mass Percent Passing
0.850	100
0.600	75-95
0.425	-
0.300	15-35
0.180	-
0.150	0-5

**612.3 General Requirements**

**612.3.1 Composition**

The pigment, beads and filler shall be uniformly dispersed in the resin. The

material shall be free from all skins, dirt and foreign objects and shall comply with the requirements as specified in Table 612.1

**Table 612.1 Composition Requirements**

Components	White	Yellow
Binder, min	18.0	18.0
Glass Beads:		
Min.	30.0	30.0
Max. Titanium	40.0	40.0
Dioxide, min.	10.0	
Chrome Yellow, Medium. Min.		10.0
Calcium Carbonate And Inert Fillers, Max.	42.0	42.0

### 612.3.2 Qualitative

The material shall conform to the qualitative requirements as specified in Table 612.2

**Table 612.2- Qualitative Requirements**

Property	Requirements	
	White	Yellow
Specific Gravity, max	2.15	
Drying Time, minutes, max	10.00	
Bond Strength to Portland Cement Concrete after heating for four (4) hours ± min. @ 218 °C, Mpa, max	1.24	
Cracking Resistance@ low temp. after heating for four (4) hours ±5min. @218±2°C	No Cracks	
Impact Resistance after heating for four (4) hour ±5 min. @ 218 ±2°C and forming test specimen mm/Kg, min.	115.00	
Softening Point after heating for four (4) hours ±5 min. @ 218 ±2°C.	102.5 ± 9.5 °C	
Daylight reflectant @ 45 Degrees – 0 degree, & min.	75.00	45.00

### 612.4 Application Properties

The material shall readily extrude at a temperature of  $211 \pm 7^{\circ}\text{C}$ , from approved equipment to produce a line 3.2 to 4.8 mm thick, which shall be continuous and uniform in shape having clear and sharp dimensions.

The material shall not exude fumes which, are toxic, obnoxious or injurious to persons or property when heated during applications.

The application of additional glass beads by drop-in method shall be at a rate of not less than 350g/L of glass beads having a size range for drop-in type. The Typical size range of spheres of drop-in type paints is as follows;

Passing 850 um (#20) sieve and

a) Preparation of RoadSurface

The materials should be applied only on the surface which is clean and dry. It shall not be laid into loose detritus, mud or similar extraneous matter, or over an old paint marking, or over an old thermoplastic marking which is faulty. In the case of smooth, polished surface stones such as smooth concrete, old asphalt surfacing with smooth polished surface stones and/or where the method of application of the manufacturer of the thermoplastic materials shall be recommended the application of materials shall be with the approval of the Engineer.

b) Preparation of ThermoplasticMaterials

The materials shall be melted in accordance with the manufacturer's instruction in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic and such that the local overheating shall be avoided. The temperature of the mass shall be within the range specified by the manufacturer and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer. The molten material shall be used as expeditiously as possible and for thermoplastics which have natural resin binders or otherwise sensitive to prolong heating the materials shall not be maintained in a molten condition for more than 4 hours.

c) Laying

Center lines, lane lines and edges shall be applied by approved mechanical means and shall be laid to regular alignment. Other markings may be applied by hand-screed, hand propelled machine or by self-propelled machine approved or directed by the Engineer. After transfer to the laying apparatus the materials shall be maintained within the temperature range specified by the manufacturer and stirred to maintain the right consistency for laying.

In the case of screen application the material shall be laid to a thickness of not less than 3mm (approx. 1/8 inch) or more than 6mm (1/4 inch) unless specifically authorized by the Engineer when laid over an existing marking. In the case of sprayed application the material shall be laid to the thickness of not less than 1.5 mm unless specifically authorized by the Engineer. In all cases the surface produced shall be uniform and appreciably free from bubbles and streaks. Where the Contract Documents require or the Engineer directs that balloting shall be applied to the surface of the markings, these shall be applied uniformly to the surface of hot thermoplastic immediately after laying such that the quality of balloting is firmly embedded and retained in the surface after completion complies with the requirements of Subsection 606.2.2 Materials Requirements.

Road markings of a repetitive nature, other center lines, lane lines, etc. shall unless otherwise directed by the Engineer be set out with stencils which comply with the size and spacing requirements shown on the Drawings.

d) Re-use of ThermoplasticMaterials

At the end of the day as much as possible, the remaining material in the heater and/or laying apparatus shall be removed. This may be broken and used again provided that the maximum heating temperature has not been exceeded and such re-using of material shall be approved by the Engineer.

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**612.4.1 Defective Materials or Workmanship**

Materials which are defective shall be replaced by a new one, to the satisfaction and approval of the Engineer. If in case pavement marking has been applied in an unsatisfactory manner or in incorrect dimensions or in a wrong location, it shall be removed immediately and shall be corrected by the Contractor at his own expense. The road pavement shall be made good to the satisfaction and approval of the Engineer.

**612.4.2 Protection of the Traffic**

The Contractor shall protect pedestrians, vehicles and other traffic adjacent to the working area against damage or disfigurement by construction equipment, tools and materials or by spatters, splashes and smirches or paint or other construction materials and during the course of the work, provide and maintain adequate signs and signals for the warning and guidance of traffic.

**612.5 Sampling**

A minimum weight of 10 kg. of Reflectorized Thermoplastic paint shall be taken for every 100 bags or fraction thereof.

**612.6 Testing**

The material shall be tested in accordance with AASHTO T 250 or with the appropriate method in ASTM designation.

**612.7 Packing and Marking**

The material shall be packaged in a suitable containers to which it will not adhere during shipment and storage. The blocks of cast thermoplastic material shall be approximately 300 x 915 by 51 mm and shall weigh approximately 23 kg. Each container label shall designate the color, manufacturer's name, batch number and date of manufacture. Each batch manufactured shall have its own separate number. The label shall warn the user that the material shall be heated to  $211 \pm 7^{\circ}\text{C}$  during application.

**612.8 Method of Measurement**

The quantity of pavement markings to be paid for shall be the area in square meter as shown on the Drawings of symbols, lettering, hatching and the like, as completed and accepted.

The quantity shown in the Bill of Quantities represents the approximate quantity in square meter of pavement markings, with width as shown and applied at the centerline of the road pavements to which may be increased or decreased depending on the Engineer's decision whether to require additional markings or delete parts of it. Other markings representing symbols, lettering, hatching and others in locations where they may be required by the Engineer shall, likewise, be implemented by the Contractor using reflectorized thermoplastic pavement markings as approved and directed.

**612.9 Basis of Payment**

The quantities measured as determined in section 612.8, Method of Measurement,

## MISCELLANEOUS STRUCTURES

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shall be paid for at the appropriate contract unit price for the Pay Items shown in the Bill of Quantities which price and payment shall constitute full compensation for furnishing and placing all materials, sampling and packing, for the preparation of the surface, and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
612(1)	Reflectorized Thermoplastic Pavement Markings	Square Meter

### MISCELLANEOUS-001 INTERLOCKING PRECAST CONCRETE BLOCKS

#### Description

This work item shall consist of constructing/installing Interlocking Precast Concrete Blocks for paving and for the protection of coastal areas and riverbeds, in conformity with the lines, grades and dimensions shown in the plans and specifications. The works will involve incidental excavation/trimming and embankment build-up; slope stabilization and installation of appropriate Interlocking Precast Concrete Blocks; Precast Concrete Paving Blocks for paving works; and, Articulated Precast Concrete Blocks for protection of coastal areas and riverbeds.

#### Material Requirements

##### Interlocking Precast Concrete Blocks

##### Concrete Paving Blocks

Concrete paving blocks shall be free from defects that would interfere in the interlocking property or impair the strength or performance of the units, individually or as a whole. It shall conform to ASTM C 936M, Standard Specification for Interlocking Concrete Paving Units.

Aggregates for concrete paving blocks shall be either lightweight or normal weight or a mixture of both. It shall be lifted and placed with one hand, and have an exposed face area of less than or equal to 0.065 m<sup>2</sup> with an aspect ratio (length divided by thickness) of less than or equal to 4.

A thickness of 60mm shall be given to concrete paving blocks laid along and over pedestrian areas and driveways while 80 mm for areas under constant vehicular traffic.

Samples tested using ASTM C 418, Standard Test Methods for Abrasion Resistance of Concrete by Sandblasting shall have a volume loss of not more than 15 cm<sup>3</sup>/ 50 cm<sup>2</sup> and average thickness loss shall not exceed 3mm. The average absorption shall not be less than or equal to 5%, with individual unit of no greater than 7%.

The length or width of concrete paving blocks shall not differ by more than + 1.6 mm from approved samples. Heights of units shall not differ more than +3.2 mm from the specified standard dimension.



**Physical Requirements**

<b>Minimum Compressive Strength, MPa</b>		<b>Maximum Water Absorption, kg/m<sup>3</sup></b>		<b>Minimum Density (in air), kg/m<sup>3</sup></b>	
Average of 3 units	Individual unit	Average of 3 units	Individual unit	Average of 3 units	Individual unit
28	24	146	187	2082	2002

Width, height and length of articulated concrete blocks shall not differ by more than +3.2 mm from the specified standard dimension.

Interlocking articulated concrete blocks for coastal and riverbank protection shall be open-cell type having a void rate of approximately 15% to 17% to allow re-vegetation.

The articulated concrete blocks, considering proper installation and well compacted subgrade, shall maintain hydraulic stability of approximately 6.10 m/s under high velocity of flow, with corresponding bed shear stresses of 1.44 kN/m<sup>2</sup> to 1.92 kN/m<sup>2</sup>.

**Aggregate Base Material**

Aggregate base materials shall conform to the applicable requirements of Item 703, Aggregates.

**Bedding Sand**

Bedding sand shall be clean, washed natural or manufactured sand which conforms to ASTM C 33M, Standard Specification for Concrete Aggregates.

**Joint Sand**

Joint sand shall conform to ASTM C 144, Standard Specification for Aggregate for Masonry Mortar.

**Edge Restraints**

Edge restraints are a key part of interlocking concrete paving blocks. By providing lateral resistance to loads, they maintain continuity and interlock among the paving blocks. For pedestrian areas and driveways, edge restraints shall be steel, aluminum, timber, troweled (hidden) concrete curb or plastic edging specifically designed for concrete paving blocks. Formed or precast concrete restraints are required for streets, parking lots and roads.

**Geotextile**

Geotextile shall conform to the applicable requirements of Item 715, Geotextiles.

**Revetment Cable**

Cable shall be made of high tenacity and low elongated wires that exhibit good to excellent resistance to most concentrated acids, alkalis and solvents. It shall be impervious to rot, mildew and degradation associated with marine organisms with high resistance to deterioration for long period of fresh/saltwater immersion.

Revetment cable shall be selected so that the cable and all connections result in a minimum factor-of-safety of 5.0 with respect to lifting.

**Anchors**

Anchors shall be provided to fix blocks on the slope. These are usually reinforced concrete, one (1) meter in length, inserted through its centrally disposed holes at certain interval. GI pipe filled with concrete, reinforced by steel bars may be used as alternative. Installation shall be in accordance with the specifications shown on the Plan.

**Reinforced Concrete Anchor**

Concrete shall be Class B as specified in Item 405, Structural Concrete. Reinforcing material shall be Deformed Billet-Steel Bars for Concrete Reinforcement as specified in Item 710, Reinforcing Steel and Wire Rope.

**Galvanized Iron Pipe**

Galvanized Iron (GI) Pipe shall conform to the applicable requirements of Item 733, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

**Vegetation**

Vegetation shall be a choice of vetiver grass or any equivalent deep-rooting species planted on each gap of interlocking blocks to complement its anti-erosion function. Vetiver grass shall conform to the applicable requirements of Item 622, Coconut Bio-Engineering Solutions.

**Construction Requirements****Concrete Paving Blocks**

Compaction of subgrade shall be at least 98% of standard Proctor density as specified in ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>). However, modified Proctor density (ASTM D 1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m<sup>3</sup>)) is preferred, especially for areas under constant vehicular traffic.

In moist or wet areas, and where the soil is expansive, geotextile shall be installed to separate the soil from the aggregate base. Bases for pedestrian areas and residential driveways shall be compacted a minimum 98% of standard Proctor density. For vehicular areas, compaction shall be at least 98% of modified Proctor density as determined by ASTM D 1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m<sup>3</sup>).

