

# **PHILIPPINE BIDDING DOCUMENTS**

(As Harmonized with Development Partners)

## **Construction of San Roque-San Antonio Magcopa-San Pablo Suha-Doonga Ilaya Farm to Market Road with Two (2) Bridge Component**

**Project ID No. PRDP-SU-IB-R04A-QUE-004-CAT-001-2023-FMB**

**Municipality of Catanauan, Quezon**

**October 15, 2024**

**Fifth Edition  
June 2023**

**Subproject Name:** Construction of San Roque-San Antonio Magcopa-San Pablo Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge Component  
**Subproject ID No.:** PRDP-SU-IB-R04A-QUE-004-CAT-001-2023-FMB  
**Location:** Brgys. San Roque, San Antonio Magcopa, San Pablo Suha, Doongan Ilaya Catanauan, Quezon

**Bidder Name:** \_\_\_\_\_

### BID OPENING CHECKLIST

#### *Envelope 1*

<b>ELIGIBILITY DOCUMENTS</b>	
a. Registration Certification of the Company (DTI, SEC or CDA)	
b. Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid and average Annual Turnover as specified in ITB Clause 5.4 hereof:	
<b>Basis of Critical Eligibility and Qualification Criteria:</b>	
- At least one (1) work of a nature and complexity equivalent to the Works generally within the last ten (10) years with at least fifty percent (50%) of the Estimated Project Cost (EPC) in the amount of PhP190,000,000.00; or at least two (2) similar contracts (1 road and 1 bridge) within the last ten (10) years and the aggregate contract amount should be equivalent to at least fifty percent (50%) of the Estimated Project Cost. (EPC) PhP190,000,000.00; and	
- Average Annual turnover of Construction Income for the last three (3) years of at least 100% of the EPC in the amount of PhP380,000,000.00 of the EPC as evidenced by the submitted Audited Financial Statement for the last three (3) years.	
c. Audited Financial Statement for the last three (3) years [with supporting Income Tax Return stamped "received" by BIR or its duly accredited and authorized institutions or eBIR Tax Return Receipt Confirmation (if submitted through eBIR), and eFPS/validated bank deposit slip payment]	
d. In case of Joint Venture, a duly notarized Joint Venture agreement and a copy of the duly accomplished application form for Special License of the Joint Venture filed with the PCAB, or a copy of the Special License of the Joint Venture if already issued.	
e. Qualification Information (please follow the link <a href="https://bit.ly/SectionIX-BiddingForms">https://bit.ly/SectionIX-BiddingForms</a> for the template)	
<b>TECHNICAL DOCUMENTS</b>	
f. Bid Security, in a form of <b>Bid Securing Declaration</b> (please follow the link <a href="https://bit.ly/SectionIX-BiddingForms">https://bit.ly/SectionIX-BiddingForms</a> for the template)	
g. Project requirements, which shall include the following:	
(i) List of Contractor's personnel, viz	
<b>a. Project Manager</b> – Licensed Civil Engineer with minimum of five (5) years of relevant experience as Project Manager in road and in bridge construction,	
<b>b. Two (2) Project Engineers for Road</b> - minimum of five (5) years of experience as Licensed Civil/Agricultural Engineer with at least two (2) projects handled in road construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of road or at least PhP67,335,400.00 <u>each project</u> ;	
<b>c. Project Engineer for Bridge</b> - minimum of five (5) years of experience as Licensed Civil/Agricultural Engineer with at least two (2) projects handled in bridge construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of bridge or at least PhP8,664,600.00 <u>each project</u> ;	
<b>d. Materials Engineer</b> – Licensed Civil Engineer Duly accredited by DPWH as Materials Engineer II following DPWH D.O. 98, S. of 2016 (as required under SCC Clause 6.5)	
<b>e. Geodetic Engineer</b> - Licensed Geodetic Engineer (not subject for evaluation but required during implementation)	
(ii) List of Bidder's major and critical equipment units, which are owned and are supported by proof of ownership, such as, without limitation, Deed of Sale, Official Receipt/Certificate of Registration, Sales Invoice, Charge Invoice or Delivery Receipt, which must meet the minimum requirement for the contract set in the Bid Data Sheet	

Pass (if all the above documents are present);

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

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

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

#### *Envelope 2*

<b>FINANCIAL PROPOSAL</b>	
Bid price in approved Bid form (please follow the link <a href="https://bit.ly/SectionIX-BiddingForms">https://bit.ly/SectionIX-BiddingForms</a> for the template of Bid Form) and Bid prices in the Bill of Quantities (please follow the link: <a href="#">Bill Of Quantities for Catanauan Subproject</a> for the template for the Bill of Quantities)	

#### **BID DATA SHEET**

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

Subproject Name: Construction of San Roque-San Antonio Magcopa-San Pablo Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge Component  
 Subproject ID No.: PRDP-SU-IB-R04A-QUE-004-CAT-001-2023-FMb  
 Location: Brgys. San Roque, San Antonio Magcopa, San Pablo Suha, Doongan Ilaya Catanauan, Quezon  
 Bidder Name: \_\_\_\_\_

**BID OPENING CHECKLIST (Joint Venture)**

**Envelope 1**

<b>ELIGIBILITY DOCUMENTS</b>	
a. Registration Certification of the Company (DTI, SEC or CDA) <i>(for each partner)</i>	
b. Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid and average Annual Turnover as specified in ITB Clause 5.4 hereof <i>(each partner/either one of the partners)</i> :	
<b>Basis of Critical Eligibility and Qualification Criteria:</b>	
- At least one (1) work of a nature and complexity equivalent to the Works generally within the last ten (10) years with at least fifty percent (50%) of the Estimated Project Cost (EPC) in the amount of PhP190,000,000.00 <i>(each partner/either one of the partners)</i> and 25% of the EPC in the amount of PhP95,000,000.00 for the rest of the partners; or at least two (2) similar contracts (1 road and 1 bridge) within the last ten (10) years and the aggregate contract amount should be equivalent to at least fifty percent (50%) of the Estimated Project Cost. (EPC) PhP190,000,000.00 <i>(each partner/either one of the partners)</i> and aggregate amount of 25% of the EPC in the amount of PhP95,000,000.00;	
- Average Annual turnover of Construction Income for the last three (3) years of at least 100% of the EPC in the amount of PhP380,000,000.00 of the EPC as evidenced by the submitted Audited Financial Statement for the last three (3) years (each partner/either one of the partners and 50% of the EPC in the amount of PhP190,000,000.00 for the rest of the partners.	
c. Audited Financial Statement for the last three (3) years [with supporting Income Tax Return stamped "received" by BIR or its duly accredited and authorized institutions or eBIR Tax Return Receipt Confirmation (if submitted through eBIR), and eFPS/validated bank deposit slip payment] <i>(each partner)</i>	
d. In case of Joint Venture, a duly notarized Joint Venture agreement and a copy of the duly accomplished application form for Special License of the Joint Venture filed with the PCAB, or a copy of the Special License of the Joint Venture if already issued.	
e. Qualification Information (please follow the link <a href="https://bit.ly/SectionIX-BiddingForms">https://bit.ly/SectionIX-BiddingForms</a> for the template)	
<b>TECHNICAL DOCUMENTS</b>	
f. Bid Security, in a form of <b>Bid Securing Declaration</b> (please follow the link <a href="https://bit.ly/SectionIX-BiddingForms">https://bit.ly/SectionIX-BiddingForms</a> for the template) <i>(prescribed template in the name of the Joint Venture)</i>	
g. Project requirements, which shall include the following <i>(pooling of resources or combination among partners)</i> :	
(i) List of Contractor's personnel, viz	
<b>a. Project Manager</b> – Licensed Civil Engineer with minimum of five (5) years of relevant experience as Project Manager in road and in bridge construction,	
<b>b. Two (2) Project Engineers for Road</b> - minimum of five (5) years of experience as Licensed Civil/Agricultural Engineer with at least two (2) projects handled in road construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of road or at least PhP67,335,400.00 <b>each project</b> ;	
<b>c. Project Engineer for Bridge</b> - minimum of five (5) years of experience as Licensed Civil/Agricultural Engineer with at least two (2) projects handled in bridge construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of bridge or at least PhP8,664,600.00 <b>each project</b> ;	
<b>d. Materials Engineer</b> – Licensed Civil Engineer Duly accredited by DPWH as Materials Engineer II following DPWH D.O. 98, S. of 2016 (as required under SCC Clause 6.5)	
<b>e. Geodetic Engineer</b> - Licensed Geodetic Engineer (not subject for evaluation but required during implementation)	
(ii) List of Bidder's major and critical equipment units, which are owned and are supported by proof of ownership, such as, without limitation, Deed of Sale, Official Receipt/Certificate of Registration, Sales Invoice, Charge Invoice or Delivery Receipt, which must meet the minimum requirement for the contract set in the Bid Data Sheet	

Pass (if all the above documents are present);

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

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

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

**Envelope 2**

<b>FINANCIAL PROPOSAL</b>	
Bid price in approved Bid form (please follow the link <a href="https://bit.ly/SectionIX-BiddingForms">https://bit.ly/SectionIX-BiddingForms</a> for the template of Bid Form) and Bid prices in the Bill of Quantities (please follow the link: <b>Bill Of Quantities for Catanauan Subproject</b> for the template for the Bill of Quantities)	

**BID DATA SHEET**

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

## **TABLE OF CONTENTS**

<b>SECTION I. INVITATION TO BID .....</b>	<b>5</b>
<b>SECTION II. INSTRUCTION TO BIDDERS .....</b>	<b>7</b>
<b>SECTION III. BID DATA SHEET .....</b>	<b>36</b>
<b>SECTION IV. GENERAL CONDITIONS OF CONTRACT .....</b>	<b>43</b>
<b>SECTION V. SPECIAL CONDITIONS OF CONTRACT .....</b>	<b>74</b>
<b>SECTION VI. SPECIFICATIONS .....</b>	<b>79</b>
<b>SECTION VII. DRAWINGS .....</b>	<b>268</b>
<b>SECTION VIII. BILL OF QUANTITIES .....</b>	<b>270</b>
<b>SECTION IX. BIDDING FORMS .....</b>	<b>271</b>

**Section I. Invitation to Bid**

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

**Construction of San Roque-San Antonio Magcopa-San Pablo  
Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge  
Component**

**Identification No. PRDP-SU-IB-R04A-QUE-004-CAT-001-2023-FMB  
Loan No. 9577-PH**

**October 15, 2024**

1. The Government of the Philippines (GoP) has received a Loan from the World Bank towards the cost of Philippine Rural Development Project and it intends to apply part of the proceeds of this Loan to payments under the contract for the **Construction of San Roque-San Antonio Magcopa-San Pablo Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge Component /PRDP-SU-IB-R04A-QUE-004-CAT-001-2023-FMB**.
2. The **Municipal Government of Catanauan, Quezon**, implementing partner of the Department of Agriculture, now invites bids for Construction of San Roque-San Antonio Magcopa-San Pablo Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge Component. Completion of the Works is required by **665 calendar days**. Bidders should have completed, within the last ten (10) years, a contract similar to the Project. The description of an eligible bidder is contained in the Bidding Documents, particularly, in Section II. Instructions to Bidders.
3. Bidding will be conducted in accordance with relevant procedures for open competitive bidding as specified in the IRR of RA 9184 (R.A. 9184), with some amendments, as stated in these bidding documents and is open to all bidders from eligible source countries as defined in the applicable procurement guidelines of the World Bank. The contract shall be awarded to the Lowest Calculated Responsive Bidder (LCRB) who was determined as such during post-qualification. The Estimated Project Cost for this project is **Three Hundred Eighty Million Pesos (PhP380,000,000.00)**.
4. Interested bidders may obtain further information from the Bids and Awards Committee of the **Municipality of Catanauan, Quezon** and inspect the Bidding Documents at the address given below also at **PRDP Regional Project Coordination Office CALABARZON (RPCO IV-A)** with address at Lipa Agricultural Research and Extension Station Brgy. Marawoy, Lipa City, Batangas and/or at **PRDP South Luzon Project Support Office (PSO Luzon B Procurement Unit)** at 3<sup>rd</sup> Floor Department of Agriculture RFO IV-A, RMIC Bldg. BPI Compound, Visayas Ave. Diliman, Quezon City and at the **National Project Coordination Office (NPCO)** with address at Elliptical Road, Diliman, Quezon City from **08:30 a.m. to 04:30 p.m.**, Mondays to Fridays.
5. A complete set of Bidding Documents may be purchased by interested Bidders starting **October 15, 2024** from the address below, at the **PRDP Regional Project Coordination Office CALABARZON (RPCO IV-A)** with address at Lipa Agricultural Research and Extension Station Brgy. Marawoy, Lipa City, Batangas and/or at **PRDP South Luzon Project Support**

**Office (PSO Luzon B Procurement Unit)** at 3<sup>rd</sup> Floor Department of Agriculture RFO IV-A, RMIC Bldg. BPI Compound, Visayas Ave. Diliman, Quezon City, and upon payment or depositing to the ***Municipality of Catanauan Quezon, Trust Fund Account No. 4352-1006-55 Landbank of the Philippines (LBP) Catanauan Branch*** of a non-refundable fee for the bidding documents in the amount of **Ten Thousand Pesos (PhP10,000.00) not later than the submission of their bids**. The LGU Treasurer's official receipt, the bank teller's validated deposit slip or **printed receipt from online payment** serves as the proof of payment.