Variation in final base surface elevations shall not exceed +10 mm when tested with a 3 m straightedge.

Edge restraints shall be set at the correct level, especially if the tops of the restraints are used for screeding the bedding sand. Their elevations shall be checked prior to placing the sand and concrete paving blocks. Edge restraints are typically installed before the bedding sand and paving blocks are laid.

The sand shall be spread evenly over the base course and screeded to a nominal 25 mm thickness, not exceeding 40 mm thickness. After the sand is screeded, it shall not be disturbed.

Concrete paving blocks shall be installed in accordance with patterns shown on the drawings. Typical joints between the paving concrete blocks shall be between 2 mm to 5 mm wide on average. Cut concrete paving blocks shall be used to fill gaps along the edge of the pavement. Gaps less than 10 mm shall be filled with sand or filled by shifting courses of concrete paving blocks.

After a substantial area of concrete paving blocks have been placed, the concrete paving blocks shall be compacted into the sand using a vibrating plate compactor which is capable of exerting a minimum of 22 kN of centrifugal compaction force and operate at 75- 90 hertz. Simultaneously, dry joint sand is swept into the joints and the paving blocks shall be compacted again until the joints are full.

Final surface elevations shall not vary more than + 10 mm under a 3 m straightedge, unless otherwise specified. The top of the concrete paving blocks shall be 3 to 10 mm above adjacent catch basins, utility covers, or drain channels. The top of the installed concrete paving blocks shall be 3 to 6 mm above the final elevations to compensate for possible minor settling. Sealers or joint sand stabilizers shall be applied if needed.

#### **Articulated Concrete Blocks**

The subgrade shall be well-compacted; and, free of voids, pits and depressions. Obstructions such as roots and projecting stones larger than 2.5 cm left visible on the surface, shall be removed. Soft or low-density pockets of material removed shall be filled with embankment material and compacted up to the desired minimum proctor density.

The base foundation shall be designed considering actual site conditions and slope stability analysis is considered. Base footing shall be made from interlocking block layers, assembled horizontally on the riverbed from the toe of the embankment extended down to a specified length towards the river centerline, interconnected using revetment cable. The length may vary, depending on the computed value from scour analysis. The construction shall proceed after graded foundation bed is fully covered with geotextile.

The foundation bed shall also be prepared by providing excavation at the base of the slope and thereby, the initial layer of assembled blocks shall be positioned 1-meter below the riverbed line. The excavated area shall follow the designed embankment H:V ratio from the baseline up to the desired excavation depth. Upon the preliminary block installation, excavated trench shall be backfilled with soil and compacted to a minimum required compaction ratio.

Other forms of interlocking articulated concrete block foundation shall be made of construction materials such as gabion, boulder fill, and reinforced concrete provided that the design and construction method will produce the same effect to what is specified in this Item.

Areas where geotextile and interlocking articulated concrete blocks are to be placed shall be laid parallel to the lines and grades as specified in the Plans. Prior to articulated concrete block installation, geotextile shall be placed and anchored on a smooth graded surface approved by the Engineer. The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch or tear the geotextile. Coverage area for geotextile shall be equal to the computed slope area subject for block installation.

Interlocking articulated concrete blocks shall be placed within the limits as described on the Plans. The blocks shall be well-fastened to prevent vertical or horizontal displacement. No more than 61 linear meter of geotextile shall be laid before covered with interlocking blocks. Geotextile installed more than two (2) days not covered by blocks shall be lifted and the surface of the slope shall be inspected for slope defects.

The interlocking articulated concrete blocks shall be installed in the field by the use of revetment cables. These cables shall be extended up to a required length. Anchors shall be provided to fix blocks on the slope. These are usually installed at 2-meter interval upon placing the blocks with cable. Anchor depth may vary depending on the computed length as required from the conducted slope stability analysis.

Gaps noticed after the block-laying shall be filled with topsoil, grass and fertilizer in accordance with the Plans and Specifications. Grass shall conform to the applicable requirements of Item 622, Coconet Bio-Engineering Solutions. Prior to grass planting, the block's surface shall be inspected for damage. Individual blocks with noticeable cracks resulting to a reduced individual block weight of 1/3 shall be replaced.

**Sampling and Testing**

Sampling and Testing for Interlocking Concrete Blocks shall conform to ASTM C 140M, Sampling and Testing Concrete Masonry Units and Related Units.

**Delivery, Storage and Handling**

Materials delivered to the site shall be inspected for damage, unloaded and stored at least through proper handling. The Contractor shall designate storage site ready for use before the materials are delivered. Avoid leaving the delivered materials placed unattended on the ground where probable contact and/or exposure to dirt and debris may occur. Materials shall be so handled with utmost care to ensure undamaged condition upon delivery.

**Method of Measurement**

The quantity to be paid for under this item shall be the number of square meter unit comprising the areas shown in the plans where the Interlocking Precast Concrete Blocks will be laid and shall be determined by direct measurements of the actual dimensions

**Basis of Payment**

The quantity as determined in Section 741.6 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 appropriate Interlocking Precast Blocks, labor cost and all the incidental expenses necessary to complete the work.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
MISCELLANEOUS-001	Paving Blocks	Square Meter

# **PART L**

## **Street Landscape**

**PART K - LANDSCAPE****LANDSCAPES-001 – LANDSCAPING WORKS****7.1 Scope of Work**

This section includes the furnishing of all plant, tools, equipment, materials and other in the installation of waterproofing and roofing, including miscellaneous sheet metal works as required providing a waterproof installation.

**7.2 Hardscape Components****7.2.1 Concrete Reinforcement*****Product Delivery, Storage and Handling***

All reinforcing bars delivered to the site shall be new and shall be carefully stored and sheltered to prevent from rust, oil defects, grease per kinks.

***Materials***

- a. Deformed Reinforcing bar: ASTM A G15M-82
- b. G.I Wire Ga. No.16 - shall be used for tying bar intersections
- c. Reinforcing bars specified by structural engineer's drawings for landscape area

***Preparatory Works***

Bends for stirrups and ties shall be made around a pin having diameter not less than two times the minimum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than six times the minimum thickness of the bar, except for bar larger than 1- inch, the pin shall not less than eight times the minimum thickness of bar. All bars shall be bent cold. Heating of reinforcement will not be permitted and reinforcement shall not be bent or straightened in any manner that will injure the material.

***Installation***

- a) Metal reinforcement shall be accurately placed in accordance with the plans and shall be secured in position by concrete or metal chairs or spacers. Nails shall not be driven into forms to support reinforcement nor shall tie wires come in contact with forms. All steel reinforcement shall be accurately placed against displacement by tying them together at each bar intersection with Ga. No. 16 G.I.wire
- b) Design: Laps and splices shall be sufficient to transfer stress between bars by bond and shares. Splices generally shall be avoided at points of maximum shear in every member. Bar extension of cut-off reinforcing bars shall be 12 times bar diameter of the effective depth, whichever is greater.

***Concrete Protection***

Unless otherwise noted, the thickness of concrete over reinforcement shall be

as follows:

- a. Where concrete is deposited against ground without use of forms, not less than 75mm.
- b. Where concrete may be exposed to ground but placed on forms not less than 50mm.
- c. Where concrete may be exposed to weather, not less than 50mm.
- d. In all cases, the thickness of concrete over the reinforcement shall be at least equal to the diameter of round bars or one and one half times the side dimensions of square bars.

Do not allow pedestrian traffic on the newly installed reinforcement to prevent misalignment of bars.

### ***Cleaning***

Upon installation of reinforcing bars is completed, surplus, materials, apparatus, etc. shall be removed and shall be left in a clean and neat condition ready for concreting.

## **7.2.2 Stone and Other Finishes**

### **7.2.2.a Textured Homogenous Tiles on Concrete Slab**

#### ***Preparation***

- a) Structural slabs with limited bending: Prepared in accordance with ANSIA 108.1. Before stones are applied with dry set mortar, the structural concrete floor shall be tested for levelness or uniformity of slope by using a straight edge. Areas where the floor does not meet the required tolerances shall be filled and leveled in accordance with ANSI A108.5 and provide expansion joints.
- b) Slab on Grade construction where no bending stresses occur: Prepare in accordance with ANSIA 108.1.
- c) The concrete surface shall be wet for at least four (4) hours before the scratch coat is applied. The required scratch coat of cement mortar is the proportion of one (1) part Portland cement to two (2) parts sand, by volume shall be applied to not more than  $\frac{3}{4}$  in thickness.

#### ***Installation***

- a) The buttering mortar for tiles shall be per manufacturer specifications and shall be worked to true even plain, either leveled or sloped to drain as required. For areas of more than 100 sq. ft. screed strip shall be set as temporary guide to secure this result. As large a floor area as can be covered with tiles before the mortar has reached its initial set, shall be placed in one operation. When more setting mortar has been spread then it can thus be covered, it shall be cut to a clean beveled edge close to the tiles and be removed.



- b) Tiles shall be firmly secured in place. Joints shall be well-filled, lines kept straight and true, and finished surfaces brought to a true plane.

- c) The complete work shall be free from loose, cracked or broken units.

**Grouting**

Grouting shall be done as soon as the mortar beds have sufficiently settled. Cement grout shall be colored as called for by the color of the tiles.

**Protection**

Spaces in which tiles are being laid shall be closed to traffic or other work shall be kept free until the floors are completed and the stones firmly set. Tile work shall be adequately protected from damage until the completion of the contract.

**Cleaning**

Upon completion of the work, wash the finished surface with clean water and brush thoroughly to produce a clean and sparkling appearance.

**7.2.2.b Exposed Aggregate Finish with Glow-in-the-Dark Aggregates****Installation**

- a) Forms, made from wood, metal or plastic, are attached to stakes to contain the concrete in the area desired. It is important that forms are in good condition, be set to provide the proper slope or grade for drainage, and are erected to create clean corners where they abut each other or structures.
- b) Using steel reinforcing bars or welded wire mesh is critical to providing structural function and support in the slab. The main reasons to include reinforcement in the slab is to help control cracking, provide structural capacity, increase impact resistance, and reduce joint maintenance. The most common method for placing concrete is to have the ready-mix truck pull up to the placement area and deposit the concrete from the chute. The concrete should be placed as close to its final destination as possible because moving it around too much (with shovels or other tools) can lead to segregation. Also be sure plastic sheeting is used to protect adjacent buildings, landscaping, or other existing slabs from concrete splatter. The type of concrete used is also crucial to successful placement. Make sure to discuss with your contractor how he plans to avoid issues that can arise without the proper slump, or mix design.
- c) Slabs should be cast monolithically with a mix as follows: portland cement, 1 part by weight, three-eighths inch and smaller pea gravel, 3.2 parts by weight, and concrete sand, 2.3 parts by weight.
- d) The work done immediately following concrete placement is critical, since this is when you must create the perfect canvas for decorative stamping. The two most important factors are that the surface is leveled to prevent any low or high spots, and that cement paste is brought to the surface to permit a well-defined imprint. Water should be carefully controlled to hold

the slump as low as practicable for workability. In placing the concrete, usual procedures should be followed with respect to spreading and screed leveling. Following the straightedge, the slab should be wood floated with darbles or bull floats until the surface is level and properly sloped todrains.

- e) Toss the ½ inch diameter glow-in-the-dark aggregates over the entire concrete surface as it is setting up. Gently work the aggregates into the curing concrete with a trowel, leaving them just under the surface covered with a thin film of concrete. The spread of glow-in-the-dark aggregates per square meter shall be 200grams.
- f) To expose the aggregates, the curing concrete surface shall be lightly sprayed by a concrete retarding agent. The concrete retarder chemically slows down the curing process leaving 1/8 to 3/8 inch of the surface uncured. The top is then pressure-washed off, which exposes the glow-in-the-dark and the non-glow-in-the-dark aggregates on the surface. After washing, normal curing practices should beemployed.

#### **7.2.2.c Groove LineFinish**

The concrete shall be screed and floated to the required finish level with no coarse aggregate visible while concrete is still green, steel or wood trowel to an even, smooth finish and then a fiber bristle brush in a direction transverse to that of the main traffic. This should be used on sidewalks in plain cement finish.

#### **7.2.2.d Concrete Pavers on SandSetting**

##### ***Paving Material***

0.125m x 0.368m x 0.05m Plank Paver, Dark Gray, 3000 psi minimum by Quality-Star Concrete Products, Inc. or approved equivalent

##### ***Sand Setting Bed Material***

Sand shall generally referred to as sand setting and shall free of organic materials and any other contaminates that could potentially stain or otherwise damage the unit pavers.

##### ***Edge Restraint***

Paving banding materials as indicated in landscape architectural drawings.

##### ***Execution***

Examine all surfaces to receive the parts of the work specified. Contractor shall verify all dimensions of in-place and subsequent construction. Contractor shall not proceed with the work until unsatisfactory conditions have been corrected. Installation of concrete pavers and associated construction constitutes acceptance of the adjacent and underlyingconstruction.

##### ***Installation of Sand Setting Bed***

- a) (Optional) Place a layer of the specified geotextile filter fabric uniformly on the surface of the properly prepared grade that is ready to receive the sand setting bed. Cover the designated area in its entirety.
- b) Place solid steel  $\frac{3}{4}$  or 1 inch thick control bars directly on the sand or geotextile filter fabric. Install shims under bars for minor adjustment of depth and finish paver elevations and slopes. Space bars approximately 7
- c) feet apart and parallel to each other to serve as guides for strike-off boards. Spacing can vary as determined by the size of the area and layout.
- d) Place sand setting bed between control bars on the sand or geotextile filter fabric to not less than thickness of the designated control bars. Spread material and strike off by pulling the material with a 8 foot long x 2 inch x 6 inch wood board several times to produce a smooth firm and even setting bed. Add fresh material in low areas after each pass of the strike-off board. After each panel is complete remove and advance the first control bar to the next panel position in readiness for placing and striking adjacent panels. Fill in depressions left by the control bar and any shims.

### ***Paver Installation***

- a) Install concrete pavers, slabs and curbs in locations, patterns and at elevations and with slopes for surface drainage as shown on the Drawings. Install concrete pavers, slabs and curbs in accordance with the manufacturer's printed installation instructions and the final reviewed shop drawings.
- b) Lay out pavement in working area modules according to concrete paver mainfield as specified in landscape architectural drawings. Set concrete pavers, slabs and curbs by hand, on sand setting bed in patterns shown on the drawings with hand tight joints  $\frac{1}{8}$  to  $\frac{3}{16}$  inch wide joints and uniform top surfaces.
- c) Field cut concrete pavers in accordance with manufacturer's recommendations for methods, equipment and precautions.
- d) Maintain accurate alignment and check for creep and shrinkage. Make adjustments to creep and shrinkage within the concrete paver working area or mainfield.
- e) Install edge restraints where required and as shown on landscape architectural drawings and details.
- f) Spread sand to fill joints immediately after installing concrete pavers on setting bed. Brush in sand until joints are completely filled, remove surplus sand. Do not allow traffic on installed pavers, slabs or curbing until the joints have been filled.
- g) Protect newly laid pavers with plywood panels on which workers stand.

Advance protective panels as work progresses but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of installed pavers.

- h) Contractor to replace cracked or chipped concrete pavers until final acceptance period by Owner.

***Cleaning and Protection (Responsibility of end user)***

- a) Remove and replace pavers, which are loose, chipped, broken, stained or otherwise damaged or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units with same joint treatment to eliminate evidence of replacement
- b) Cleaning: Remove soiling from exposed paver surfaces and brush of particles aside from sand.
- c) Provide final protection and maintain conditions in a manner acceptable to installer, which ensures paver work being without damage or deterioration at time of substantial completion.
- d) Spread sand to backfill the spaces along the edges of the concrete paver mainfield and level concrete pavers to specified finish floor elevation as per landscape architecture drawings.

**7.2.3 Metal Works**

***Materials***

- a) All metals shall be free from defects impairing strength, durability or appearance and shall be of best commercial quality for each intended purpose.
- b) Fastening: Which are exposed shall be of the same material, color and finish as the metal to which they are applied, unless otherwise shown on the drawings or as specified. All items employed with galvanized iron and steel shall be galvanized ferrous metal.
- c) Steel Shapes: Shall conform to the requirements of ASTM A36 for the Structural Steel. Steel Pipes shall conform to ASTM A53 or A120.
- d) Cast Iron: Shall conform to the requirements of ASTM A36 for the structural Steel. Steel pipes shall conform to ASTM A53 or A120.
- e) Gauges: Of sheet iron and steel are U.S. Standard for sheet and plate where needed. Gauges of non-ferrous metals are Brown and Matte.

***Installation***

- a) Take all measurements required at the building. Check and compare

dimensions and other data with various trades, installing adjoining work to assure proper coordination.

- b) Do all drilling and fitting, cutting, welding, bolting and riveting required to erect, install and fit metal work to adjoining work. Conform to AISC Code. Furnish all screws, bolts, anchors, etc., required to attach metal work securely to adjoining work.
- c) Do not cut or alter members in the field without Landscape Architect's approval or Engineer's approval. Do not enlarge unfair holes by burning or forcing, but correct by reaming.
- d) Be responsible for the correct location of miscellaneous metal work, including anchor bolts and base plates, lintels and others. Take particular care to details.
- e) All work should be accurately set to established lines and elevations and rigidly fastened in place with suitable attachments to the construction of the building.
- f) Furnish, fabricate, install and anchor all lights steel, miscellaneous and ornamental metal/grille work as indicated in the drawings as specified herein. Install all supports and anchors for miscellaneous metal work, except those to be cast into concrete or built into masonry.
- g) Furnish all metal inserts, dovetail anchor slots, anchors, anchor bolts, fastenings, etc. for a attachment of work of all trades to concrete and masonry, except where otherwise specified or obviously included under other Section of the Specifications.

### **7.3 Softscape Components**

#### **7.3.1 Scope of Works**

The scope of work in this section shall include but not be limited to the following:

- a. Installation of plants
- b. Removal and transfer of existing trees
- c. Maintenance of landscape area

#### **7.3.2 Quality of Workmanship and Materials**

- a. All materials and workmanship shall be of the highest standards and quality demanded by this specification. Substandard work and materials identified by the Installer's cost.
- b. All plant materials shall be of the genus, species and variety specified and substitutions shall not be permitted unless authorized in writing by the Landscape Architect.
- c. All trees and shrubs installed by the Plant Installer shall be free of pest,

disease, discoloration and damage. Plants shall be well branched with vigorous shoots. The root systems of each plant shall contain a good proportion of fibrous roots.

- d. All materials are to be approved by the Landscape Architect or by the Engineer prior to use on site. Materials shall be obtained from approved sources, manufacturers and/or suppliers.
- e. Where particular products are specified and the Plant Installer wishes the use of similar products from other suppliers, prior confirmation in writing shall be obtained from the Landscape Architect or the Engineer.

### 7.3.3 Supply of Softscape Materials

- a) The Landscape Architect reserves the right to make field adjustments and reasonable substitutions to ensure implementation of the landscape concept in relation to field conditions.
- b) The Plant Installer (from the Contractor side) shall submit his proposed construction program based on the criteria of the Master Program showing the intended sequences, stages, and order of proceeding with the works together with the period of time he has estimated for each and every stage of progress.
- c) The Plant Installer shall liaise with other Contractors at each phase to program and execute the works.
- d) The Plant Installer shall complete the works on or before the date of completion as set forth in the Contract.
- e) All work carried out must be done in accordance with the relevant Code of Practice as stipulated by the relevant Government and Statutory bodies.
- f) The Plant Installer shall undertake all responsibility for defects and maintenance to the landscape for a period of twelve (12) months from the date of practical completion.
- g) This specification is a set of directions for the installation of Softscape Works. The Plant Installer must read these specifications at the time of tender in order to be aware of his obligations under the Contract should he be the successful bidder.
- h) It is essential therefore that the Plant Installer is fully conversant with the techniques set out in this specification and is adequately prepared with the trained management, supervisors, foreman and labor force as well as tools, equipment and materials to complete the works to these specifications.
- i) The Plant Installer shall not use different techniques or quality criteria or materials unless the alternative system has been approved in writing by the Landscape Architect or the Engineer. No cost increased for alternative specifications will be entertained unless formally submitted in writing as an

improvement in the quality of a product and accepted in writing following the Client's/Owner's approval, through the Landscape Architect.

- j) The Plant Installer is to study the drawings at the time of tender and notify the Landscape Architect of any discrepancy at the time of tender submission.
- k) On completion of the works, the Plant Installer will prepare a set of as-built drawings covering the areas installed. These drawings shall be at the same scale as the original planting plans and shall contain the accurate positions of all planting with the actual number of plants installed. These drawings and the quantities shall be approved by the Landscape Architect before being signed and stamped by the Plant Installer.
- l) The general description of the works mentioned above is only for the guidance of the Plant Installer (Contractor's side) and any error or omission shall not constitute a ground for claim by the Plant Installer. The

onus for investigating and ensuring the actual extent and nature of the works comprised in this Contract prior to the submission of the tender is solely with the Plant Installer. Any doubts should be clarified with the Landscape Architect before the tender is submitted. No claim arising out of lack of clarity or availability of information will be entertained. Allowance for any or all of these provisions shall be made in the tender.

#### 7.3.4 Backfill and Growing Media

Materials for backfilling and planting holes and beds shall consist of approved quality topsoil transplanted to the site and thoroughly mixed with sand, organic compost and coco peat. The Plant Installer must submit samples for approval of Landscape Architect.

The soil mix compositions are as follows or other growing mix as specified by Landscape Architect:

##### Planting on Grade

Loamy topsoil	50%
White washed sand	10%
Soil Conditioner	10%
Sugarcane waste soil	6%
Rice hull	6%
fiber	6%
6% Sugarcane waste soil	
Rice hull	
6% Begasse	

##### Planter Boxes on concrete slab decks

Loamy topsoil	30%
White washed sand	10%
Soil Conditioner	7.5%
Vermiculite	7.5%
Perlite	16%
Coconut fiber	5%
Begasse	6%
Chicken manure (composted)	6%
Coconut fiber	
6%	

Chicken manure (composted) 6%

##### **Soil Mix**

For soil mix, submit a written statement to the Landscape Architect or

Engineer by delivery, stating location of soil source and chemical analysis of soil samples including pH, percentage of soluble salts, and amount of potassium, phosphorus and nitrogen.

Mechanical Analysis of topsoil will determine conformance percentage of sand, silt, clay and organic matter.

### ***Samples of Materials***

2 soil aggregate types	-	2 liter each
2 drainage aggregate types	-	2 liter each
Soil conditioner	-	2 liter each
Filter Fabric	-	0.4 sq.m.
Mulch	-	2 kg bag
Fertilizer	-	1 liter plus manufacturer's label
Anti-Transpirant Spray	-	500 ml plus manufacturer's label

### ***Top Soil***

Soil composition for turfed areas shall be 70% sandy loam, 20% sand (washed), and 10 % organic compost (as outlined).

- a. Shall be fertile natural red/brown topsoil transported to the site, free from stones, clay, wood and sod, and obtained from naturally well-drained area. Topsoil shall neither be excessively acidic nor have high alkalinity, and shall be free from any toxic matter liable to be harmful to plant growth. The pH for topsoil shall be in the range of 5.5-6.5.
- b. Topsoil shall generally be reasonably loose in a form containing not more than 10-15% of moisture content. Topsoil delivered in a wet and soggy condition will be rejected by the Landscape Architect.
- c. Topsoil depth in designated planting areas shall be as follows:

1. Lawns and Sodded Areas - 0.15cm
2. Ground Cover Areas - 0.30cm
3. Shrubbery Areas - 0.60cm
4. Palms and trees - Shall conform with the size of the root ball. Allow 0.30 minimum dimension from palm/tree root ball edge to rim of prepared excavation.

Depth of pit excavation shall have a minimum of 0.60 cm. Allow 0.30 cm soil pedestal to prevent balled tree from settling. Actual pit depth shall be determined by the existing root ball dimensions. Refer to tree planting details.

### ***Soil Conditioner***



Shall be peat moss, coco peat, ground bark, well composted chicken manure, begasse, sugarcane (mud) waste/pulp or other approved fibrous organic matter suitable for mixing with topsoil to make a friable growing medium for plants, resistant to rapid decay, free of soluble salts below 900 ppm, pH 6-6.5, free of large lumps or debris.

***Lightweight Aggregate***

Shall be an approved low-density, inert material such as charcoal, expanded shale or porous volcanic stone free from dust and debris, pH 6-6.5, free of soluble salts.