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

Biddings Documents may also be downloaded free of charge from the website of the Philippine Government Electronic Procurement System (PhilGEPS) and the PRDP website (**[prdp.da.gov.ph](http://prdp.da.gov.ph)**). For Detailed Engineering Design (DED), drawings and plans, please follow the link:

**<https://drive.google.com/drive/folders/15TWDWrpNwifTZfyjGzxwHKn4Eo6GzzIR>**

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

6. The **Municipal Government of Catanauan, Quezon** will hold a Pre-Bid Conference on **October 30, 2024 at 10:00 AM** at the **2<sup>nd</sup> Floor Conference Room, Municipal Building, Catanauan, Quezon**, with invitation link: **<https://calendar.app.google/T8xxqh6LckB5gjVs5>**, which shall be open to all interested parties.
7. Bids must be duly received by the BAC Secretariat on or before **November 14, 2024 at 10:00 A.M.** at the **2<sup>nd</sup> Floor Conference Room, Municipal Building, Catanauan, Quezon**. All bids must be accompanied by a **Bid Securing Declaration**.
8. Bids will be opened on **November 14, 2024 at 10:00 A.M.** at the **2<sup>nd</sup> Floor Conference Room, Municipal Building, Catanauan, Quezon** with invitation link: **<https://calendar.app.google/DTmRH4CCXljFqQFx6>** which shall be open to all interested parties. Bids will be opened in the presence of bidder's representatives who choose to attend at the address below. Late bids shall not be accepted.
9. The Municipal Government of Catanauan, Quezon reserves the right to accept or reject any bid, to annul the bidding process, and to reject all bids at any time prior to contract award, without thereby incurring any liability to the affected bidder or bidders.
10. For further information, please refer to:

**Sgd. ENGR. MARDEUN D. ABELLANIDA**

BAC Chairperson

Municipality of Catanauan

Catanauan, Quezon

Tel No.

CP: +63917-1278618

**Section II. Instruction to Bidders**

**TABLE OF CONTENTS**

<b>A. GENERAL.....</b>	<b>10</b>
1. Scope of Bid.....	10
2. Source of Funds .....	10
3. Corrupt, Fraudulent, Collusive, Coercive, and Obstructive Practices .....	10
4. Conflict of Interest .....	12
5. Eligible Bidders.....	13
6. Bidder’s Responsibilities .....	14
7. Origin of Goods and Services .....	16
8. Subcontracts .....	16
<b>B. CONTENTS OF BIDDING DOCUMENTS.....</b>	<b>17</b>
9. Pre-Bid Conference.....	17
10. Clarification and Amendment of Bidding Documents.....	17
<b>C. PREPARATION OF BIDS .....</b>	<b>18</b>
11. Language of Bids .....	18
12. Documents Comprising the Bid: Eligibility and Technical Components.....	18
13. Documents Comprising the Bid: Financial Component .....	20
14. Alternative Bids .....	21
15. Bid Prices .....	22
16. Bid Currencies.....	22
17. Bid Validity.....	22
18. Bid Security.....	23
19. Format and Signing of Bids .....	25
20. Sealing and Marking of Bids .....	25
<b>D. SUBMISSION AND OPENING OF BIDS .....</b>	<b>26</b>
21. Deadline for Submission of Bids .....	26
22. Late Bids .....	26
23. Modification and Withdrawal of Bids .....	26
24. Opening and Preliminary Examination of Bids .....	27

<b>E. EVALUATION AND COMPARISON OF BIDS .....</b>	<b>29</b>
25. Process to be Confidential.....	29
26. Clarification of Bids .....	29
27. Detailed Evaluation and Comparison of Bids .....	29
28. Post Qualification.....	30
29. Reservation Clause.....	31
<b>F. AWARD OF CONTRACT .....</b>	<b>32</b>
30. Contract Award .....	32
31. Signing of the Contract .....	33
32. Performance Security .....	34
33. Notice to Proceed .....	34
34. Protest Mechanism .....	35
1. Definitions.....	45
2. Interpretation .....	47
3. Governing Language and Law .....	48
4. Communications .....	48
5. Possession of Site.....	48
6. The Contractor’s Obligations .....	49
7. Performance Security .....	50
8. Subcontracting .....	51
9. Liquidated Damages .....	51
10. Site Investigation Reports .....	51
11. The Procuring Entity, Licenses and Permits .....	51
12. Contractor’s Risk and Warranty Security .....	52
13. Liability of the Contractor.....	54
14. Procuring Entity’s Risk.....	54
15. Insurance .....	54
16. Termination for Default of Contractor .....	55
17. Termination for Default of Procuring Entity .....	56
18. Termination for Other Causes .....	56
19. Procedures for Termination of Contracts .....	58
20. Force Majeure, Release From Performance .....	60
21. Resolution of Disputes .....	61
22. Suspension of Loan, Credit, Grant, or Appropriation.....	61
23. Procuring Entity’s Representative’s Decisions .....	62



24.	Approval of Drawings and Temporary Works by the Procuring Entity’s Representative .....	62
25.	Acceleration and Delays Ordered by the Procuring Entity’s Representative .....	62
26.	Extension of the Intended Completion Date .....	62
27.	Right to Vary .....	63
28.	Contractor's Right to Claim.....	63
29.	Dayworks .....	63
30.	Early Warning .....	64
31.	Program of Work .....	64
32.	Management Conferences .....	64
33.	Bill of Quantities .....	65
34.	Instructions, Inspections and Audits .....	65
35.	Identifying Defects.....	65
36.	Cost of Repairs .....	66
37.	Correction of Defects .....	66
38.	Uncorrected Defects.....	66
39.	Advance Payment .....	66
40.	Progress Payments .....	67
41.	Payment Certificates .....	68
42.	Retention .....	68
43.	Variation Orders.....	69
44.	Contract Completion .....	70
45.	Suspension of Work .....	70
46.	Payment on Termination .....	71
47.	Extension of Contract Time .....	72
48.	Price Adjustment.....	73
49.	Completion.....	73
50.	Taking Over .....	73
51.	Operating and Maintenance Manuals.....	73

## **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 seventy five percent (75%) of the interest belongs to citizens of the Philippines;
  - (c) Corporations duly organized under the laws of the Philippines, and of which at least seventy five percent (75%) of the outstanding capital stock belongs to citizens of the Philippines;
  - (d) Cooperatives duly organized under the laws of the Philippines.
  - (e) Persons/entities forming themselves into a JV, i.e., a group of two (2) or more persons/entities that intend to be jointly and severally responsible or liable for a particular contract: Provided, however, that, in accordance with Letter of Instructions No. 630, Filipino ownership or interest of the joint venture concerned shall be at least seventy five percent (75%): Provided, further, that joint ventures in which Filipino ownership or interest is less than seventy five percent (75%) may be eligible where the structures to be built require the application of techniques and/or technologies which are not adequately possessed by a person/entity meeting the seventy five percent (75%) Filipino ownership requirement: Provided, finally, that in the latter case, Filipino ownership or interest shall not be less than twenty five percent (25%). For this purpose, Filipino ownership or interest shall be based on the contributions of each of the members of the joint venture as specified in their JVA.
- 5.2. The Procuring Entity may also invite foreign bidders when provided for under any Treaty or International or Executive Agreement as specified in the **BDS**.
- 5.3. Government owned or controlled corporations (GOCCs) may be eligible to participate only if they can establish that they (a) are legally and financially autonomous, (b) operate under commercial law, and (c) are not attached agencies of the Procuring Entity.
- 5.4. (a) The Bidder must have an experience of having completed a Single Largest Completed Contract (SLCC) that is similar to this Project, equivalent to at least fifty percent (50%) of the ABC adjusted, if necessary, by the Bidder to current prices using the Philippine Statistics Authority (PSA) consumer price index. However, contractors under Small A and Small B categories without similar

experience on the contract to be bid may be allowed to bid if the cost of such contract is not more than the Allowable Range of Contract Cost (ARCC) of their registration based on the guidelines as prescribed by the PCAB.

(b) For Foreign-funded Procurement, the Procuring Entity and the foreign government/foreign or international financing institution may agree on another track record requirement, as specified in the **BDS**.

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

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

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 Bidding Forms as required in **ITB** Clause 12.1(b)(ii.3).

6.2. The Bidder is responsible for the following:

- (a) Having taken steps to carefully examine all of the Bidding Documents;
- (b) Having acknowledged all conditions, local or otherwise, affecting the implementation of the contract;
- (c) Having made an estimate of the facilities available and needed for the contract to be bid, if any;
- (d) Having complied with its responsibility to inquire or secure Supplemental/Bid Bulletin/s as provided under **ITB** Clause 10.4.
- (e) Ensuring that it is not "blacklisted" or barred from bidding by the GoP or any of its agencies, offices, corporations, or LGUs, including foreign government/foreign or international financing institution whose blacklisting rules have been recognized by the GPPB;

- (f) Ensuring that each of the documents submitted in satisfaction of the bidding requirements is an authentic copy of the original, complete, and all statements and information provided therein are true and correct;
- (g) Authorizing the HoPE or its duly authorized representative/s to verify all the documents submitted;
- (h) Ensuring that the signatory is the duly authorized representative of the Bidder, and granted full power and authority to do, execute and perform any and all acts necessary to participate, submit the bid, and to sign and execute the ensuing contract, accompanied by the duly notarized Special Power of Attorney, Board/Partnership Resolution, or Secretary's Certificate, whichever is applicable;
- (i) Complying with the disclosure provision under Section 47 of RA 9184 and its IRR in relation to other provisions of RA 3019;
- (j) Complying with existing labor laws and standards, in the case of procurement of services. Moreover, bidder undertakes to:
  - (i) Ensure the entitlement of workers to wages, hours of work, safety and health and other prevailing conditions of work as established by national laws, rules and regulations; or collective bargaining agreement; or arbitration award, if and when applicable.  
  
 In case there is a finding by the Procuring Entity or the DOLE of underpayment or non-payment of workers' wage and wage-related benefits, bidder agrees that the performance security or portion of the contract amount shall be withheld in favor of the complaining workers pursuant to appropriate provisions of Republic Act No. 9184 without prejudice to the institution of appropriate actions under the Labor Code, as amended, and other social legislations.
  - (ii) Comply with occupational safety and health standards and to correct deficiencies, if any.  
  