***Organic Compost***

Shall be an organic vegetable compost e.g. tree bark compost produced by a thorough horticultural or industrial composting process. Compost is to have a clean, under composed smell free from any rotting substances, debris, refuse, clay or visible fungus. A sample and test data is to be submitted before being packed for transport and odorous materials used on site will be rejected. Any vermin resulting in use of organic compost will have to be controlled by the Plant Installer within 12 hours of any infestation.

***Soil Analyst's Test Reports on Mechanical Analysis of Soil Mix***

Shall be clean, coarse-grained and angular material with a minimum 1mm diameter section. It shall be well-graded, free from soluble salts ranging in size so that 80- 100% passes the 3mm sieve and 0-50% passes the 2mm sieve, with 0% passing through a 1mm sieve.

***Fertilizer and Lime***

- a. Fertilizer used shall be complete food having an N:P:K formulation of 15:15:15 for foliage plants and trees, and 12:12:17:2 for flowering plants.  
ThePlant

Installer shall also provide an approved basic fertilizer (slow release fertilizer) for every plant that is being potted and reported. The nutrients in the fertilizer must be freely available to the plants and all fertilizer must be delivered in original, unopened containers, bearing the manufacturer's guaranteed analysis.

- b. Triple Superphosphate 0-46-0 uniform in composition delivered to the site in unopened containers, each fully labeled, conforming to the applicable fertilizer laws, and bearing the name or mark of the manufacturer.

- c. Ground dolomitic limestone not less than 85% total carbonates, minimum 20% calcium and 10% magnesium. Ground so that 50% passes through the 250 microns sieve materials will be acceptable and the specified rates of application are increased proportionally on the basis of quantities passing through the 250 micronssieve.

### ***Mulches***

Coarse, ground organic materials such as coco peat, or other approved available organic matter free from soluble salts and with a pH between 5.0-7.0.

## **7.3.5 PlantMaterial**

### ***Nomenclature***

Names of plants required under this contract conform to those given in Exotic Plant Manual, Alfred Byrd Graf, 3rd Edition, Roers Company, East Rutherford, N.J., USA. Names of varieties not included therein conform to names generally accepted in the nurserytrade.

### ***Quality and Size***

- a. Provide plants grown in approved nursery, acclimatized not fertilized for a period of at least four months before delivery. Habit of growth that is normal for the species, sound, healthy, vigorous and free from insects, diseases, injuries, abrasions, sunscald, disfigurement. Equal to or exceeding measurements specified in branches in normal position; necessary pruning done at time of planting as recommended bythe

Landscape Architect Sizes and methods of handling according to accepted practice where it is not indicated.

- b. Plants shall be grown or established in containers in which they will be delivered for at least six months but not more than twenty-four months in advance or finalplanting.
- c. Trees shall be well-formed with uniform branching. There shall be no abrasion of the bark, and no fresh cuts of limbs over 30 mm which have not completely callusedover.
- d. Trees and palms larger in size than specified may be used but increase in price is as limited by the contract documents. It is the responsibility of the Plant Installer to ascertain that materials larger in size than that specified can be accommodated in the proposedlocations.

### ***Plants Required***

The species (scientific and common name) size, manner in which to be furnished, and indication of the approximate number to complete the planting plan are given in the plant list. Plant quantities on the list are indicated only for the convenience of the Plant Installer. The Plant Installer shall furnish and plant all plant materials required by the plans. Surpluses or shortages in the list shall not be used for claims for additionalcompensation.

- a. Plants of kinds other than those named in the plant list will not be accepted unless specifically approved in writing by the Landscape Architect. Proposed substitute, in each case, must possess the same essential characteristics as the type of plant actually specified in regard to appearance, ultimate height, shape, habit of growth and other requirements. Where a substitution is approved for the Plant Installer's convenience, plants of greater value may be accepted without additional cost to the Employer.
- b. The Plant Installer or his authorized representative shall be present during inspection.
- c. Make a written request to the Landscape Architect or to the Engineer, a minimum of thirty working days in advance of all inspections at the nursery. List the particular plants which are to be inspected as well as the size of the plants.

***Special Guarantee***

All plant materials furnished under this Section shall be guaranteed for a period of one year from Completion as to the species, hybrid, flower color and/or variety specified herein or on the drawings. If after the issue of the completion certificate for the Main Contract by the Landscape Architect, any guaranteed plant material proves to be of different species, hybrid, flower color and/or variety not initially determined, the Plant Installer shall replace that plant with a new plant of the originally specified species, hybrid, flower color and/or variety.

***Minor Materials***

Accessories or other materials not described but required for completed work shall conform to commonly accepted industry standards and shall be of types of sizes best suited for the intended purpose and related conditions such as using a plastic plant separator for separating lawn from shrubs and planting from grade and other purposes. The Plant Installer is required to submit samples to the Landscape Architect for approval, before installation.

**7.3.6 Installation*****Acclimatization***

Local practice will dictate the percent shade that should be provided during this acclimatization period. Light levels listed in the schedule of plant materials represent the approximate condition that the plant will be provided when it is installed in the building and not the light level that should be produced during the first stage of acclimatization when the plant is grown under shade before installation.

***Planting***

- a. Planting shall be performed in accordance with the recognized best horticultural practice.
- b. All plants must come with pots or plastic bags in which they were originally grown and established in the nursery.

## **STREET LANDSCAPE**

- c. All plants are to be removed from their original growing receptacles prior to installation. They should be arranged in a manner such that the leaves complement each other and are within touching distance of the other and not overlapping one another unless specified to the contrary.
- d. All planting works shall have the appearance of established growth. Plants shall be arranged with their foliage showing off their best face so that the intended design will be fully realized.
- e. Plants shall be set plumb and at such a level or elevation to level surrounding ground as they bore to ground from which they were dug. All plants shall be planted on and in soil mix. The soil mix will be properly compacted before the placement of trees with a heavy rootball.
- f. Earth balled and hessian covered plants shall have all cloth, ropes, etc. removed from the tops of the earth balls but no cloth shall be pulled out from under the earthballs.
- g. In planting beds designated, deposit planting mix to full required depth as shown on the drawings. Deposit enough material to allow for settling and compaction. Compact by hand tamping and rolling. Do not compact by puddling. After soil is spread and compacted and just before planting, moisten evenly to full depth with a fine water spray. Place additional planting mix as necessary, to correct any settling occurring at this time.
- h. Bare-rooted plants are not acceptable.
- i. Disturbance to the root system or ball or earth shall be prevented in removing plants from containers. Root bound plants shall not be planted.
- j. After placing the plant, the plant pit shall be back filled with planting soil mix placed in layers and tamped firmly to eliminate air-void, minimize settlement and provide stability for the plant. A watering ring should be made out of the soil around the plant to store water.
- k. During and after planting, the plants shall be thoroughly watered to eliminate air voids around the roots and watered regularly as required for the planting to become established.
- l. All saplings shall be securely staked and tied.
- m. All semi-matured instant trees and palm shall be staked by guying or by ground anchors as specified.
- n. Trees of the species and of the size specified on the plans shall be planted in locations shown. Trees shown on plans at spacing shall be accurately and evenly spaced in true lines.
- o. Shrubs shall be positioned in the location and numbers shown on plan and placed to achieve even spacing and proper matching of shapes related in a random fashion of approximately equal centers to obtain a natural dense cover.
- p. Groundcover plants and all potted plants shall be planted with a hand trowel to firm soil around roots.

### 7.3.7 Staking

- a. Provide all necessary support for plant material as required, such as posts and line wires for tree and tall shrub planting, stakes or tripods for tall tree and palms, using durable materials which will remain in good condition for the duration of the contract.
- b. Stakes for supporting trees shall be sound wood, uniform in size, reasonably free of knots and capable of standing in the ground for at least one (1) year. Stakes for supporting trees, two meters tall and over shall be 50mm and not less than 2.5 meters in length.
- c. Wire for tree bracing and guying shall be pliable 12 to 14 gauge (2.0-2.8mm) galvanized soft steel wire.
- d. Ground anchors shall be 25mm diameter GI anchors or equivalent. Hose shall be two-ply fiber bearing garden hose, not less than ½" (1cm) inside diameter.
- e. Wrapping material shall be first quality, heavy waterproof crepe paper manufactured for this purpose, or first quality burlap not less than 15cm nor more than 25cm wide of suitable strength and manufactured for this purpose.

### 7.3.8 Maintenance Operations

- a. Watering of plants and turfed areas is the responsibility of the sub-contractor to water and spray water to remove dust to all plants regularly.

All the external plants shall be watered twice daily in the absence of sufficient natural rainfall.

- b. Weeding - all weeds found growing in the landscaped area under maintenance must be removed. All plant beds must be weeded weekly.
- c. Forking - all plant beds must be forked fortnightly to loosen the soil and provide sufficient aeration for the roots.
- d. Pruning - plant shoots must be pruned when necessary. All trees, palms, shrubs and groundcovers shall be pruned by thinning out and shortening branches to the extent of 1/3 of the existing growth. Trees shall be pruned if dead, rotten or crossed branches are present or to maintain a clear stem up to the specified height using the methods described below. Allowances are to be made for all shrubs and climbers to be pruned at least twice during the Maintenance Period to promote bushy growth and good flowering characteristics. The shrubs shall be checked and all dead wood, broken, damaged or crossed branches shall be cut back, depending on species. Allowances must be made for the regular pruning of dead and dying plant parts. Pruning and removal of branches are to be carried out using sharp and clean instruments to give a clean, sloping cut with one flat face. Ragged edges of bark or wood are to be trimmed with a sharp knife. Dead wood and broken or badly bruised branches shall be removed. Main leaders shall not be cut. Pruning shall be done with clean and sharp tools to produce a clean-cut face.
- e. Topdressing/ Mulching - plant with exposed root planting beds and turfing with low top soil level and those affected by rain water splashing and erosion

## **STREET LANDSCAPE**

shall be topped a minimum of every three months or as instructed. A

mulch can reduce the amount of water loss through surface evaporation, weed generation and soil erosion. All planting beds must be mulched with coco peat with a minimum depth of 75mm every three months or as instructed. Mulch should not touch the stem of a plant or cover the foliage in any situation.

- f. Spraying of plants - all foliage and flowering plants must be sprayed with a fungicide, miticide and an insecticide once every two weeks or as directed by the Landscape Architect. Trees are to be sprayed with the proper pesticide when required.
- g. Fertilizing of plants - slow release of NPK (nitrogen, phosphorus, potassium) combined with fast release organic fertilizer shall be applied regularly to ensure healthy growth, repeating the application once every four to six weeks. All trees, foliage and flowering plants are to be given fertilizer according to the following dosage, fertilizertype:

### **(A) Trees/Palms (NPK -15:15:15)**

<u>AgeGroup</u>	<u>ApplicationRate</u>
1-3yrs.	2 kg/plant per year in twoapplications <ul style="list-style-type: none"><li>• 1 kg eachtime</li></ul>
3-5 yrs.	4 kg/plant per year in threeapplications <ul style="list-style-type: none"><li>• 1.3 kg eachtime</li></ul>
5 yrs. andabove	6 kg/ plant per year in threeapplications <ul style="list-style-type: none"><li>• 2 kg eachtime</li></ul>

The Plant Installer shall put manure on every tree each month with slow releasing fertilizer, recommended and approved by the Landscape Architect.

### **(B) Shrubs/ Climbers/ Foliage/ Groundcovers**

Heightof Plants	ApplicationDate	Remarks
1mht	35g/plantpermonth	NPK:15:15:15
1-1.5mht	50g/plantpermonth	and1-12:12:17
1.5mht	65g/plant permonth	as and when
		Directed
Flower bed	70g/meterpermonth	by theLandscape Architect

- h. Replacement of Plant - all poor conditioned, dying and dead plants and turf not growing properly are to be replaced by healthy plants of the same species as specified and size of those adjacent in the planting area during the maintenance period at the Plant Installer'sexpense.
- i. Maintenance of Turf AfterLaying:
- j. The Plant Installer shall remove and replace any portion of turfed area where the turf fails to become established within thirty days ofturfing.
- k. The Plant Installer shall regularly maintain all turfed areas in a neat manner by watering, moving, ranking and clipping during the whole of the Maintenance Period. All turfed areas shall be moved after one month of completion of turfing, and thereafter at maximum intervals of threeweeks.