 In case of imminent danger, injury or death of the worker, bidder undertakes to suspend contract implementation pending clearance to proceed from the DOLE Regional Office and to comply with Work Stoppage Order; and
  - (iii) Inform the workers of their conditions of work, labor clauses under the contract specifying wages, hours of work and other benefits under prevailing national laws, rules and regulations; or collective bargaining agreement; or arbitration award, if and when applicable, through posting in two (2) conspicuous places in the establishment's premises; and
- (k) Ensuring that it did not give or pay, directly or indirectly, any commission, amount, fee, or any form of consideration, pecuniary or otherwise, to any person or official, personnel or representative of the;

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

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

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

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

## 8. **Subcontracts**

- 8.1. Unless otherwise specified in the **BDS**, the Bidder may subcontract portions of the Works to an extent as may be approved by the Procuring Entity and stated in the **BDS**. However, subcontracting of any portion shall not relieve the Bidder from any liability or obligation that may arise from the contract for this Project.
- 8.2. Subcontractors must submit the documentary requirements under **ITB** Clause 12 and comply with the eligibility criteria specified in the **BDS**. In the event that any



subcontractor is found by the Procuring Entity to be ineligible, the subcontracting of such portion of the Works shall be disallowed.

- 8.3. The Bidder may identify the subcontractor to whom a portion of the Works will be subcontracted at any stage of the bidding process or during contract implementation. If the Bidder opts to disclose the name of the subcontractor during bid submission, the Bidder shall include the required documents as part of the technical component of its bid.

## **B. Contents of Bidding Documents**

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

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

(b) The pre-bid conference shall be held at least twelve (12) calendar days before the deadline for the submission of and receipt of bids, but not earlier than seven (7) calendar days from the posting of the Invitation to Bid/Bidding Documents in the PhilGEPS website. If the Procuring Entity determines that, by reason of the method, nature, or complexity of the contract to be bid, or when international participation will be more advantageous to the GoP, a longer period for the preparation of bids is necessary, the pre-bid conference shall be held at least thirty (30) calendar days before the deadline for the submission and receipt of bids, as specified in the **BDS**.

- 9.2. Bidders are encouraged to attend the pre-bid conference to ensure that they fully understand the Procuring Entity's requirements. Non-attendance of the Bidder will in no way prejudice its bid; however, the Bidder is expected to know the changes and/or amendments to the Bidding Documents as recorded in the minutes of the pre-bid conference and the Supplemental/Bid Bulletin. The minutes of the pre-bid conference shall be recorded and prepared not later than five (5) calendar days after the pre-bid conference. The minutes shall be made available to prospective bidders not later than five (5) days upon written request.

- 9.3. Decisions of the BAC amending any provision of the bidding documents shall be issued in writing through a Supplemental/Bid Bulletin at least seven (7) calendar days before the deadline for the submission and receipt of bids.

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

- 10.1. Prospective bidders may request for clarification(s) on and/or interpretation of any part of the Bidding Documents. Such a request must be in writing and submitted to the Procuring Entity at the address indicated in the **BDS** at least ten (10) calendar days before the deadline set for the submission and receipt of Bids.

- 10.2. The BAC shall respond to the said request by issuing a Supplemental/Bid Bulletin, to be made available to all those who have properly secured the Bidding Documents, at least seven (7) calendar days before the deadline for the submission and receipt of Bids.

- 10.3. Supplemental/Bid Bulletins may also be issued upon the Procuring Entity's initiative for purposes of clarifying or modifying any provision of the Bidding Documents not later than seven (7) calendar days before the deadline for the submission and receipt of Bids. Any modification to the Bidding Documents shall be identified as an amendment.
- 10.4. Any Supplemental/Bid Bulletin issued by the BAC shall also be posted in the PhilGEPS and the website of the Procuring Entity concerned, if available, and at any conspicuous place in the premises of the Procuring Entity concerned. It shall be the responsibility of all Bidders who have properly secured the Bidding Documents to inquire and secure Supplemental/Bid Bulletins that may be issued by the BAC. However, Bidders who have submitted bids before the issuance of the Supplemental/Bid Bulletin must be informed and allowed to modify or withdraw their bids in accordance with **ITB** Clause 23.

### **C. Preparation of Bids**

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

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

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

- 12.1. Unless otherwise indicated in the **BDS**, the first envelope shall contain the following eligibility and technical documents:
  - (a) Eligibility Documents –  
Class "A" Documents
    - (i) PhilGEPS Certificate of Registration and Membership in accordance with Section 8.5.2 of the IRR, except for foreign bidders participating in the procurement by a Philippine Foreign Service Office or Post, which shall submit their eligibility documents under Section 23.1 of the IRR, provided, that the winning bidder shall register with the PhilGEPS in accordance with Section 37.1.4 of the IRR;

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

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

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

- (ii.1) name of the contract;
- (ii.2) date of the contract;
- (ii.3) contract duration;
- (ii.4) owner's name and address;
- (ii.5) nature of work;
- (ii.6) contractor's role (whether sole contractor, subcontractor, or partner in a JV) and percentage of participation;
- (ii.7) total contract value at award;
- (ii.8) date of completion or estimated completion time;
- (ii.9) total contract value at completion, if applicable;
- (ii.10) percentages of planned and actual accomplishments, if applicable; and
- (ii.11) value of outstanding works, if applicable.

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

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

#### Class "B" Documents

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

- (b) Technical Documents –
  - (i) Bid security in accordance with **ITB** Clause 18. If the Bidder opts to submit the bid security in the form of:
    - (i.1) a bank draft/guarantee or an irrevocable letter of credit issued by a foreign bank, it shall be accompanied by a confirmation from a Universal or Commercial Bank; or
    - (i.2) A surety bond accompanied by a certification coming from the Insurance Commission that the surety or insurance company is authorized to issue such instruments.
  - (ii) Project Requirements, which shall include the following:
    - (ii.1) Organizational chart for the contract to be bid;
    - (ii.2) List of contractor’s personnel (*e.g.*, Project Manager, Project Engineers, Materials Engineers, and Foremen), to be assigned to the contract to be bid, with their complete qualification and experience data. These personnel must meet the required minimum years of experience set in the **BDS**; and
    - (ii.3) List of contractor’s major equipment units, which are owned, leased, and/or under purchase agreements, supported by proof of ownership, certification of availability of equipment from the equipment lessor/vendor for the duration of the project, as the case may be, which must meet the minimum requirements for the contract set in the **BDS**; and
  - (iii) Sworn statement in accordance with Section 25.3 of the IRR of RA 9184 and using the form prescribed in Section IX Bidding Forms.

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

- 13.1. Unless otherwise stated in the **BDS**, the financial component of the bid shall contain the following:
  - (a) Financial Bid Form, which includes bid prices and the bill of quantities, in accordance with **ITB** Clauses 15.1 and 15.3; and
  - (b) Any other document related to the financial component of the bid as stated in the **BDS**.
- 13.2. (a) Unless otherwise stated in the **BDS**, all Bids that exceed the ABC shall not be accepted.

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

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

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

## 15. Bid Prices

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

## 16. Bid Currencies

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

## 17. Bid Validity

- 17.1. Bids shall remain valid for the period specified in the **BDS** which shall not exceed one hundred twenty (120) calendar days from the date of the opening of bids.

17.2. In exceptional circumstances, prior to the expiration of the bid validity period, the Procuring Entity may request Bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. The bid security described in **ITB** Clause 18 should also be extended corresponding to the extension of the bid validity period at the least. A Bidder may refuse the request without forfeiting its bid security, but his bid shall no longer be considered for further evaluation and award. A Bidder granting the request shall not be required or permitted to modify its bid.

**18. Bid Security**

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

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

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

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

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

shall be returned only after the Bidder with the Lowest Calculated Responsive Bid (LCRB) has signed the contract and furnished the Performance Security, but in no case later than the expiration of the Bid Security validity period indicated in **ITB** Clause 18.2.

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

18.5. The bid security may be forfeited:

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



- (xii) all other acts that tend to defeat the purpose of the competitive bidding, such as habitually withdrawing from bidding, submitting late Bids or patently insufficient bid, for at least three (3) times within a year, except for valid reasons.
- (b) if the successful Bidder:
  - (i) fails to sign the contract in accordance with **ITB** Clause 31;
  - (ii) fails to furnish performance security in accordance with **ITB** Clause 32.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- 24.1. The BAC shall open the Bids in public, immediately after the deadline for the submission and receipt of bids in public, as specified in the **BDS**. In case the Bids cannot be opened as scheduled due to justifiable reasons, the BAC shall take custody of the Bids submitted and reschedule the opening of Bids on the next working day or at the soonest possible time through the issuance of a Notice of Postponement to be posted in the PhilGEPS website and the website of the Procuring Entity concerned.
- 24.2. Unless otherwise specified in the BDS, the BAC shall open the first bid envelopes and determine each Bidder's compliance with the documents prescribed in ITB Clause 12, using a non-discretionary "pass/fail" criterion. If a Bidder submits the required document, it shall be rated "passed" for that particular requirement. In this regard, bids that fail to include any requirement or are incomplete or patently insufficient shall be considered as "failed". Otherwise, the BAC shall rate the said first bid envelope as "passed".
- 24.3. Unless otherwise specified in the **BDS**, immediately after determining compliance with the requirements in the first envelope, the BAC shall forthwith open the second bid envelope of each remaining eligible Bidder whose first bid envelope was rated "passed." The second envelope of each complying Bidder shall be opened within the same day. In case one or more of the requirements in the second envelope of a particular bid is missing, incomplete or patently insufficient, and/or if the submitted total bid price exceeds the ABC unless otherwise provided in **ITB** Clause 13.2, the BAC shall rate the bid concerned as "failed." Only bids that are determined to contain all the bid requirements for both components shall be rated "passed" and shall immediately be considered for evaluation and comparison.

- 24.4. Letters of Withdrawal shall be read out and recorded during bid opening, and the envelope containing the corresponding withdrawn bid shall be returned to the Bidder unopened.
- 24.5. All members of the BAC who are present during bid opening shall initial every page of the original copies of all bids received and opened.
- 24.6. In the case of an eligible foreign bidder as described in **ITB** Clause 5, the following Class “A” Documents may be substituted with the appropriate equivalent documents, if any, issued by the country of the foreign bidder concerned, which shall likewise be uploaded and maintained in the PhilGEPS in accordance with Section 8.5.2 of the IRR.:
- a) Registration certificate from the Securities and Exchange Commission (SEC), Department of Trade and Industry (DTI) for sole proprietorship, or CDA for cooperatives;
  - b) Mayor’s/Business permit issued by the local government where the principal place of business of the Bidder is located; and
  - c) Audited Financial Statements showing, among others, the prospective Bidder’s total and current assets and liabilities stamped “received” by the Bureau of Internal Revenue or its duly accredited and authorized institutions, for the preceding calendar year which should not be earlier than two years from the date of bid submission.
- 24.7. Each partner of a joint venture agreement shall likewise submit the document required in **ITB** Clause 12.1(a)(i). Submission of documents required under **ITB** Clauses 12.1(a)(ii) to 12.1(a)(iv) by any of the joint venture partners constitutes compliance.
- 24.8. The Procuring Entity shall prepare the minutes of the proceedings of the bid opening that shall include, as a minimum: (a) names of Bidders, their bid price (per lot, if applicable, and/or including discount, if any), bid security, findings of preliminary examination, and whether there is a withdrawal or modification; and (b) attendance sheet. The BAC members shall sign the abstract of bids as read.
- 24.8. 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.
- 24.9 To ensure transparency and accurate representation of the bid submission, the BAC Secretariat shall notify in writing all Bidders whose bids it has received through its PhilGEPS-registered physical address or official e-mail address. The notice shall be issued within seven (7) calendar days from the date of the bid opening.

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

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

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

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

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

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

- 27.1. The Procuring Entity will undertake the detailed evaluation and comparison of Bids which have passed the opening and preliminary examination of Bids, pursuant to **ITB** Clause 24, in order to determine the Lowest Calculated Bid.
- 27.2. The Lowest Calculated Bid shall be determined in two steps:
  - (a) The detailed evaluation of the financial component of the bids, to establish the correct calculated prices of the bids; and
  - (b) The ranking of the total bid prices as so calculated from the lowest to highest. The bid with the lowest price shall be identified as the Lowest Calculated Bid.
- 27.3. The Procuring Entity's BAC shall immediately conduct a detailed evaluation of all bids rated "passed," using non-discretionary "pass/fail" criterion. The BAC shall consider the following in the evaluation of bids:
  - (a) Completeness of the bid. Unless the **BDS** allows partial bids, bids not addressing or providing all of the required items in the Schedule of Requirements including, where applicable, bill of quantities, shall be considered non-responsive and, thus, automatically disqualified. In this regard, where a required item is provided, but no price is indicated, the same shall be considered as non-responsive, but specifying a zero (0) or a dash (-) for the said item would mean that it is being offered for free to the Procuring Entity, except those required by law or regulations to be provided for; and

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

## 28. **Post Qualification**

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

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

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

## 29. **Reservation Clause**

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

award, or not to award the contract, without thereby incurring any liability, and make no assurance that a contract shall be entered into as a result of the bidding:

- (a) If there is *prima facie* evidence of collusion between appropriate public officers or employees of the Procuring Entity, or between the BAC and any of the Bidders, or if the collusion is between or among the Bidders themselves, or between a Bidder and a third party, including any act which restricts, suppresses or nullifies or tends to restrict, suppress or nullify competition;
- (b) If the Procuring Entity's BAC is found to have failed in following the prescribed bidding procedures; or
- (c) For any justifiable and reasonable ground where the award of the contract will not redound to the benefit of the GOP as follows:
  - (i) If the physical and economic conditions have significantly changed so as to render the project no longer economically, financially or technically feasible as determined by the HoPE;
  - (ii) If the project is no longer necessary as determined by the HoPE; and
  - (iii) If the source of funds for the project has been withheld or reduced through no fault of the Procuring Entity.

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

- (a) No bids are received;
- (b) All prospective Bidders are declared ineligible;
- (c) All bids fail to comply with all the bid requirements, fail post-qualification; or
- (d) The Bidder with the LCRB refuses, without justifiable cause, to accept the award of contract, and no award is made in accordance with Section 40 of the IRR of RA 9184.

## **F. Award of Contract**

### **30. 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 the following documents within ten (10) calendar days from receipt of the Notice of Award:
    - (i) In the case of procurement by a Philippine Foreign Service Office or Post, the PhilGEPS Registration Number of the winning foreign Bidder; or
    - (ii) Valid PCAB license and registration for the type and cost of the contract to be bid for foreign bidders when the Treaty or International or Executive Agreement expressly allows submission of the PCAB license and registration for the type and cost of the contract to be bid as a pre-condition to the Award;
  - (b) Posting of the performance security in accordance with **ITB** Clause 32;
  - (c) Signing of the contract as provided in **ITB** Clause 31; and
  - (d) Approval by higher authority, if required, as provided in Section 37.3 of the IRR of RA 9184.

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

- 31.1. At the same time as the Procuring Entity notifies the successful Bidder that its bid has been accepted, the Procuring Entity shall send the Contract Form to the Bidder, which Contract has been provided in the Bidding Documents, incorporating therein all agreements between the parties.
- 31.2. Within ten (10) calendar days from receipt of the Notice of Award, the successful Bidder shall post the required performance security, sign and date the contract and return it to the Procuring Entity.
- 31.3. The Procuring Entity shall enter into contract with the successful Bidder within the same ten (10) calendar day period provided that all the documentary requirements are complied with.
- 31.4. The following documents shall form part of the contract:
- (a) Contract Agreement;
  - (b) Bidding Documents;
  - (c) Winning Bidder's bid, including the Technical and Financial Proposals, and all other documents/statements submitted (*e.g.*, Bidder's response to request for clarifications on the bid), including corrections to the bid, if any, resulting from the Procuring Entity's bid evaluation;
  - (d) Performance Security;
  - (e) Notice of Award of Contract; and

- (f) Other contract documents that may be required by existing laws and/or specified in the **BDS**.

**32. Performance Security**

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

Form of Performance Security	Amount of Performance Security (Not less than the Percentage of the Total Contract Price)
(a) Cash or cashier's/manager's check issued by a Universal or Commercial Bank.	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.	
(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%)

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

**33. Notice to Proceed**

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

34. **Protest Mechanism**

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

### Section III. Bid Data Sheet

ITB Clause	
1.1	<p>The Procuring Entity is <b>Municipal Government of Catanauan, Quezon.</b></p> <p>The name of the Contract is <b>Construction of San Roque-San Antonio Magcopa-San Pablo Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge Component</b></p> <p>The identification number of the Contract is <b>PRDP-SU-IB-R04A-QUE-004-CAT-001-2023-FMB</b></p>
2	<p>The Funding Source is World Bank through <b>Loan No. 9577-PH</b> in the amount of <b>US \$600,000,000.00.</b></p> <p>The name of the Project is <b>Philippine Rural Development Project Scale-Up,</b></p> <p>Payments by the Foreign Funding Source will be made only at the request of the PROCURING ENTITY and upon approval by the Funding Source in accordance with the terms and conditions of the Loan Agreement between the PROCURING ENTITY and the Funding Source. (Hereunder called the “Loan Agreement”).</p> <p>The Payments will be subject in all respect to the terms and conditions of the Loan Agreement and the applicable law. No party other than the PROCURING ENTITY shall derive any rights from the Loan Agreement or have any claim to the funds.</p>
3.1	<p>The World Bank’s Anti-Corruption Policy requires the Borrowers (including beneficiaries of Bank-financed activity), as well as Bidders, Suppliers, Contractors and their agents (whether declared or not), sub-contractors, sub-consultants, service providers or suppliers, and any personnel thereof, observe the highest standard of ethics during the procurement and execution of Bank-financed contracts. Any action to influence the procurement process or contract execution for undue advantage is improper.</p> <p>In pursuance of this policy, the Bank:</p> <p>(a) defines, for the purposes of this provision, the terms set forth below as follows:</p> <p style="padding-left: 40px;">(i) "Corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party. Another party refers to a public official acting in relation to the procurement process or contract execution. Public official includes World Bank staff and employees of other organizations taking or reviewing procurement decisions;</p> <p style="padding-left: 40px;">(ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation. The term "party" refers to a public official; the terms "benefit" and "obligations" relate to the procurement process or contract execution; and the "act or omission" is intended to influence the procurement process or contract execution;</p> <p style="padding-left: 40px;">(iii) "Coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party</p>

to influence improperly the actions of a party. The term "party" refers to a participant in the procurement process or contract execution;

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

(v) "obstructive practice" is

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

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

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

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

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

	<p>proceeding. See footnote 14 and paragraph 8 of Appendix 1 of the World Bank Guidelines for Procurement of Goods, Works, and Non-Consulting Services;</p> <p>(e) will require that a clause be included in bidding documents and in contracts financed by a Bank loan or grant, requiring bidders, suppliers and contractors, and their sub-contractors, agents, personnel, consultants, service providers, or suppliers to permit Bank to inspect all accounts and records and other documents relating to the submission of bids and contract performance, and to have them audited by auditors appointed by Bank.</p>											
5.1	The Financing Agreement provides that procurement shall follow the Bank's Procurement Regulations and Section 3.21 thereof permits the participation of firm from all countries except for those mentioned in Section 3.23 thereof.											
5.2	Foreign bidders may participate in this Project as provided for in the financing agreement which provides that procurement shall follow the Bank's Procurement Regulations and Section 3.21 thereof permits the participation of firm from all countries except for those mentioned in Section 3.23 thereof.											
5.4	<p>To be considered eligible and qualified, a Bidder must have:</p> <p>-A successful experience as prime contractor in the construction of at least one (1) work of a nature and complexity equivalent to the Works, generally within the last ten (10) years (to comply with this requirement, single works cited should be at least fifty percent (50%) of value of estimated contract cost of Works under bid in the amount of One Hundred Ninety Million Pesos (PhP190,000,000.00) or</p> <p>At least two (2) similar contracts (1 Road and 1 Bridge) within the last ten (10) years and the aggregate contract amount should be equivalent to at least fifty percent (50%) of the Estimated Project Cost (EPC) in the amount of One Hundred Ninety Million Pesos (PhP190,000,000.00);</p> <table border="1"> <thead> <tr> <th rowspan="2">Name of Subproject</th> <th>If not Joint Venture</th> <th colspan="2">If Joint Venture</th> </tr> <tr> <th>Amount of One work of a nature and complexity of at least 50% of the EPC</th> <th>Amount of One work of a nature and complexity of at least 50% of the EPC for one partner</th> <th>Amount of One work of a nature and complexity of at least 25% of the EPC for the rest of the partners</th> </tr> </thead> <tbody> <tr> <td>Construction of San Roque-San Antonio Magcopa-San Pablo Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge Component</td> <td>PhP190,000,000.00</td> <td>PhP190,000,000.00</td> <td>PhP95,000,000.00</td> </tr> </tbody> </table> <p>such being verifiable from contract and completion certificate; and</p> <p>- An average annual turnover of Construction Income for the last three (3) years equal or greater than one hundred percent (100%) of the estimated value of the contract to be bid as evidenced by the audited financial statement for the last three (3) years stamped "received by the BIR [with Supporting Income Tax Return stamped "received" by BIR or its duly accredited and authorized institutions or eBIR Tax Return Receipt Confirmation (if submitted through eBIR), and eFPS/validated deposit slip payment], in the amount of:</p>	Name of Subproject	If not Joint Venture	If Joint Venture		Amount of One work of a nature and complexity of at least 50% of the EPC	Amount of One work of a nature and complexity of at least 50% of the EPC for one partner	Amount of One work of a nature and complexity of at least 25% of the EPC for the rest of the partners	Construction of San Roque-San Antonio Magcopa-San Pablo Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge Component	PhP190,000,000.00	PhP190,000,000.00	PhP95,000,000.00
Name of Subproject	If not Joint Venture		If Joint Venture									
	Amount of One work of a nature and complexity of at least 50% of the EPC	Amount of One work of a nature and complexity of at least 50% of the EPC for one partner	Amount of One work of a nature and complexity of at least 25% of the EPC for the rest of the partners									
Construction of San Roque-San Antonio Magcopa-San Pablo Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge Component	PhP190,000,000.00	PhP190,000,000.00	PhP95,000,000.00									

	Name of Subproject	If not Joint Venture	If Joint Venture	
		Amount of Average Annual Turn-over of at least 100% of the EPC	Amount of Average Annual Turn-over of at least 100% of the EPC for one partner	Amount of Average Annual Turn-over of at least 50% of the EPC for the rest of the partners
	Construction of San Roque-San Antonio Magcopa-San Pablo Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge Component	PhP380,000,000.00	PhP380,000,000.00	PhP195,000,000.00
	For this purpose, similar contracts shall refer to <b>Construction/Concreting/Improvement/Rehabilitation of Roads and Bridge.</b>			
5.1	Not mandatory.			
8.1	Subcontracting is allowed. There is no restriction on the involvement of general sub-contractors in the areas of manual and semi-skilled labor or construction materials provided that the contractor undertakes not less than fifty percent (50%) of the contracted works with its own resources.			
8.2	To be considered eligible and qualified a subcontractor must have a successful experience as contractor in the construction of at least one work of a nature and complexity equivalent to the scope of works to be subcontracted, generally during the last ten (10) years.			
9.1	The Date, Time and Venue of the Pre-Bid Conference is: <b>October 30, 2024, at 10:00 A.M.</b> <b>2<sup>nd</sup> Floor Conference Room, Municipal Building, Catanauan, Quezon</b>  <b>with invitation link: <a href="https://calendar.app.google/T8xxqh6LckB5gIVs5">https://calendar.app.google/T8xxqh6LckB5gIVs5</a></b>			
10.1	The PROCURING ENTITY's address is: <b>LGU Municipal Building, Catanauan, Quezon</b>			
10.4	No further instructions.			
12.1	During Bid opening, if the first bid envelope lacks any of the following requirements that are historical information, these can be clarified following Section II, ITB Clause 26. If the first bid envelope lacks the Bid Securing Declaration, the bid shall be declared non-responsive.  The first envelope shall contain the following eligibility and technical documents: <b>a. Eligibility Requirements</b>  i. Registration Certification of the Company (from SEC or DTI or CDA);  ii. Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid and Average Annual Turnover, as specified in ITB Clause 5.4;			