- i. About one month after planting, the grass shall be applied with manure with a complete chemical fertilizer which supplies Nitrogen, Phosphorus, Potassium and Magnesium approximately in the following proportion 18:12:6:3. This shall be applied at rate of 125 kg/ha of grass after all weeds have been removed. The fertilizer shall be mixed with the topdressing and spread evenly over the field. This application shall be repeated after threemonths.

### 7.3.9 Clean-up

- a. The Plant Installer must ensure that all plant beds are tidied up and free from any debris or unapproved plant materials immediately on completion of the plantingworks.
- b. All areas affected by horticulture activities must be thoroughly cleaned of soil stains, etc. removed to the satisfaction of the LandscapeArchitect.


### 7.3.10 Final Planting Inspection and Acceptance ofWorks

- a. Final inspection for acceptance shall be made at the conclusion of maintenance period provided that all the projects improvements and corrective work has been complete. If improvements are not complete, maintenance shall be continued until completion of suchwork.
- b. If the Plant Installer fails to complete the final planting after notification by registered mail, the Landscape Architect reserves the right to take the work out of the sub-contract and rectify the work. All charges for rectification shall be at the Plant Installer'sexpense.
- c. Written notice requesting final inspection shall be submitted by the Plant Installer to the Landscape Architect at least fifteen (15) days before the anticipated date ofcompletion.
- d. Prior to handing over of the work at contract completion and at the end of the Maintenance Period, all plants must be groomed and neatly trimmed to show off their best for the purpose ofinspections.

## SUMMARY OF MATERIALS AND FINISHES

LANDSCAPE ARCHITECTURAL		SPACE NOS.	AREA OF APPLICATION	REMARKS
ITEM NO.	MATERIALS			
I	PAVING FINISHES			
	A. Texture Homogenous Tile (Granite Tile)			
	0.20m x 0.40m, 0.20m x 0.20m		Urban Streetscape Walkway Paving Banding	Non-skid; gray
	0.40m x 0.60m		Urban Streetscape Walkway Typical Paving Mainfield	Non-skid; dark gray
	0.20m x 0.20m		Urban Streetscape Walkway Typical Paving Mainfield	Non-skid; dark gray




**STREET LANDSCAPE****L**

	<del>B. Concrete Paver (Plank Paver by Quality-Star Concrete Solutions or Approved Equivalent)</del>			
	0.1250m x 0.368m x 0.05m thick		Urban Streetscape Walkway Typical Paving Mainfield	On sand setting
II	PLANT MATERIALS			
	A. Tree/Palm			
	<p>"Acacia mangium" (MANGIUM)</p> 			See Planting Plan for specifications






# STREET LANDSCAPE

L

<p><i>Alstoniascholaris</i> (DITA)</p> 			<p>See Planting Plan for specifications</p>
<p>"Bucida sp." (PHILIPPINE TALISAY)</p> 			<p>See Planting Plan for specifications</p>
<p>"Cassia philipinensis" (PALAWAN CHERRY)</p>  <p>"Lagerstroemia speciosa"</p>			<p>See Planting Plan for specifications</p>

**STREET LANDSCAPE**  
(BANABA)

**L**

				<p>See Planting Plan for specifications</p>
	<p>“Livistonia philippinensis” (ANAHAW)</p> 			<p>See Planting Plan for specifications</p>
	<p>“Michelia champaca” (GOLDEN CHAMPACA)</p> 			<p>See Planting Plan for specifications</p>

## STREET LANDSCAPE




L

				See Planting Plan for specifications
	<p>"Peltophorumpterocarpum" (YELLOW PONCIANA)</p> 			See Planting Plan for specifications
	<p>"Petersianthusquadrilatus" (TOOG)</p> 			See Planting Plan for specifications



## STREET LANDSCAPE

L

	<p><i>Plumeria rubra</i> (RED KALACHUCHI)</p> 			<p>See Planting Plan for specifications</p>
	<p><i>Spathodeacampanulata</i> (AFRICAN TULIP TREE)</p> 			<p>See Planting Plan for specifications</p>
	<p><b>B. Shrubs</b></p>			
	<p><i>Crinum xanthophyllum</i> (YELLOW CRINUM)</p> 			<p>See Planting Plan for specifications</p>

# STREET LANDSCAPE

L

	<p><i>Bougainvillea "Mary Palmer"</i> (MARY PALMER)</p> 			<p>See Planting Plan for specifications</p>
	<p><i>Hymenocallis littoralis</i> (SPIDERLILY)</p> 			<p>See Planting Plan for specifications</p>
	<p><i>Philodendron selloum</i> (SELLOUM)</p>  <p><i>Calathea lutea</i></p>			<p>See Planting Plan for specifications</p>

**STREET LANDSCAPE**  
(CIGAR PLANT)

**L**



See Planting Plan for specifications

“Iris pseudacorus”  
(YELLOW IRIS)



See Planting Plan for specifications

“Alocasiaodora”  
(NIGHT FRAGRANT ELEPHANT EAR)






See Planting Plan for specifications



# STREET LANDSCAPE

L

	<p><i>Costus spectabilis</i> (RED COSTUS)</p> 			See Planting Plan for specifications
	<p><b>C. Ground Cover</b></p>			
	<p><i>Wedelia trilobata</i> (WEDELIA)</p> 			See Planting Plan for specifications
	<p><i>Arachis pintoi</i> (PEANUT PLANT)</p> 			See Planting Plan for specifications

## STREET LANDSCAPE

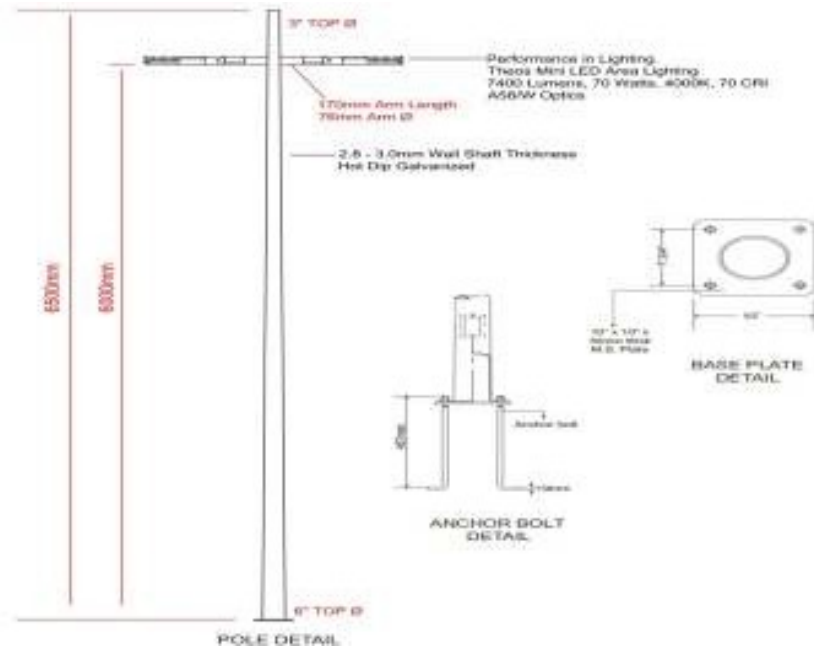
L

	<p><i>Ipomoea pes-caprae</i> (BEACH KANGKONG)</p> 			See Planting Plan for specifications
	<p>"Paspalum cv." (FROG GRASS)</p> 			See Planting Plan for specifications
III	LIGHTINGS			

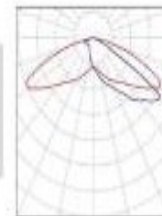


SPL 1200-2

Supply and Install 6.0m High Pedestrian Lamp Post Double Arms with 70W Luminaire @ 30m On center. Including Concrete Pedestal and Ground Rod with Clamp. (Theos by Performance inLighting)



SBP 06222196 THEOS MINI/A58/W 8-40K-  
96/70W  
Article No.: 06222196  
Luminous flux (Luminaire): 7464 lm  
Luminous flux (Lamps): 7463 lm  
Luminaire Wattage: 69.0 W  
Luminaire classification according to CIE: 100  
CIE flux code: 25 67 97 100 98  
Fitting: 1 x 06222196 (Correction Factor 1.000).



Theos Mini Lighting Fixture by Performance Lighting/LGC Electric or Approved Equivalent

IV	IRRIGATION			
	Quick Coupler Valve			
	<div></div>			

**SECTION VII**

**Drawings**  
(IN SEPARATE VOLUME)

**SECTION VIII**

**Bill of Quantities**

## BILL OF QUANTITIES

Project **CONSTRUCTION OF NEW CLARK CITY CONNECTING ROAD PACKAGE 1**

Name: **New Clark City**

Location:

SUMMAR Y		
PAR T	DESCRIPTI ON	BID AMOUNT in Php
A	Facilities for the Engineer	
B	Other General Requirement	
C	Earthworks	
D	Subbase and Base Course	
E	Surface Courses	
F	Bridge Construction	
G	Drainage and Slope Protection Structures	
J	Streetlights and Area Lightings	
K	Miscellaneous Structures	
L	Landscape	
TOTAL BID AMOUNT		

**TOTAL BID AMOUNT:**

in Figures: \_\_\_\_\_

in Words: \_\_\_\_\_

\_\_\_\_\_  
Name of Bidder's Company

\_\_\_\_\_  
Name and Signature of Bidder's Authorized Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Official Stamp

## BILL OF QUANTITIES

Project Name : CONSTRUCTION OF NEW CLARK CITY CONNECTING  
Location : New Clark

ITEM NO.	DESCRIPTION	UNIT	QTY.	UNIT COST (Pesos)	AMOUNT (Pesos)
	<b>PART A - FACILITIES FOR THE ENGINEER</b>				
A.1.1(3)	Construction of Field Office for the Engineer (Minimum of 180 sq.m. Floor Area)	l.s.	1.00		
A.1.1(10)	Provision of Living Quarters for the Engineer 2 units (Rental Basis)	mo.	30.00		
A.1.1(11)	Provision of Furniture/Fixtures, Equipment and Appliances for the Field Office for the Engineer	l.s.	1.00		
A.1.1(13)	Provision of Furniture/Fixtures, Equipment and Appliances for the Living Quarters for the Engineer	l.s.	1.00		
A.1.1(16)	Operation and Maintenance of Field Office for the Engineer	mo.	15.00		
A.1.1(18)	Operation and Maintenance of Living Quarters for the Engineer	mo.	15.00		
A.1.2(2)	Provision of (2 units) 4x4 Pick Up Type Service Vehicle for the Engineer on Bare Rental Basis	mo.	30.00		
A.1.2(5)	Operation and Maintenance of (2 units) 4x4 Pick Up Type Service Vehicle for the Engineer	mo.	30.00		
A.1.4(1)	Provision of Progress Photographs	mo.	15.00		
A.1.5(1)	Provision of Communication Facility for the Engineer	ea.	6.00		
<b>TOTAL FOR PART A - FACILITIES FOR THE ENGINEER</b>				Php	

\_\_\_\_\_  
Name of Bidder's Company

\_\_\_\_\_  
Name and Signature of Bidder's Authorized Representative

\_\_\_\_\_  
Date

## BILL OF QUANTITIES

Project Name : CONSTRUCTION OF NEW CLARK CITY CONNECTING  
 Location : New Clark

ITEM NO.	DESCRIPTION	UNIT	QTY.	UNIT COST (Pesos)	AMOUNT (Pesos)
	<b>PART B - OTHER GENERAL REQUIREMENTS</b>				
B.2	Medical Room and First Aid Facilities	l.s.	1.00		
B.4(1)	Construction Survey and Staking	km.	5.00		
B.4(2)	Slope, Reference and Clearing and Grubbing stakes	km.	5.00		
B.4(3)	Centerline Reestablishment	km.	5.00		
B.4(4)	Culvert Survey and Staking	ea.	20.00		
B.4(5)	Bridge Survey and Staking	l.s.	1.00		
B.4(7)	Grade Finishing Stakes	km.	5.00		
B.4(8)	Permanent Monuments and Markers	ea.	25.00		
B.5	Project Signboard	ea.	2.00		
B.7	Construction Occupational Safety and Health Program	mo.	15.00		
B.9	Mobilization/Demobilization	l.s.	1.00		
<b>TOTAL FOR PART B - OTHER GENERAL REQUIREMENTS</b>				Php	

\_\_\_\_\_  
 Name of Bidder's Company

\_\_\_\_\_  
 Name and Signature of Bidder's Authorized Representative

\_\_\_\_\_  
 Date

## BILL OF QUANTITIES

Project Name : CONSTRUCTION OF NEW CLARK CITY CONNECTING  
 Location : New Clark

ITEM NO.	DESCRIPTION	UNIT	QTY.	UNIT COST (Pesos)	AMOUNT (Pesos)
	<b>PART C - EARTHWORKS</b>				
100(1)	Clearing and Grubbing	ha.	14.01		
100(3)a2	Individual Removal of Trees above 301-500mm dia. Small	ea.	181.00		
100(3)a4	Individual Removal of Trees above 751-900mm dia. Small	ea.	208.00		
102(2)	Roadway Surplus Common Excavation	cu.m.	52,246.00		
103(3)	Foundation Fill	cu.m.	19,906.94		
103(6)a	Structure Excavation (Electrical)	cu.m.	18,559.80		
103(6)a	Structure Excavation (Pipe Culverts and Drain)	cu.m.	29,830.68		
104(1)a	Embankment (From Roadway Excavation)	cu.m.	136,999.48		
104(1)b	Embankment (From Borrow)	cu.m.	5,452.88		
105(1)a	Subgrade Preparation	sq.m.	87,257.61		
<b>TOTAL FOR PART C – EARTHWORKS</b>				Php	

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 Name of Bidder's Company

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 Name and Signature of Bidder's Authorized Representative

\_\_\_\_\_  
 Date



## BILL OF QUANTITIES

Project Name : CONSTRUCTION OF NEW CLARK CITY CONNECTING  
 Location : New Clark

ITEM NO.	DESCRIPTION	UNIT	QTY.	UNIT COST (Pesos)	AMOUNT (Pesos)
	<b>PART D - SUBBASE AND BASE COURSE</b>				
200(1)	Aggregate Subbase Course	cu.m.	43,678.1 1		
<b>TOTAL FOR PART D - SUBBASE AND BASE COURSE</b>				Php	

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 Name of Bidder's Company

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 Name and Signature of Bidder's Authorized Representative

\_\_\_\_\_  
 Date

## BILL OF QUANTITIES

Project Name : CONSTRUCTION OF NEW CLARK CITY CONNECTING

Location : New Clark

ITEM NO.	DESCRIPTION	UNIT	QTY.	UNIT COST (Pesos)	AMOUNT (Pesos)
	<b>PART E - SURFACE COURSE</b>				
	<b>Sta. 0 + 000 to Sta. 1 + 500</b>				
311(1)f1	Portland Cement Concrete Pavement (PCCP Unreinforced) 0.30m thick	sq.m.	79,550.25		
311(1)f2	Portland Cement Concrete Pavement (PCCP Unreinforced) 0.15m thick	sq.m.	79,408.05		
<b>TOTAL FOR PART E - SURFACE COURSE</b>				Php	

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Name of Bidder's Company

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Name and Signature of Bidder's Authorized Representative

\_\_\_\_\_  
Date

## BILL OF QUANTITIES

Project Name : CONSTRUCTION OF NEW CLARK CITY CONNECTING

Location : New Clark

ITEM NO.	DESCRIPTION	UNIT	QTY.	UNIT COST (Pesos)	AMOUNT (Pesos)
	<b>PART F - BRIDGE CONSTRUCTION</b>				
	<b>Bridge 1</b>				
103(2)a	Bridge Excavation (Common Soil)	cu.m.	249.20		
104(1)b	Embankment from Borrow (Common Soil)	cu.m.	2,632.00		
202(1)	Crushed Aggregate Base Course	cu.m.	109.20		
400(23)a11	Bored Pile (1.80m Diameter)	l.m.	252.00		
400(23)a13	Bored Pile (2.0m Diameter)	l.m.	168.00		
400(24)k1	Permanent Casing (1.80m dia. X 12mm thk.)	l.m.	75.60		
400(24)m1	Permanent Casing (2.0m dia. X 12mm thk.)	l.m.	50.40		
400(27)b	Load Test (PIT)	ea.	11.00		
400(28)	Load Test (Pile Dynamic Method, PDA)	ea.	2.00		
401(2)c	Reinforced Concrete Railing, Painted	l.m.	64.40		
404(1)a	Reinforcing Steel Bar (Grade 40)	kg.	18,400.90		
404(1)b	Reinforcing Steel Bar (Grade 60)	kg.	166,008.50		
405(1)b2	Structural Concrete Class "A" (fc=27.58 Mpa), 14 days	cu.m.	107.80		
405(1)b3	Structural Concrete Class "A" (fc=27.58 Mpa), 28 days	cu.m.	953.40		
406(1)d4	Prestressed Structural Concrete Member (Type III, L=15.2m, I-Girders)	ea.	25.00		
407(8)	Lean Concrete (Class B, 16.50 Mpa)	cu.m.	33.60		
412(1)	Elastomeric Bearing Pad DURO 60	ea.	50.40		
507(1)	Rubble Concrete	cu.m.	511.70		
508(1)	Hand Laid Rock Embankment	cu.m.	249.20		
517(1)a	Drain Pipe 100mm dia. Galvanized Pipe including Pipe Fittings	l.m.	50.40		
BRIDGE-001	Premolded Expansion Joint Filler with Sealant	sq.m.	342.30		
<b>TOTAL FOR PART F - BRIDGE CONSTRUCTION</b>				Php	

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Name of Bidder's Company

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Date

## BILL OF QUANTITIES

Project Name : CONSTRUCTION OF NEW CLARK CITY CONNECTING

Location : New Clark

ITEM NO.	DESCRIPTION	UNIT	QTY.	UNIT COST (Pesos)	AMOUNT (Pesos)
	<b>PART G - DRAINAGE AND SLOPE PROTECTION STRUCTURES</b>				
404(1)a	Reinforcing Steel, Grade 60	kg.	376,103.40		
405(1)a3	Structural Concrete, Class "A" (Drainage Structures)	cu.m.	2,839.10		
500(1)a1	Pipe Culvert, 300mm dia. Class II, TYPE B (RCPC)	l.m.	699.20		
500(1)a2	Pipe Culvert, 610mm dia. Class II, TYPE B (RCPC)	l.m.	1,468.88		
500(1)a3	Pipe Culvert, 910mm dia. Class II, TYPE B (RCPC)	l.m.	2,906.00		
500(1)a4	Pipe Culvert, 1070mm dia. Class II, TYPE B (RCPC)	l.m.	428.00		
500(1)a5	Pipe Culvert, 1220mm dia. Class II, TYPE B (RCPC)	l.m.	402.00		
502(1)a3	Manhole for 910mm dia. RCPC	ea.	145.00		
502(1)a4	Manhole for 1070mm dia. RCPC	ea.	22.00		
502(1)a5	Manhole for 1220mm dia. RCPC	ea.	20.00		
502(4)a	Manhole for RCBC	ea.	110.00		
502(3)	Catch Basin	ea.	349.00		
502(8)	Hand Laid Rocks	cu.m	252.00		
DRAINAGE-001	HW/WW for 910mm Dia. RCPC	ea.	1.00		
DRAINAGE-002	HW/WW for 1070mm Dia. RCPC	ea.	2.00		
<b>TOTAL FOR PART G - DRAINAGE AND SLOPE PROTECTION STRUCTURES</b>				Php	

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Name of Bidder's Company

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Name and Signature of Bidder's Authorized Representative

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Date

## BILL OF QUANTITIES

Project Name : CONSTRUCTION OF NEW CLARK CITY CONNECTING  
 Location : New Clark

ITEM NO.	DESCRIPTION	UNIT	QTY.	UNIT COST (Pesos)	AMOUNT (Pesos)
	<b>PART J - STREETLIGHTS AND AREA LIGHTINGS</b>				
LIGHTING-001	Construction of Concrete Pedestal	set	443.00		
LIGHTING-002	Supply and Install Single Arm Post, with Street Light (including lighting control panel, photoelectric cell, feeder distribution system, footing, steel pole, wires, conduits , ground rod, clamp, etc.)	set	235.00		
LIGHTING-003	Supply and Install Double Arm Post, with Street Light (including lighting control panel, photoelectric cell, feeder distribution system, footing, steel pole, wires, conduits, ground rod, clamp etc.)	set	207.00		
<b>TOTAL FOR PART J - STREETLIGHTS AND AREA LIGHTINGS</b>				Php	

\_\_\_\_\_  
 Name of Bidder's Company

\_\_\_\_\_  
 Name and Signature of Bidder's Authorized Representative

\_\_\_\_\_  
 Date

## BILL OF QUANTITI

Project Name : CONSTRUCTION OF NEW CLARK CITY CONNECTING  
Location ROAD PACKAGE 1

ITEM NO.	DESCRIPTI ON	UNIT	QTY.	UNIT COST (Pesos)	AMOUNT (Pesos)
	<b>PART H - MISCELLANEOUS STRUCTURES</b>				
600(2)	Concrete Curb and Gutter (D1)	l.m.	24,615.60		
600(3)	Concrete Curb and Gutter (D2)	l.m.	8,205.20		
605(2)r2	Regulatory Signs	ea.	62.00		
610	Sodding	sq.m.	100,564.20		
612(1)	Reflectorized Thermoplastic Pavement Marking	sq.m.	8,724.20		
MISCELLANEOUS-001	Paving Blocks	sq.m.	36,080.13		
<b>TOTAL FOR PART K - MISCELLANEOUS STRUCTURES</b>				Php	

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Name of Bidder's Company

\_\_\_\_\_  
Name and Signature of Bidder's Authorized Representative

\_\_\_\_\_  
Date

## BILL OF QUANTITI

Project Name : CONSTRUCTION OF NEW CLARK CITY CONNECTING  
Location ROAD PACKAGE 1

ITEM NO.	DESCRIPTI ON	UNI T	QTY.	UNIT COST (Pesos)	AMOUNT (Pesos)
	<b>PART K - STREET LANDSCAPES</b>				
LANDSCAPES- 001	Landscaping Works	lot	1.00		
<b>TOTAL FOR PART L - STREET LANDSCAPES</b>				Php	

\_\_\_\_\_  
Name of Bidder's Company

\_\_\_\_\_  
Name and Signature of Bidder's Authorized Representative

\_\_\_\_\_  
Date

# **SECTION IX**

## **Bidding Forms**



## Table of Contents

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## **Bid Form**

## Bid Form

*[Insert date]*

To: *[Name of PROCURING ENTITY]*  
*[Insert address]*

We, the undersigned, declare that:

- (a) We have examined and have no reservation to the Bidding Documents, including Addenda, for the Contract *[insert name of contract]*;
- (b) We offer to execute the Works for this Contract in accordance with the Bid and Bid Data Sheet, General and Special Conditions of Contract accompanying this Bid;

The total price of our Bid, excluding any discounts offered below is: *[insert amount in figures]* and *[insert amount in words]*;

The discounts offered and the methodology for their application are: *[insert amount in figures]* and *[insert amount in words]*;

- (c) Our Bid shall be valid for a period of 120 days from the date fixed for the Bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (d) 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;
- (e) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from the following eligible countries: *[insert information]*;
- (f) 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;
- (g) Our firm, its affiliates or subsidiaries, including any subcontractors or suppliers for any part of the Contract, has not been declared ineligible by the Funding Source;
- (h) 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
- (i) We understand that you are not bound to accept the Lowest Calculated Bid or any other Bid that you may receive.
- (j) 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]*.

- (k) 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: \_\_\_\_\_

In the capacity of: \_\_\_\_\_

Signed: \_\_\_\_\_

Duly authorized to sign the Bid for and on behalf of: \_\_\_\_\_

Date: \_\_\_\_\_

## **Statement of Availability of Key Personnel and Equipment**

## STATEMENT OF AVAILABILITY OF KEY PERSONNEL AND EQUIPMENT

*[Date of Issuance]*

**To: The DBM-PS BAC I Chairperson**

Procurement Service  
PS Complex, Cristobal Street  
Paco, Manila

Dear \_\_\_\_\_:

In compliance with the requirements of the PS-DBM Bids and Awards Committee I for the bidding of the Construction of New Clark City Connecting Road Package 1 under PB 20-XXX-1 ("the Project"), we certify that [Name of the Bidder] has in its employ key personnel, such as Project Manager, Project Engineer, Bridge/Structural Engineer, Quantity Engineer, Materials Engineer II, Site Engineer, Electrical Engineer, Health and Safety Officer, Drainage Engineer and Geodetic Engineer, who will be engaged for the construction of the said Project. Further, we likewise certify the availability of equipment that *[Name of the Bidder]* owns, has under lease, and/or has under purchase agreement that may be used for the Project.