	<p>iii. Audited Financial Statement for the last three (3) years stamped “received” by the BIR;</p> <p>iv. In case of Joint Venture, a duly notarized Joint Venture agreement and a copy of the duly accomplished application form for Special License of the Joint Venture filed with the PCAB, or a copy of the Special License of the Joint Venture if already issued.</p> <p><b>b. Technical Documents</b></p> <p>v. Project Requirements, to include the following:</p> <p>(v.1) List of contractor’s personnel (e.g. one (1) Project Manager, two (2) Project Engineers for Road, one (1) Project Engineer for Bridge and Materials Engineer II to be assigned to the contract to be bid, with their complete qualification and experience data; and</p> <p>(v.2) List of contractor’s major equipment units which are owned and are supported by Certified True Copy from the Original of proof of ownership such as, without limitation, Deed of Sale, Official Receipt/Certificate of Registration, Sales Invoice, Charge Invoice or Delivery Receipt, which must meet the minimum requirement for the contract set in the BDS 12.1(b)(iii.3)</p> <p>vi. Bid Securing Declaration as required in ITB 18;</p> <p>Foreign bidders may submit the equivalent documents, if any, issued by the country of the foreign bidder.</p>															
12.1(a)(iii)	Foreign bidders may submit their valid Philippine Contractors Accreditation Board (PCAB) license or special PCAB License in case of joint ventures, and registration for the type and cost of the contract for this Project as a pre-condition for award as provided in the Financing Agreement, and ITB Nos. 12.1(b)(ii.2) and 12.1(b)(ii.3)															
12.1(b)(ii.2)	<p>The minimum work experience requirements for key personnel are the following:</p> <table border="1"> <thead> <tr> <th><u>Key Personnel</u></th> <th><u>General Experience</u></th> <th><u>Relevant Experience</u></th> </tr> </thead> <tbody> <tr> <td>1. Project Manager (PM)</td> <td>Licensed Civil/ Agricultural Engineer</td> <td>With a minimum of five (5) years relevant work experience as Project Manager in road and in bridge construction</td> </tr> <tr> <td>2. Two (2) Project Engineers (PE) for Road</td> <td>Minimum of five (5) year experience as Licensed Civil/ Agricultural Engineer</td> <td>with at least two (2) projects handled in road construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of Road or at least PhP67,335,400.00 <u>each project</u></td> </tr> <tr> <td>3. Project Engineer (PE) for Bridge</td> <td>Minimum of five (5) year experience as Licensed Civil/ Agricultural Engineer</td> <td>with at least two (2) projects handled in bridge construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of bridge or at least PhP8,664,600.00 <u>each project</u></td> </tr> <tr> <td>4. Materials Engineer (ME)</td> <td>Licensed Civil Engineer</td> <td>Duly accredited by DPWH as Materials Engineer II following DPWH D.O. 98, S. of 2016</td> </tr> </tbody> </table>	<u>Key Personnel</u>	<u>General Experience</u>	<u>Relevant Experience</u>	1. Project Manager (PM)	Licensed Civil/ Agricultural Engineer	With a minimum of five (5) years relevant work experience as Project Manager in road and in bridge construction	2. Two (2) Project Engineers (PE) for Road	Minimum of five (5) year experience as Licensed Civil/ Agricultural Engineer	with at least two (2) projects handled in road construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of Road or at least PhP67,335,400.00 <u>each project</u>	3. Project Engineer (PE) for Bridge	Minimum of five (5) year experience as Licensed Civil/ Agricultural Engineer	with at least two (2) projects handled in bridge construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of bridge or at least PhP8,664,600.00 <u>each project</u>	4. Materials Engineer (ME)	Licensed Civil Engineer	Duly accredited by DPWH as Materials Engineer II following DPWH D.O. 98, S. of 2016
<u>Key Personnel</u>	<u>General Experience</u>	<u>Relevant Experience</u>														
1. Project Manager (PM)	Licensed Civil/ Agricultural Engineer	With a minimum of five (5) years relevant work experience as Project Manager in road and in bridge construction														
2. Two (2) Project Engineers (PE) for Road	Minimum of five (5) year experience as Licensed Civil/ Agricultural Engineer	with at least two (2) projects handled in road construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of Road or at least PhP67,335,400.00 <u>each project</u>														
3. Project Engineer (PE) for Bridge	Minimum of five (5) year experience as Licensed Civil/ Agricultural Engineer	with at least two (2) projects handled in bridge construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of bridge or at least PhP8,664,600.00 <u>each project</u>														
4. Materials Engineer (ME)	Licensed Civil Engineer	Duly accredited by DPWH as Materials Engineer II following DPWH D.O. 98, S. of 2016														



	5. Geodetic Engineer	Licensed Geodetic Engineer	(Not subject for bid evaluation BUT required for project implementation)
12.1(b)(ii.3)	The minimum equipment requirements are the following:		
	Minimum Required Equipment		Owned
	1. Bulldozer, 155Hp		1
	2. Backhoe, (0.80 cu.m)		1
	3. Payloader, 1.50cu.m		2
	4. Road Grader, 140 Hp		1
	5. Road Roller, (Vibratory), 10Tons		1
	6. Backhoe, (0.80 cu.m)		2
	7. Batching Plant, 30 cu.m		1
	8. Cargo Truck, 5 tons		2
	<b>Total</b>		<b>6</b>
			<b>8</b>
13.1	No further instructions.		
13.2(a) & (b)	There is no ceiling for Financial Proposals.		
14.2	No further instructions.		
15.4	No further instructions.		
16.1	The bid prices shall be quoted in Philippine Pesos.		
16.3	No further instructions.		
17.1	Bids will be valid until ninety (90) calendar days from bid opening date.		
18.1	The bid security shall be in the form of a <b>Bid Securing Declaration</b> .		
18.2	The bid security shall be valid until one hundred twenty (120) calendar days from the date set for Bid opening date.		
19.2	Substance over the form is considered.		
20.3	<p>If bidder shall submit hard copies at the <b>2<sup>nd</sup> Floor Conference Room, Municipal Building, Catanauan, Quezon</b> , each Bidder shall submit:</p> <ul style="list-style-type: none"> <li>a. one (1) original and</li> <li>b. four (4) copies of the first and second components of its bid; and</li> <li>c. Electronic copy of the bid should also be submitted in PDF file format in a flash drive.</li> </ul> <p>Should there be discrepancies, the original copy would prevail.</p>		
21	The address for Submission of Bids is at the <b>2<sup>nd</sup> Floor Conference Room, Municipal Building, Catanauan, Quezon</b> The deadline for Submission of Bids is on <b>November 14, 2024, 10:00 A.M.</b>		
24.1	<p>The BAC shall open the bids in public on <b>November 14, 2024, 10:00 A.M.</b> at the <b>2<sup>nd</sup> Floor Conference Room, Municipal Building, Catanauan, Quezon</b></p> <p>with invitation link: <a href="https://calendar.app.google/DTmRH4CCXLjFqQFx6">https://calendar.app.google/DTmRH4CCXLjFqQFx6</a></p> <p>The time for the bid opening shall be the same as the deadline for receipt of bids or promptly thereafter. Re-scheduling the date of the opening of bids shall not be considered except for force majeure, such as natural calamities. In re-scheduling the opening of bids, the BAC shall issue a Notice of Postponement to be posted at the PhilGEPS' and the Procuring Entity's websites.</p>		

24.2	During Bid opening, if the first envelope lacks any of the requirements that are historical information, as listed in World Bank BDS 12.1, these can be clarified following Section II, ITB Clause 26. If the first bid envelope lacks the Bid Securing Declaration, the bid shall be declared non-responsive but the documents shall be kept by the Procuring Entity.
24.3	The financial proposals in the second envelope of all the bidders shall be read for record purposes. The first and second envelopes shall not be returned to the bidders.
27.4	No financial ceiling.
28.2	None
31.4(f)	<p>The other document required are:</p> <ol style="list-style-type: none"> <li>1) Construction schedule</li> <li>2) S-Curve</li> <li>3) Manpower schedule</li> <li>4) Construction methods</li> <li>5) Equipment Utilization schedule</li> <li>6) Construction Safety and Health program approved by the Department of Labor and Employment; and</li> <li>7) PERT/CPM; and</li> <li>8) Environmental and Social Management Plan (ESMP)</li> </ol>
32.2	<p>In times of declaration of state of emergency/calamity, to allow submission of the following (until revoke/lifted) the following documents:</p> <ol style="list-style-type: none"> <li>1. Performance Securing Declaration (PSD) in lieu of a performance security to guarantee the winning bidder's faithful performance of obligations under the contract, subject to the following: <ol style="list-style-type: none"> <li>a. Similar to the PSD used in Framework Agreement, such declaration shall state, among others, that the winning bidder shall be blacklisted from being qualified to participate in any government procurement activity for one (1) year, in case of first offense or two (2) years, if with prior similar offense, in the event it violates any of the conditions stated in the contract.</li> <li>a. An un-notarized PSD may be accepted, subject to submission of a notarized PSD before payment, unless the same is replaced with a performance security in the prescribed form, as stated below; and</li> <li>b. The end-user may require the winning bidder to replace the submitted PSD with a performance security in any of the prescribed forms under Section 39.2 of the 2016 revised IRR of RA No. 9184 upon lifting of the State of Calamity.</li> </ol> </li> </ol>