Very truly yours,

*[Name of Authorized Representative]*

*[Position]*

*[Name of Bidder]*

**List of Construction Key Personnel Proposed to be  
Assigned to the Project**

## LIST OF CONSTRUCTION KEY PERSONNEL PROPOSED TO BE ASSIGNED TO THE CONTRACT

Construction of New Clark City Connecting Road Package 1 under Public Bidding No. 20-021-1

Business Name : \_\_\_\_\_  
 Business Address : \_\_\_\_\_

	Project Manager	Project Engineer	Bridge/ Structural Engineer	Quantity Engineer	Materials Engineer II	Site Engineer	Electrical Engineer	Health and Safety Officer	Drainage Engineer	Geodetic Engineer
1. Name										
2. Address										
3. Date of Birth										
4. Employed Since (Current Co.)										
5. Previous Employment										
6. Education										
7. PRC License/ Accreditation from DOLE-OHSC (for the Health and Safety Officer)/ DPWH Accreditation										
8. Years of Experience in Proposed Position										

**Note:** This List must be supported by individual resumes the following documents:

51.2.1.1.1.1 Individual resumes to show proof of the following:

- a. that the proposed personnel meets the required relative experience
- b. list of projects handled with the corresponding position and its inclusive years of experience (e.g. Construction of Roads and/or Bridges, Project Manager, 2012-2017)

51.2.1.1.1.2 Photocopy of PRC Licenses/DOLE-OHSC/DPWH Accreditation.

Submitted by : \_\_\_\_\_  
 (Printed Name & Signature of Authorized Representative)  
 Designation : \_\_\_\_\_  
 Date : \_\_\_\_\_



**List of Equipment, Owned or Leased and/or Under  
Purchase Agreement, Pledged to the Proposed  
Contract**

# LIST OF EQUIPMENT, OWNED OR LEASED AND/OR UNDER PURCHASE AGREEMENT, PLEDGED TO THE PROPOSED CONTRACT

Construction of New Clark City Connecting Road Package 1 under Public Bidding No. 20-021-1

Business Name : \_\_\_\_\_  
Business Address : \_\_\_\_\_

Description	Model/ Year	Capacity/Performance/Size	Plate No.	Motor No./ Body No.	Location	Condition	Proof of Ownership/ Lessor/Vendor
<b>A. Owned</b>							
i.							
ii.							
iii.							
<b>B. Leased</b>							
i.							
ii.							
iii.							
<b>C. Under Purchase Agreement</b>							
i.							
ii.							
iii.							

**Note: This List must be supported by proof of ownership, lease and/or purchase agreement. For lease and purchase agreement, such proof must include a certification of availability of equipment from the lessor/vendor for the duration of the project.**

Submitted by : \_\_\_\_\_  
(Printed Name & Signature of Authorized Representative)

Designation : \_\_\_\_\_  
\_\_\_\_\_

Date : \_\_\_\_\_

## **Statement of Completed Similar Contracts**

STATEMENT OF SINGLE LARGEST COMPLETED CONTRACT (SLCC)

I, \_\_\_\_\_, in compliance with the eligibility requirements for the bidding of the Construction of New Clark City Connecting Road Package 1, this is to certify that [name and complete address of contractor] has completed government and private contracts:

No. of Contract	Date of Contract	Contract Duration	Owner's Name and Address	Nature of Work	Contractor's Role (whether sole contractor, subcontractor or partner in a JV)	Total Contract Value at Award (in PhP)	Date of Completion	Total Contract Value at Completion, if applicable (in PhP)	Percentages of Planned & Actual Accomplishments, if applicable	Value of Work (in PhP)

I hereby,  
  
[Signature]  
[Over printed name of Authorized Representative]  
[Title]

**Note:** This statement shall be supported by contracts, certificate of award, or owner's final acceptance and CPES rating sheets, if applicable. These supporting documents shall be numbered and tabulated in the same sequence as the list of contracts appears in this statement.

## **Statement of All On-Going Contracts**

[Date]

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Dear \_\_\_\_\_,

In compliance with the eligibility requirements for the bidding of the Construction of New Clark City Connecting Road Package 1, this is to certify that *[name and complete address of Bidder]* has the following on-going government and private contracts. [Including contracts awarded but not yet started]:

Ta b No .	Name of Contr act	Date of Contr act	Contr act Durati on	Owne r's Name and Addre ss	Natu re of Wor k	Contracto r's Role (whether sole contractor , subcontra ctor or partner in a JV)	Total Contr act Value at Award (in PhP)	[Estimat ed] Date of Completi on	Total Contract Value at Completi on, if applicabl e (in PhP)	Percentages of Planned & Actual Accomplishm ents, if applicable	Value of Outstand ing Works, if applicabl e (in PhP)

Yours sincerely,

[Signature over printed name of Authorized Representative]  
[Title]  
[Name of Firm]

**Note:** This statement shall be subject to audit or notices to proceed and all supporting documents shall be submitted as the list of contracts.

## **Omnibus Sworn Statement**

## Omnibus Sworn Statement

---

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] [insert "as shown in the attached duly notarized Special Power of Attorney" for the authorized representative];

*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], accompanied by the duly notarized Special Power of Attorney, Board/Partnership Resolution, or Secretary's Certificate, 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;

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 following responsibilities as a Bidder:
  - a) Carefully examine all of the Bidding Documents;
  - b) Acknowledge all conditions, local or otherwise, affecting the implementation of the Contract;
  - c) Made an estimate of the facilities available and needed for the contract to be bid, if any; and
  - d) Inquire or secure 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. [Name of Bidder] hereby assigns the following contact number/s and e-mail address/es as the official telephone/fax number and contact reference of the company where the PS BAC and PS notices may be transmitted.  
Telephone No/s. : \_\_\_\_\_  
Fax No/s. : \_\_\_\_\_  
E-mail Add/s. : \_\_\_\_\_  
Mobile No/s. : \_\_\_\_\_

IN WITNESS WHEREOF, I have hereunto set my hand this \_\_\_\_ day of \_\_\_\_, 20\_\_ at \_\_\_\_\_, Philippines.

\_\_\_\_\_  
Bidder's Representative/Authorized Signatory

**SUBSCRIBED AND SWORN** to before me this \_\_\_\_ day of [month] [year] at [place of execution], Philippines. Affiant/s is/are personally known to me and was/were identified by me through competent evidence of identity as defined in the 2004 Rules on Notarial Practice (A.M. No. 02-8-13-SC). Affiant/s exhibited to me his/her [insert type of government identification card used], with his/her

photograph and signature appearing thereon, with no. \_\_\_\_\_ and his/her Community Tax Certificate No. \_\_\_\_\_ issued on \_\_\_\_ at \_\_\_\_\_.

Witness my hand and seal this \_\_\_\_ day of *[month]* *[year]*.

**NAME OF NOTARY PUBLIC**

Serial No. of Commission \_\_\_\_\_

Notary Public for \_\_\_\_\_ until \_\_\_\_\_

Roll of Attorneys No. \_\_\_\_\_

PTR No. \_\_, *[date issued]*, *[place issued]*

IBP No. \_\_, *[date issued]*, *[place issued]*

MCLE No. \_\_

Doc. No. \_\_\_\_

Page No. \_\_\_\_

Book No. \_\_\_\_

Series of \_\_\_\_

## **Joint Venture Agreement**

## JOINT VENTURE AGREEMENT

### KNOW ALL MEN BY THESE PRESENTS:

This **JOINT VENTURE AGREEMENT** (hereinafter referred to as the "Agreement"), entered into this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_ at \_\_\_\_\_ City, Philippines by and among:

\_\_\_\_\_, a domestic corporation duly organized, registered and existing under and by virtue of the laws of the Republic of the Philippines, with office address at \_\_\_\_\_, represented by its \_\_\_\_\_, \_\_\_\_\_, hereinafter referred to as "\_\_\_\_\_",

- and -

\_\_\_\_\_, a domestic corporation duly organized, registered and existing under and by virtue of the laws of the Republic of the Philippines, with office address at \_\_\_\_\_, represented by its \_\_\_\_\_, \_\_\_\_\_, hereinafter referred to as

"\_\_\_\_\_",  
\_\_\_\_\_,"

- and -

\_\_\_\_\_ a foreign corporation organized and existing under and by virtue of the laws of \_\_\_\_\_, represented by its \_\_\_\_\_, \_\_\_\_\_, hereinafter referred to as "\_\_\_\_\_",  
\_\_\_\_\_,"

(Henceforth collectively referred to as the "**Parties**")

### WITNESSETH: That

**WHEREAS**, the Procurement Service (PS) has recently published an Invitation to Apply for Eligibility and to Bid for the Supply and Delivery of \_\_\_\_\_ for the \_\_\_\_\_;

**WHEREAS**, the parties have agreed to pool their resources together to form the "\_\_\_\_\_ Joint Venture", hereinafter referred to as the Joint Venture, under the laws of the Philippines, for the purpose of participating in the abovementioned procurement of PS-DBM;

NOW, THEREFORE, for and in consideration of the foregoing premises and the covenants hereto set forth, the Parties have agreed as follows:

## **ARTICLE I ORGANIZATION OF THE JOINT VENTURE**

SECTION 1. Formation – The Parties do hereby agree and bind themselves to establish, form and organize a Joint Venture pursuant to the laws of the Republic of the Philippines, in order for the JV to carry on the purposes and objectives for which it is created;

SECTION 2. Name – The name and style under which the JV shall be conducted is  
“ \_\_\_\_\_ ”,

SECTION 3. Principal Place of Business – The JV shall maintain its principal place of business at \_\_\_\_\_ ;

SECTION 4. Preparation and Documentation – The Parties shall secure and/or execute such certifications, documents, deeds and instruments as may be required by the laws of the Republic of the Philippines for the realization of the JV and in compliance with the Project. Further, they shall do all other acts and things requisite for the continuation of the JV pursuant to applicable laws;

SECTION 5. The Joint Venture shall be represented by the \_\_\_\_\_ in all biddings, related procurement transactions and other official dealings that it shall enter into with the PS-DBM and third parties, such transactions to include, among others, the submission of eligibility documents, bids, registration documents obtaining bonds, performing the principal contract in the event that the contract is awarded in favor of the Joint Venture, receipt of payment for goods delivered, and similar and related activities.

SECTION 6. The period of the Joint Venture shall begin upon execution of this Agreement and shall continue until the complete performance of its contractual obligations to PS-DBM, as described in Article II hereof, or upon its termination for material breach of any term or condition of this Agreement, by service of a written statement in English on the other Party, not less than 90 days prior to the intended date termination

## **ARTICLE II PURPOSE**

SECTION 1. The primary purpose of the Joint Venture is to participate in the public bidding to be conducted by the DBM-PS Bids and Awards Committee for the supply and delivery of \_\_\_\_\_ for the \_\_\_\_\_ .

SECTION 2. If the above-described contract/s is/are awarded to the Joint Venture, the Joint Venture shall undertake the performance thereof to PS-DBM, and such other incidental activities necessary for the completion of its contractual obligations.

## **ARTICLE III SOLIDARY LIABILITY OF THE PARTIES**

SECTION 1. In the performance of the contract/s that may be awarded to the Joint Venture by the PS-DBM, and all other related activities/obligations, as described in Article II hereof, the Parties bind themselves jointly and solidarily, in the concept of solidarily debtors, subject to the right of reimbursement, as provided in the relevant provisions of the Civil Code of the Philippines.

**ARTICLE IV**  
**CONTRIBUTION AND OTHER ARRANGEMENTS**

SECTION 1. Contribution – The Parties shall contribute the amount of \_\_\_\_\_ (Php ) to support the financial requirements of the Joint Venture, in the following proportion:

A.	-	P	.00
B.	-	<u>P</u>	<u>.00</u>
TOTAL		P	.00

Additional contributions to the Joint Venture shall be made as may be required for contract implementation. In addition, \_\_\_\_\_ shall contribute any labor and contract management requirements.