Section IV. General Conditions of Contract

**TABLE OF CONTENTS**

**1. DEFINITIONS.....45**

**2. INTERPRETATION .....47**

**3. GOVERNING LANGUAGE AND LAW.....48**

**4. COMMUNICATIONS.....48**

**5. POSSESSION OF SITE .....48**

**6. THE CONTRACTOR’S OBLIGATIONS .....49**

**7. PERFORMANCE SECURITY .....50**

**8. SUBCONTRACTING .....51**

**9. LIQUIDATED DAMAGES.....51**

**10. SITE INVESTIGATION REPORTS .....51**

**11. THE PROCURING ENTITY, LICENSES AND PERMITS .....51**

**12. CONTRACTOR’S RISK AND WARRANTY SECURITY.....52**

**13. LIABILITY OF THE CONTRACTOR.....54**

**14. PROCURING ENTITY’S RISK .....54**

**15. INSURANCE.....54**

**16. TERMINATION FOR DEFAULT OF CONTRACTOR.....55**

**17. TERMINATION FOR DEFAULT OF PROCURING ENTITY.....56**

**18. TERMINATION FOR OTHER CAUSES.....56**

**19. PROCEDURES FOR TERMINATION OF CONTRACTS .....58**

**20. FORCE MAJEURE, RELEASE FROM PERFORMANCE .....60**

**21. RESOLUTION OF DISPUTES .....61**

**22. SUSPENSION OF LOAN, CREDIT, GRANT, OR APPROPRIATION.....60**

**23. PROCURING ENTITY’S REPRESENTATIVE’S DECISIONS .....62**

**24. APPROVAL OF DRAWINGS AND TEMPORARY WORKS BY THE PROCURING ENTITY’S REPRESENTATIVE .....62**

**25. ACCELERATION AND DELAYS ORDERED BY THE PROCURING ENTITY’S REPRESENTATIVE.....62**

**26. EXTENSION OF THE INTENDED COMPLETION DATE.....62**

<b>27. RIGHT TO VARY .....</b>	<b>63</b>
<b>28. CONTRACTOR'S RIGHT TO CLAIM .....</b>	<b>63</b>
<b>29. DAYWORKS .....</b>	<b>63</b>
<b>30. EARLY WARNING.....</b>	<b>64</b>
<b>31. PROGRAM OF WORK.....</b>	<b>64</b>
<b>32. MANAGEMENT CONFERENCES .....</b>	<b>64</b>
<b>33. BILL OF QUANTITIES .....</b>	<b>65</b>
<b>34. INSTRUCTIONS, INSPECTIONS AND AUDITS .....</b>	<b>65</b>
<b>35. IDENTIFYING DEFECTS .....</b>	<b>65</b>
<b>36. COST OF REPAIRS .....</b>	<b>66</b>
<b>37. CORRECTION OF DEFECTS .....</b>	<b>66</b>
<b>38. UNCORRECTED DEFECTS.....</b>	<b>66</b>
<b>39. ADVANCE PAYMENT .....</b>	<b>66</b>
<b>40. PROGRESS PAYMENTS .....</b>	<b>67</b>
<b>41. PAYMENT CERTIFICATES .....</b>	<b>68</b>
<b>42. RETENTION .....</b>	<b>68</b>
<b>43. VARIATION ORDERS .....</b>	<b>69</b>
<b>44. CONTRACT COMPLETION .....</b>	<b>70</b>
<b>45. SUSPENSION OF WORK .....</b>	<b>70</b>
<b>46. PAYMENT ON TERMINATION .....</b>	<b>70</b>
<b>47. EXTENSION OF CONTRACT TIME .....</b>	<b>72</b>
<b>48. PRICE ADJUSTMENT .....</b>	<b>73</b>
<b>49. COMPLETION .....</b>	<b>73</b>
<b>50. TAKING OVER.....</b>	<b>73</b>
<b>51. OPERATING AND MAINTENANCE MANUALS .....</b>	<b>73</b>

## 1. **Definitions**

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

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

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

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

## 2. Interpretation

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

- g) Specifications;
- h) Bill of Quantities; and
- i) Drawings.

### **3. Governing Language and Law**

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

### **4. Communications**

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

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

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



## 6. The Contractor's Obligations

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

## 7. Performance Security

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

## 8. **Subcontracting**

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

## 9. **Liquidated Damages**

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

## 10. **Site Investigation Reports**

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

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

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

## 12. Contractor's Risk and Warranty Security

- 12.1. The Contractor shall assume full responsibility for the Works from the time project construction commenced up to final acceptance by the Procuring Entity and shall be held responsible for any damage or destruction of the Works except those occasioned by *force majeure*. The Contractor shall be fully responsible for the safety, protection, security, and convenience of his personnel, third parties, and the public at large, as well as the Works, Equipment, installation, and the like to be affected by his construction work.
- 12.2. The defects liability period for infrastructure projects shall be one year from contract completion up to final acceptance by the Procuring Entity. During this period, the Contractor shall undertake the repair works, at his own expense, of any damage to the Works on account of the use of materials of inferior quality within ninety (90) days from the time the HoPE has issued an order to undertake repair. In case of failure or refusal to comply with this mandate, the Procuring Entity shall undertake such repair works and shall be entitled to full reimbursement of expenses incurred therein upon demand.
- 12.3. Unless otherwise indicated in the SCC, in case the Contractor fails to comply with the preceding paragraph, the Procuring Entity shall forfeit its performance security, subject its property(ies) to attachment or garnishment proceedings, and perpetually disqualify it from participating in any public bidding. All payables of the GoP in his favor shall be offset to recover the costs.
- 12.4. After final acceptance of the Works by the Procuring Entity, the Contractor shall be held responsible for "Structural Defects," *i.e.*, major faults/flaws/deficiencies in one or more key structural elements of the project which may lead to structural failure of the completed elements or structure, or "Structural Failures," *i.e.*, where one or more key structural elements in an infrastructure facility fails or collapses, thereby rendering the facility or part thereof incapable of withstanding the design loads, and/or endangering the safety of the users or the general public:
- (a) Contractor – Where Structural Defects/Failures arise due to faults attributable to improper construction, use of inferior quality/substandard materials, and any violation of the contract plans and specifications, the contractor shall be held liable;
  - (b) Consultants – Where Structural Defects/Failures arise due to faulty and/or inadequate design and specifications as well as construction supervision, then the consultant who prepared the design or undertook construction supervision for the project shall be held liable;
  - (c) Procuring Entity's Representatives/Project Manager/Construction Managers and Supervisors – The project owner's representative(s), project manager, construction manager, and supervisor(s) shall be held liable in cases where the Structural Defects/Failures are due to his/their willful intervention in altering the designs and other specifications; negligence or omission in not approving or acting on proposed changes to noted defects or deficiencies in the design and/or specifications; and the use of substandard construction materials in the project;

- (d) Third Parties - Third Parties shall be held liable in cases where Structural Defects/Failures are caused by work undertaken by them such as leaking pipes, diggings or excavations, underground cables and electrical wires, underground tunnel, mining shaft and the like, in which case the applicable warranty to such structure should be levied to third parties for their construction or restoration works.
- (e) Users - In cases where Structural Defects/Failures are due to abuse/misuse by the end user of the constructed facility and/or non-compliance by a user with the technical design limits and/or intended purpose of the same, then the user concerned shall be held liable.

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

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

Form of Warranty	Amount of Warranty Security Not less than the Percentage (%) of Total Contract Price
(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%)

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

12.8. In case of structural defects/failure occurring during the applicable warranty period provided in **GCC** Clause 12.5, the Procuring Entity shall undertake the necessary restoration or reconstruction works and shall be entitled to full reimbursement by the parties found to be liable for expenses incurred therein

upon demand, without prejudice to the filing of appropriate administrative, civil, and/or criminal charges against the responsible persons as well as the forfeiture of the warranty security posted in favor of the Procuring Entity.

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

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

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

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

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

### 15. **Insurance**

15.1. The Contractor shall, under his name and at his own expense, obtain and maintain, for the duration of this Contract, the following insurance coverage:

- (a) Contractor's All Risk Insurance;
- (b) Transportation to the project Site of Equipment, Machinery, and Supplies owned by the Contractor;
- (c) Personal injury or death of Contractor's employees; and
- (d) Comprehensive insurance for third party liability to Contractor's direct or indirect act or omission causing damage to third persons.

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

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

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

- 15.4. If the Contractor fails to obtain and keep in force the insurances referred to herein or any other insurance which he may be required to obtain under the terms of this Contract, the Procuring Entity may obtain and keep in force any such insurances and pay such premiums as may be necessary for the purpose. From time to time, the Procuring Entity may deduct the amount it shall pay for said premiums including twenty five percent (25%) therein from any monies due, or which may become due, to the Contractor, without prejudice to the Procuring Entity exercising its right to impose other sanctions against the Contractor pursuant to the provisions of this Contract.
- 15.5. In the event the Contractor fails to observe the above safeguards, the Procuring Entity may, at the Contractor's expense, take whatever measure is deemed necessary for its protection and that of the Contractor's personnel and third parties, and/or order the interruption of dangerous Works. In addition, the Procuring Entity may refuse to make the payments under GCC Clause 40 until the Contractor complies with this Clause.
- 15.6. The Contractor shall immediately replace the insurance policy obtained as required in this Contract, without need of the Procuring Entity's demand, with a new policy issued by a new insurance company acceptable to the Procuring Entity for any of the following grounds:

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

## 16. Termination for Default of Contractor

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

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

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

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

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

- (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(a), unless otherwise specified in the SCC;
- (ii) drawing up or using forged documents;
- (iii) using adulterated materials, means or methods, or engaging in production contrary to rules of science or the trade; and
- (iv) Any other act analogous to the foregoing.

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

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

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

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

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

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

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

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

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

- (a) Failure of the contractor, due solely to his fault or negligence, to mobilize and start work or performance within the specified period in the Notice to Proceed ("NTP");
- (b) Failure by the contractor to fully and faithfully comply with its contractual obligations without valid cause, or failure by the contractor to comply with any written lawful instruction of the procuring entity or its representative(s) pursuant to the implementation of the contract. For the procurement of infrastructure projects or consultancy contracts, lawful instructions include but are not limited to the following:
  - (i) Employment of competent technical personnel, competent engineers and/or work supervisors;
  - (ii) Provision of warning signs and barricades in accordance with approved plans and specifications and contract provisions;

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

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

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

20.1. For purposes of this Contract the terms "*force majeure*" and "fortuitous event" may be used interchangeably. In this regard, a fortuitous event or *force majeure* shall be interpreted to mean an event which the Contractor could not have foreseen, or which though foreseen, was inevitable. It shall not include ordinary unfavorable weather conditions; and any other cause the effects of

Which could have been avoided with the exercise of reasonable diligence by the Contractor.

20.2. If this Contract is discontinued by an outbreak of war or by any other event entirely outside the control of either the Procuring Entity or the Contractor, the Procuring Entity's Representative shall certify that this Contract has been discontinued. The Contractor shall make the Site safe and stop work as quickly

as possible after receiving this certificate and shall be paid for all works carried out before receiving it and for any Work carried out afterwards to which a commitment was made.

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

## 21. **Resolution of Disputes**

- 21.1. If any dispute or difference of any kind whatsoever shall arise between the parties in connection with the implementation of the contract covered by the Act and this IRR, the parties shall make every effort to resolve amicably such dispute or difference by mutual consultation.
- 21.2. If the Contractor believes that a decision taken by the Procuring Entity's Representative was either outside the authority given to the Procuring Entity's Representative by this Contract or that the decision was wrongly taken, the decision shall be referred to the 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. Procuring Entity's Representative's Decisions**

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

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

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

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

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

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

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

## 27. **Right to Vary**

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

## 28. **Contractor's Right to Claim**

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

## 29. **Dayworks**

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

29.3. The Contractor shall be paid for Dayworks subject to obtaining signed Dayworks forms.

### 30. **Early Warning**

30.1. The Contractor shall warn the Procuring Entity's Representative at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works. The Procuring Entity's Representative may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.

30.2. The Contractor shall cooperate with the Procuring Entity's Representative in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Procuring Entity's Representative.

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

31.1. Within the time stated in the **SCC**, the Contractor shall submit to the Procuring Entity's Representative for approval a Program of Work showing the general methods, arrangements, order, and timing for all the activities in the Works.

31.2. An update of the Program of Work shall show the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.

31.3. The Contractor shall submit to the Procuring Entity's Representative for approval an updated Program of Work at intervals no longer than the period stated in the **SCC**. If the Contractor does not submit an updated Program of Work within this period, the Procuring Entity's Representative may withhold the amount stated in the **SCC** from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program of Work has been submitted.

31.4. The Procuring Entity's Representative's approval of the Program of Work shall not alter the Contractor's obligations. The Contractor may revise the Program of Work and submit it to the Procuring Entity's Representative again at any time. A revised Program of Work shall show the effect of any approved Variations.

31.5. When the Program of Work is updated, the Contractor shall provide the Procuring Entity's Representative with an updated cash flow forecast. The cash flow forecast shall include different currencies, as defined in the Contract, converted as necessary using the Contract exchange rates.

31.6. All Variations shall be included in 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 there from the amounts for advance payments and retention. The Procuring Entity shall pay the Contractor the amounts certified by the Procuring Entity's Representative within twenty eight (28) days from the date each certificate was issued. No payment of interest for delayed payments and adjustments shall be made by the Procuring Entity.
- 40.4. The first progress payment may be paid by the Procuring Entity to the Contractor provided that at least five percent (5%) of the work has been accomplished as certified by the Procuring Entity's Representative.

- 40.5. Items of the Works for which a price of “0” (zero) has been entered will not be paid for by the Procuring Entity and shall be deemed covered by other rates and prices in the Contract.

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

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

#### **42. Retention**

- 42.1. The Procuring Entity shall retain from each payment due to the Contractor an amount equal to a percentage thereof using the rate as specified in GCC Sub-Clause 42.2.
- 42.2. Progress payments are subject to retention of ten percent (10%), referred to as the “retention money.” Such retention shall be based on the total amount due to the Contractor prior to any deduction and shall be retained from every progress payment until fifty percent (50%) of the value of Works, as determined by the Procuring Entity, are completed. If, after fifty percent (50%) completion, the Work is satisfactorily done and on schedule, no additional retention shall be made; otherwise, the ten percent (10%) retention shall again be imposed using the rate specified therefor.
- 42.3. The total “retention money” shall be due for release upon final acceptance of the Works. The Contractor may, however, request the substitution of the retention money for each progress billing with irrevocable standby letters of credit from a commercial bank, bank guarantees or surety bonds callable on demand, of amounts equivalent to the retention money substituted for and acceptable to the Procuring Entity, provided that the project is on schedule and is satisfactorily undertaken. Otherwise, the ten (10%) percent retention shall be made. Said irrevocable standby letters of credit, bank guarantees and/or surety bonds, to be posted in favor of the Government shall be valid for a duration to be determined by the concerned implementing office/agency or Procuring Entity and will answer

for the purpose for which the ten (10%) percent retention is intended, *i.e.*, to cover uncorrected discovered defects and third party liabilities.

- 42.4. On completion of the whole Works, the Contractor may substitute retention money with an “on demand” Bank guarantee in a form acceptable to the Procuring Entity.

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

- 43.1. Variation Orders may be issued by the Procuring Entity to cover any increase/decrease in quantities, including the introduction of new work items that are not included in the original contract or reclassification of work items that are either due to change of plans, design or alignment to suit actual field conditions resulting in disparity between the preconstruction plans used for purposes of bidding and the “as staked plans” or construction drawings prepared after a joint survey by the Contractor and the Procuring Entity after award of the contract, provided that the cumulative amount of the Variation Order does not exceed ten percent (10%) of the original project cost. The addition/deletion of Works should be within the general scope of the project as bid and awarded. The scope of works shall not be reduced so as to accommodate a positive Variation Order. A Variation Order may either be in the form of a Change Order or Extra Work Order.
- 43.2. A Change Order may be issued by the Procuring Entity to cover any increase/decrease in quantities of original Work items in the contract.
- 43.3. An Extra Work Order may be issued by the Procuring Entity to cover the introduction of new work necessary for the completion, improvement or protection of the project which were not included as items of Work in the original contract, such as, where there are subsurface or latent physical conditions at the site differing materially from those indicated in the contract, or where there are duly unknown physical conditions at the site of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in the Work or character provided for in the contract.
- 43.4. Any cumulative Variation Order beyond ten percent (10%) shall be subject of another contract to be bid out if the works are separable from the original contract. In exceptional cases where it is urgently necessary to complete the original scope of work, the HoPE may authorize a positive Variation Order go beyond ten percent (10%) but not more than twenty percent (20%) of the original contract price, subject to the guidelines to be determined by the GPPB: *Provided, however*, That appropriate sanctions shall be imposed on the designer, consultant or official responsible for the original detailed engineering design which failed to consider the Variation Order beyond ten percent (10%).
- 43.5. In claiming for any Variation Order, the Contractor shall, within seven (7) calendar days after such work has been commenced or after the circumstances leading to such condition(s) leading to the extra cost, and within twenty-eight (28) calendar days deliver a written communication giving full and detailed particulars of any extra cost in order that it may be investigated at that time. Failure to provide either of such notices in the time stipulated shall constitute a waiver by the

contractor for any claim. The preparation and submission of Variation Orders are as follows:

- (a) If the Procuring Entity's representative/Project Engineer believes that a Change Order or Extra Work Order should be issued, he shall prepare the proposed Order accompanied with the notices submitted by the Contractor, the plans therefore, his computations as to the quantities of the additional works involved per item indicating the specific stations where such works are needed, the date of his inspections and investigations thereon, and the log book thereof, and a detailed estimate of the unit cost of such items of work, together with his justifications for the need of such Change Order or Extra Work Order, and shall submit the same to the HoPE for approval.
- (b) The HoPE or his duly authorized representative, upon receipt of the proposed Change Order or Extra Work Order shall immediately instruct the appropriate technical staff or office of the Procuring Entity to conduct an on-the-spot investigation to verify the need for the Work to be prosecuted and to review the proposed plan, and prices of the work involved.
- (c) The technical staff or appropriate office of the Procuring Entity shall submit a report of their findings and recommendations, together with the supporting documents, to the Head of Procuring Entity or his duly authorized representative for consideration.
- (d) The HoPE or his duly authorized representative, acting upon the recommendation of the technical staff or appropriate office, shall approve the Change Order or Extra Work Order after being satisfied that the same is justified, necessary, and in order.
- (e) The timeframe for the processing of Variation Orders from the preparation up to the approval by the Procuring Entity concerned shall not exceed thirty (30) calendar days.

#### 44. **Contract Completion**

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

#### 45. **Suspension of Work**

- 45.1. The Procuring Entity shall have the authority to suspend the work wholly or partly by written order for such period as may be deemed necessary, due to *force majeure* or any fortuitous events or for failure on the part of the Contractor to correct bad conditions which are unsafe for workers or for the general public, to

carry out valid orders given by the Procuring Entity or to perform any provisions of the contract, or due to adjustment of plans to suit field conditions as found necessary during construction. The Contractor shall immediately comply with such order to suspend the work wholly or partly.

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

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

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

Representative shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.

- 46.3. The net balance due shall be paid or repaid within twenty eight (28) days from the notice of termination.
- 46.4. If the Contractor has terminated the Contract under **GCC** Clauses 17 or 18, the Procuring Entity shall promptly return the Performance Security to the Contractor.

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

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



to be furnished by the Procuring Entity, non-acquisition of permit to enter private properties or non-execution of deed of sale or donation within the right-of-way resulting in complete paralyzation of construction activities, and other meritorious causes as determined by the Procuring Entity's Representative and approved by the HoPE. Shortage of construction materials, general labor strikes, and peace and order problems that disrupt construction operations through no fault of the Contractor may be considered as additional grounds for extension of contract time provided they are publicly felt and certified by appropriate government agencies such as DTI, DOLE, DILG, and DND, among others. The written consent of bondsmen must be attached to any request of the Contractor for extension of contract time and submitted to the Procuring Entity for consideration and the validity of the Performance Security shall be correspondingly extended.

**48. Price Adjustment**

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

**49. Completion**

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

**50. Taking Over**

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

**51. Operating and Maintenance Manuals**

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

**Section V. Special Conditions of Contract**

GCC Clause	
1.17	The <b>Intended Completion Date</b> is <b>665</b> calendar days from start date.
1.22	The <b>Procuring Entity</b> is the <b>Municipal Government of Catanauan, Quezon.</b>
1.23	The <b>Procuring Entity's Representative</b> is: <b>Hon. Ramon A. Orfanel</b> , Municipal Mayor.
1.24	The <b>Site</b> is located at <b>Brgys. San Roque, San Antonio Magcopa, San Pablo Suha &amp; Doongan Ilaya, Catanauan, Quezon</b>
1.28	The <b>Start Date</b> is ten (10) calendar days upon receipt of the Notice to Proceed (NTP).
1.31	<p>The Works consist of:</p> <ul style="list-style-type: none"> <li><b>A. Facilities for the Engineer</b>- Office and Laboratories for the Engineer.</li> <li><b>B. Other General Requirements</b>- Construction Survey &amp; Staking, Project Billboard, Construction Safety and Health Program, Mobilization and Demobilization of Heavy Equipment.</li> <li><b>C. Earthworks</b> - Clearing and Grubbing(with Stripping), Removal of Actual Structure/Obstruction, 0.15m thick PCCP, Surplus Common Excavation, Structure Excavation (Common Soil), Pipe Culvert &amp; Drain Excavation (Common Soil), Embankment from Roadway Excavation (Common Soil), Subgrade Preparation (Common Material)</li> <li><b>D. Sub-Base and Base Course</b> - Aggregate Subbase Course</li> <li><b>E. Surface Course</b> - Portland Cement Concrete Pavement, 200mm thick</li> <li><b>F. Drainage &amp; Slope Protection Structure</b> – Reinforcing Steel Bar Grade 40, Structural Concrete Class A, Lean Concrete, Class B, Reinforced Concrete Pipe Culverts 910 mm ø (36” ø class II), Pipe Culverts 1220mm ø (48” ø , Class II) Stone Masonry (Slope Protection &amp; RCPC Headwalls), Rubble Concrete (Lined Canal &amp; RCPC Apron)</li> <li><b>G. Miscellaneous</b> – Metal Guardrail (Metal Beam) including post, Metal Beam End Piece, Standard Warning Signs (900mm, triangle) Reflectorized Thermoplastic Pavement Markings (White), Reflectorized Thermoplastic Pavement Markings (Yellow), Coconet Bio-Engineering Solutions (Coco-Logs/Fascine), Coconet Bio-Engineering Solutions (Vegetation)</li> <li><b>H. Bridge Construction: San Pablo Suha</b> - Bridge Excavation (Common Soil), Concrete Piles Cast in Drilled Holes, 1.20 m Ø (Ordinary Common Soil Condition), Pile Integrity Testing (Sonic) Ordinary Soil Condition, High Strain Dynamic Testing (PDA) Ordinary Common Soil, Permanent Steel Casing, 1.20 m Ø (10 m thk), Reinforced Concrete Railing, Reinforcing Steel Bar Grade 40 (Major Structures), Reinforcing Steel Bar Grade 60 (Major Structures), Structural Concrete Class “A” (27.58Mpa, 28 days), Lean Concrete (Bridge), Paint (Bridge), Elastomeric Bearing Pad, Stone Masonry (Bridge)</li> <li><b>I. Bridge Construction: Doongan Ilaya</b> – Temporary Craneway Removal, Bridge Excavation (Common Soil), Structural Steel Sheet Piles Furnished and Driven, Concrete Piles Cast in Drilled Holes 1.80</li> </ul>

	m Ø (Ordinary Soil Condition), Pile Integrity Testing (Sonic) Ordinary Soil Condition, High Strain Dynamic Testing (PDA) Ordinary Soil Condition, Permanent Steel Casing 1.80 m Ø (10 mm thk), Reinforced Concrete Railing, Reinforcing Steel Bar Grade 40 (Major Structures), Reinforcing Steel Bar Grade 60 (Major Structures), Structural Concrete Class “A” (27.58Mpa, 28 days), Pre-stressed Structural Concrete Member (Girder Type VI, 34.30 meter)Lean Concrete (Bridge), Paint (Bridge), Elastomeric Bearing Pad, Stone Masonry (Bridge)
2.2	Sectional completion is not allowed.
5.1	The <b>Procuring Entity</b> shall give possession of all parts of the Site to the Contractor upon issuance of NTP.
6.5	<p>The Contractor shall employ the following Key Personnel: as per BDS 12.1(b)(ii.2)</p> <p><b>Project Manager</b>- <i>Licensed Civil Engineer with minimum of five (5) years of relevant experience as Project Manager in road and in bridge construction</i></p> <p><b>Two (2) Project Engineer for Road</b> –<i>minimum of five (5) years’ experience as Licensed Civil/Agricultural Engineer and with at least two (2) projects handled in road construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of Road or at least PhP67,335,400.00 <u>each project</u></i></p> <p><b>Project Engineer for Bridge</b> - <i>minimum of five (5) years’ experience as Licensed Civil/Agricultural Engineer and with at least two (2) projects handled in bridge construction as Project Engineer with a value of at least twenty percent (20%) of the EPC of bridge or at least PhP8,664,600.00 <u>each project</u></i></p> <p><b>Materials Engineer</b> – <i>Licensed Civil Engineer duly accredited by DPWH as Materials Engineer II following DPWH D.O. 98, S. of 2016.</i></p> <p><b>Geodetic Engineer</b> – <i>Licensed Geodetic Engineer with relevant work experience in surveying and soil profiling of road (not subject for evaluation but required during implementation)</i></p>
7.4(c)	No further instruction.
7.7	No further instruction.
8.1	No further instruction.
10	None.
12.3	No further instruction.
12.5	Five (5) years
13	“No additional provision” or if the contractor is a joint venture, “All partners to the joint venture shall be jointly and severally liable to the Procuring Entity”.
18.3(h)(i)	The World Bank’s Anti-Corruption Policy requires the Borrowers (including beneficiaries of Bank-financed activity), as well as Bidders, Suppliers, Contractors and their agents (whether declared or not), sub-contractors, sub-consultants, service providers or suppliers, and any personnel thereof, observe the highest standard of ethics during the procurement and execution of Bank-financed contracts. Any action to influence the procurement process or contract

execution for undue advantage is improper.