SECTION 2. Profit Sharing – The share of the Parties to the JV from any profit derived or obtained from the implementation and execution of the Project shall be distributed pro rata to each, in accordance with the contribution and resources each has provided to the JV;

SECTION 3. Liquidation and Distributions – Any sum remaining after deducting from the total of all moneys or benefits received for the performance of the contract, all costs incurred by the JV after award of the contract for the Project pursuant to the accounting practices established for the JV, shall be distributed in accordance with the relative balances in the accounts of each Party pursuant to Sec.1 of this Article upon completion, final accounting, termination and liquidation of the JV. In the event of liquidation and termination of JV, and after taking into account the shares of the Parties in all income, gain, deductions, expenses, and losses, should the account of a Party contain a negative balance, such Party shall contribute cash to the JV sufficient to restore the said balance to zero;

SECTION 4. Sharing of Burden of a Net Loss – In case a net loss is incurred, additional contributions shall be made by the Parties in accordance with their respective shares.

**ARTICLE V**

**MISCELLANEOUS PROVISIONS**

SECTION 1. The provisions of the Instructions to Bidders, Supplemental Bid Bulletin, and other bidding documents issued by the PS-DBM in relation to the contract described in Article II hereof, shall be deemed incorporated in this Agreement and made an integral part thereof.

SECTION 2. This Agreement shall be binding upon and inure to the benefit of the Parties and their respective successors and assigns.

SECTION 3. The Parties herein are duly represented by their authorized officers.

SECTION 4. Governing Law - This Agreement shall be governed by and construed

according to the laws of the Republic of the Philippines. Venue of any court action arising from this Agreement shall be exclusively laid before the proper court of the \_\_\_\_\_, Philippines.

IN WITNESS WHEREOF, the parties have set their hands and affixed their signatures on the date and place first above-stated.

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Signed in the Presence of:

\_\_\_\_\_  
\_\_\_\_\_

#### ACKNOWLEDGMENT

REPUBLIC OF THE PHILIPPINES )  
CITY/MUNICIPALITY OF \_\_\_\_\_) S.S.  
PROVINCE OF (in the case of Municipality)

BEFORE ME, a Notary Public for and in the City/Municipality of \_\_\_\_\_ (indicate also the Province in the case of Municipality), this \_\_\_\_\_ day of \_\_\_\_\_ (month & year) personally appeared the following:

Name

ID Name, Number and Validity Date

Known to me and to me known to be the same persons who executed the foregoing instrument and they acknowledge to me that the same is their free and voluntary act and deed and that of the corporation(s) they represent.

This instrument refers to a Joint Venture Agreement consisting of \_\_\_\_\_ pages, including the page on which this Acknowledgement is written, and signed by the parties and their instrumental witnesses.

WITNESS MY HAND AND NOTARIAL SEAL on the place and on the date first above written.

\_\_\_\_\_  
(Notary Public)

Until	_____
PTR No.	_____
Date	_____
Place	_____
TIN	_____
IBP	_____

Doc. No. ;  
Page No. ;  
Book No. ;  
Series of 20\_\_.

***Note:** The competent evidence of identity for Notary shall comply with Sec. 12 (a), Rule II of the 2004 Rules on Notarial Practice. “Sec. 12. Competent Evidence of Identity – The phrase “competent evidence of identity” refers to the identification of an individual based on at least one current identification document issued by an official agency bearing the photograph and signature of the individual, such as but not limited to, passport, driver’s license, Professional Regulations Commission ID, National Bureau of Investigation clearance, police clearance, postal ID, voter’s ID, Barangay certification, Government Service and Insurance System (GSIS) e-card, Social Security System (SSS) card, Philhealth card, senior citizen card, Overseas Workers Welfare Administration (OWWA) ID, OFW ID, seaman’s book, alien certificate of registration/immigrant certificate of registration, government office ID, certification from the National Council for the Welfare of Disabled Persons (NCWDP), Department of Social Welfare and Development (DSWD) certification;*



## **Proforma Letter for Withdrawal of Documents**

## SUPPLIER'S LETTERHEAD

### (PROFORMA LETTER FOR WITHDRAWAL OF DOCUMENTS)

\_\_\_\_\_  
Date

**Chairperson  
Procurement Service  
Bids and Awards Committee I  
Paco, Manila**

Dear Sir:

This has reference to Public Bidding No. \_\_\_\_\_ for \_\_\_\_\_ (Name of Project) \_\_\_\_\_.  
Name of Company) \_\_\_\_\_ respectfully requests for the following:

- ( ) Withdraw of Bid Submissions
- ( ) Refund of Bid Security  
(Attached is a photocopy of the Procurement Service Official Receipt)
- ( ) Cancellation of Credit Line Certificate

It is understood that \_\_\_\_\_ waives its right to file any motion for reconsideration and/pr protest in connection with the above-cited Public Bidding Project.

Thank you.

Very truly yours,

\_\_\_\_\_  
**Authorized Signatory for the Company**

## **Form of Performance Security (Bank Guarantee)**

## Form of Performance Security (Bank Guarantee)

---

To : Procurement Service  
PS Complex, Cristobal St.,  
Paco, Manila

WHEREAS, \_\_\_\_\_ (*Name and Address of Supplier*) (hereinafter called "the Supplier") has undertaken, in pursuance of Purchase Order No. \_\_\_\_\_ dated \_\_\_\_\_ to execute (*Name of Contract and Brief Description*) (hereinafter called "the Contract");

AND WHEREAS, it has been stipulated by you in the said Contract that the Supplier shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS, we have agreed to give the Supplier such a Bank Guarantee;

NOW THEREFORE, we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Supplier, up to a total of [*Amount of Guarantee*] proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of [*Amount of Guarantee*] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Supplier before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract to be performed thereunder or of any of the Contract documents which may be made between you and the Supplier shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until the date of issue of the Final Acceptance [Inspection, & Certification of Acceptance Report (I.C.A.R.)].

SIGNATURE AND SEAL OF THE  
GUARANTOR  
NAME OF BANK  
ADDRESS  
DATE

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_

## **Bid Securing Declaration Form**

REPUBLIC OF THE PHILIPPINES )  
CITY OF \_\_\_\_\_ ) S.S.  
X-----X

**BID-SECURING DECLARATION**

**Invitation to Bid/Request for Expression of Interest No.1:**

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 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 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 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;
  - (c) I am/we are declared as 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'S AUTHORIZED REPRESENTATIVE]**

**[Insert signatory's legal capacity]**

Affiant

**SUBSCRIBED AND SWORN** to before me this \_\_\_\_ day of [month] [year] at [place of execution], Philippines. Affiant/s is/are personally known to me and was/were identified by me through competent evidence of identity as defined in the 2004 Rules on Notarial Practice (A.M. No. 02-8-13-SC). Affiant/s exhibited to me his/her [insert type of government identification card used], with his/her photograph and signature appearing thereon, with no. \_\_\_\_.

Witness my hand and seal this \_\_\_\_ day of [month] [year].

**NAME OF NOTARY PUBLIC**

Serial No. of Commission \_\_\_\_\_

Notary Public for \_\_\_\_\_ until \_\_\_\_\_

Roll of Attorneys No. \_\_\_\_\_

PTR No. \_\_\_, [date issued], [place issued]

IBP No. \_\_\_, [date issued], [place issued]

Doc. No. \_\_\_\_

Page No. \_\_\_\_

Book No. \_\_\_\_

Series of \_\_\_\_.

## **Form of Contract Agreement**



## Contract Agreement for the Construction of New Clark City Connecting Road Package 1

---

THIS AGREEMENT, made this *[insert date]* day of *[insert month]*, *[insert year]* between *[name and address of PROCURING ENTITY]* (hereinafter called the “Entity”) and *[name and address of Contractor]* (hereinafter called the “Contractor”).

WHEREAS, the Entity is desirous that the Contractor execute *[name and identification number of contract]* (hereinafter called “the Works”) and the Entity has accepted the Bid for *[insert the amount in specified currency in numbers and words]* by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

### NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement, words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents shall be attached, deemed to form, and be read and construed as integral part of this Agreement, to wit:
  - (a) General and Special Conditions of Contract;
  - (b) Drawings/Plans;
  - (c) Specifications;
  - (d) Invitation to Bid;
  - (e) Instructions to Bidders;
  - (f) Bid Data Sheet;
  - (g) Addenda and/or Supplemental/Bid Bulletins, if any;
  - (h) Bid form, including all the documents/statements contained in the Bidder’s bidding envelopes, as annexes, and all other documents submitted (e.g., Bidder’s response to request for clarifications on the bid), including corrections to the bid, if any, resulting from the Procuring Entity’s bid evaluation;
  - (i) Eligibility requirements, documents and/or statements;
  - (j) Performance Security;
  - (k) Notice of Award of Contract and the Bidder’s conforme thereto;
  - (l) Other contract documents that may be required by existing laws and/or the Entity.
3. In consideration of the payments to be made by the Entity to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Entity to

execute and complete the Works and remedy any defects therein in conformity with the provisions of this Contract in all respects.

4. The Entity hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects wherein, the Contract Price or such other sum as may become payable under the provisions of this Contract at the times and in the manner prescribed by this Contract.

IN WITNESS whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

Signed, sealed, delivered by \_\_\_\_\_ the \_\_\_\_\_ (for the Entity)

Signed, sealed, delivered by \_\_\_\_\_ the \_\_\_\_\_ (for the Contractor).

Binding Signature of Procuring Entity

\_\_\_\_\_

Binding Signature of Contractor

\_\_\_\_\_

*[Addendum showing the corrections, if any, made during the Bid evaluation should be attached with this agreement]*

## **Form for Unit Price Analysis**

## DETAILED UNIT PRICE ANALYSIS

ITEM NO.	DESCRIPTION OF BOQ ITEM	UNIT OF MEASUREMENT	QUANTITY

A. DIRECT COST				
A.1 Cost of Materials	UNIT	QUANTITY	UNIT COST	AMOUNT
A.2 Cost of Labor	NO.	NO. OF HOURS	RATE PER HOUR	AMOUNT
A.3 Equipment Expenses	NO.	NO. OF HOURS	RATE PER HOUR	AMOUNT
ESTIMATED DIRECT COST (EDC) [A.1 + A.2 +A.3]				

<b>B. INDIRECT COSTS</b>	% of EDC	AMOUNT
B.1 Overhead Expense		
B.2 Contingencies		
B.3 Miscellaneous Expense		
B.4 Contractor's Profit		
<b>TOTAL MARK-UP</b>		

<b>EDC + TOTAL MARK-UP</b>	
<b>VALUE ADDED TAX [ 12% (EDC + TOTAL MARK-UP) ]</b>	
<b>TOTAL INDIRECT COST [TOTAL MARK-UP + VAT ]</b>	
<b>TOTAL COST [ EDC + TOTAL INDIRECT COST ]</b>	

<b>UNIT COST [ (TOTAL COST) / (QUANTITY) ]</b>	
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## **Form for Dayworks Rates**

## DAYWORKS SCHEDULE

### LABOR

Construction of New Clark City Connecting Road Package 1

NO.	TYPE OF LABOR	UNIT	RATE
1	Foreman	Hour	
2	Skilled Laborer	Hour	
3	Unskilled Laborer	Hour	
4	Driver	Hour	
5	Heavy Equipment Operator	Hour	

## DAYWORKS SCHEDULE

### MATERIALS

Construction of New Clark City Connecting Road Package 1

NO.	TYPE OF MATERIALS	UNIT	RATE
1	Cement	Bag	
2	Fine Aggregate	Cu.m.	
3	Coarse Aggregate	Cu.m.	
4	Reinforcing Steel Bars	Kg.	
5	Coco Lumber	Bd.ft.	
6	Assorted CWN	Kg.	
7	G.I. Tie Wire, Ga. 16	Kg.	
8	Plywood	piece	

## DAYWORKS SCHEDULE

### EQUIPMENT

Construction of New Clark City Connecting Road Package 1

NO.	TYPE OF EQUIPMENT	UNIT	RATE
1	Concrete Mixer, 1 Bagger	Hour	
2	Excavator, 0.5 cu.m.	Hour	
3	Concrete Vibrator	Hour	
4	Rough Terrain Crane, 10 tonner	Hour	
5	Utility Truck	Hour	
6	Roller, 1 tonner	Hour	
7	Bar Cutter	Hour	