In pursuance of this policy, the Bank:

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

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

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

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

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

(v) "obstructive practice" is

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

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

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

	<p>(c) will declare mis-procurement and cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement or the implementation of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;</p> <p>(d) will sanction a firm or an individual, at any time, in accordance with the prevailing Bank's sanctions procedures, including by publicly declaring such firm or individual ineligible, either indefinitely or for a stated period of time: (i) to be awarded a Bank-financed contract; and (ii) to be a nominated sub-contractor, consultant, manufacturer or supplier, or service provider (different names are used depending on the particular bidding document) is one which has either been (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower. A firm or individual may be declared ineligible to be awarded a Bank financed contract upon (i) completion of the Bank's sanctions proceedings as per its sanctions procedures, including, inter alia, cross debarment as agreed with other International Financial Institutions, including Multilateral Development Banks, and through the application of the World Bank Group corporate administrative procurement sanctions procedures for fraud and corruption; and (ii) as a result of temporary suspension or early temporary suspension in connection with an ongoing sanctions proceeding. See footnote 14 and paragraph 8 of Appendix 1 of the World Bank Guidelines for Procurement of Goods, Works, and Non-Consulting Services;</p> <p>(e) will require that a clause be included in bidding documents and in contracts financed by a Bank loan or grant, requiring bidders, suppliers and contractors, and their sub-contractors, agents, personnel, consultants, service providers, or suppliers to permit Bank to inspect all accounts and records and other documents relating to the submission of bids and contract performance, and to have them audited by auditors appointed by Bank.</p>
21.2	<p>The Arbiter is: Construction Industry Arbitration Commission, Manila</p>
29.1	No dayworks are applicable to the contract.
31.1	The Contractor shall submit the Program of Work to the Procuring Entity's Representative within five (5) calendar days of delivery of the Notice of Award.
31.3	<p>The period between Program of Work updates is 30 days.</p> <p>The amount to be withheld for late submission of an updated Program of Work is 1% of the progress billing.</p>
34.1(a)	<p>Upon instruction by the Procuring Entity, the contractor will arrange and shall shoulder cost for the materials and field testing.</p> <p>The materials and field test shall be conducted by DPWH or its accredited testing laboratories.</p> <p>For field density test (FDT), it shall be carried out through the following options: 1. By DPWH or its accredited testing laboratories as default; 2. By independent accredited Materials Engineer located within the province;</p>

	<p>3. By an accredited Materials Engineer of the Provincial Government;</p> <p>4. By colleges and universities with testing laboratories.</p> <p>The conditions to effect the other options (2, 3 &amp; 4) mentioned above are described below. Whoever conducts the test must prepare and attest to the veracity of the test report. The contracting parties are the signatory witness in the conduct of the FDTs. The FDTs shall be closely witnessed by the contractor, and PPMIU and Regional Project Coordination Office (RPCO) or Project Support Office (PSO).</p> <p>Options 2, 3 and 4 maybe availed of by the contracting parties in the conduct of FDTs if DPWH facilities will not be available on a timely basis.</p> <p>1. The option to be adapted by the contracting parties must be communicated properly to the DPWH regional office where the LGU is covered. The response of the DPWH would trigger the application of the three options. The concurrence of the Project will be based on the evidence of impending or actual delays in the conduct of FDTs through Option 1;</p> <p>2. The engagement of accredited Materials Engineers for Options 2 and 3 will follow the limits of authority for ME1 and ME2 by the Bureau of Research and Standards (BRS) of the Department of Public Works and Highways. The nomination of which will come from the LGU and to be concurred by the Regional Project Coordination Office. However, the test apparatuses to be utilized by the accredited Materials Engineer may either come from the LGU or the contractor. The test apparatuses shall be re-calibrated and tested in the presence of the RPCO or PSO engineers prior to actual use;</p> <p>The selection of colleges and universities to conduct the FDT must be supported with proof that indeed the laboratory technicians have conducted the same test within the last three years. Records of FDT reports taken from similar projects filed by the laboratory administrator will suffice as proof of capacity to engage the said college or university.</p>
34.3	The Funding Source is the World Bank.
39.1	The amount of the advance payment is 15% of the Contract Price and to be recouped every progress billing.
39.2	Except for Surety Bond.
40.1	No further instruction.
40.4	Progress payment shall be made monthly as per work accomplished.
41.5	The Contractor is obliged to submit to the Procuring Entity's Representatives the geotagged photos taken before, during and after construction of each item of work especially the embedded items at the time that the claim for payment is made and the Statement of Work Accomplished (SWA) is executed.
51.1	The date by which "as built" drawings are required is 15-30 days from Completion Date as defined under GCC 1.1.3.
51.2	The amount to be withheld for failing to produce "as built" drawings and/or operating and maintenance manuals by the date required is 1% of the final contract amount.

Section VI. Specifications

TABLE OF CONTENTS

A.1.1 - FACILITIES FOR THE ENGINEER..... 80

B.4(1) - CONSTRUCTION SURVEY AND STAKING ..... 82

SPL 1 - PROJECT BILLBOARD ..... 88

SPL 2 – CONSTRUCTION SAFETY AND HEALTH..... 91

SPL 3 - MOBILIZATION AND DEMOBILIZATION ..... 104

ITEM 100 – CLEARING AND GRUBBING..... 104

ITEM 101 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS ..... 107

ITEM 102 – EXCAVATION ..... 109

ITEM 103 – STRUCTURE EXCAVATION ..... 114

ITEM 104 – EMBANKMENT ..... 120

ITEM 105 – SUBGRADE PREPARATION ..... 126

ITEM 200 – AGGREGATE SUBBASE COURSE..... 128

ITEM 311 – PORTLAND CEMENT CONCRETE PAVEMENT ..... 131

ITEM 400 – PILING ..... 156

ITEM 401 – RAILINGS ..... 188

ITEM 404 – REINFORCING STEEL..... 191

ITEM 405 – STRUCTURAL CONCRETE ..... 194

ITEM 407 – CONCRETE STRUCTURES ..... 207

ITEM 411 – PAINT ..... 224

ITEM 412 – ELASTOMERIC BEARING PADS ..... 232

ITEM 500 – PIPE CULVERTS AND STORM DRAINS ..... 238

ITEM 506 – STONE MASONRY ..... 243

ITEM 507 – RUBBLE CONCRETE ..... 246

ITEM 603 – GUARDRAIL..... 248

ITEM 605 – ROAD SIGN..... 251

ITEM 612 – REFLECTIVE THERMOPLASTIC STRIPPING MATERIALS (SOLID FORM)255

ITEM 622 - COCONET BIO-ENGINEERING SOLUTIONS ..... 260

HANDTOOLS..... 267

## **A.1.1 - FACILITIES FOR THE ENGINEER**

### **A.1 Requirements**

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

- (1) The Contractor shall, for the entire period during which the construction work is being undertaken, provide an equipped and furnished Field Office for the Engineer of at least 30.00 square meters of useable floor area, and which shall be complete with sanitary facilities. The minimum roofing is of galvanized iron sheets and plywood ceiling and walling. A list of the equipment, furniture, instruments, apparatus, fixtures, fittings and other items to be provided by the Contractor for the Field Office is shown in 'Attachment A' to these Technical Specifications.
- (2) The Contractor shall also, for the entire period during which testing of materials and workmanship is required, provide an equipped and furnished Laboratory Field Office of at least 20.00 square meters of useable floor area, and which shall be complete with its own sanitary facilities if not attached to the Field Office. The minimum roofing is of galvanized iron sheets and plywood ceiling and walling. A list of the equipment, furniture, instruments, apparatus, fixtures, fittings and other items to be provided by the Contractor for the Laboratory Field Office is shown in 'Attachment B' to these Technical Specifications.
- (3) The Field Office and Laboratory Field Office shall be located within close proximity to the Site and usually within the batching plant compound. In a location approved of by the Engineer and shall be made available for the Engineer's occupation before any construction work commences. Such facilities may, entirely at the discretion of the Contractor, be in rented accommodation or be purpose built, provided always that the facility is of a standard acceptable to the Engineer. Shaded areas shall be provided at all such facilities for the Engineer's car parking, with a suitable self-draining gravel base. When the Engineer decides that temporary facilities built on the Site or Government-provided land are no longer required, the Contractor shall remove all evidence of the temporary work and reinstate the ground to its original state, unless the Engineer directs otherwise.
- (4) It is the Contractor's responsibility to make all necessary arrangements to provide the Field Office and Laboratory Field Office and to provide all necessary equipment, furniture, utilities and security staff to attend thereto, including payment thereof at his own cost. The Employer and the Engineer shall be free from any liability in connection with the use of such facilities.
- (5) The Contractor shall provide an adequate supply of all necessary stationery, printing papers, laboratory materials, testing materials and any other consumable items for the Engineer's Field Office and Laboratory Field Office as required by and to the satisfaction of the Engineer.
- (6) All equipment, furniture, instruments, apparatus, fixtures, fittings and other items to be provided for the use of the Engineer shall be new and shall conform to the specifications as to kinds, grades, types and sizes, all to the satisfaction of the Engineer. When the Engineer decides that such items are no longer required, they shall be handed back to the Contractor, who shall then remove them from the Site.
- (7) Electrical power for the Field Office and Laboratory Field Office shall be continuously available and adequate for all the equipment, apparatus and lighting needs. Similarly, a continuous water supply and other provisions necessary for the



efficient operation of all the facilities shall be made available, including the provision of potable water where the facilities are manned on a regular or continuous basis.

- (8) The Contractor shall provide an adequate complement of qualified and competent laboratory staff or technicians to carry out all the materials quality control and all the tests required by the Engineer. The persons so appointed shall work full time and shall be responsible to the Engineer for all the laboratory work required to be carried out.
- (9) The Contractor shall make available, for the exclusive use of the Engineer and staff, a single direct telephone line service and a two-way radio communication service for the entire period during which construction activities take place. If the Laboratory Field Office is adjacent to the Field Office, then an extension telephone line between the Laboratory Field Office and the Field Office shall be provided, but otherwise an additional telephone service to the Laboratory Field Office shall be provided or a cellphone.”

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

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

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

#### **A.1.3 Assistance to the Engineer**

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

### **A.2 Measurement and Payment**

#### **A.2.1 Measurement**

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

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

- (2) The provision of transportation for the Engineer’s use shall be measured in months.

The payment for transportation shall be deemed to include remuneration for a qualified and competent driver, supply of all appropriate fuel and lubricants, and all

necessary maintenance, spare parts and servicing to keep the respective vehicle(s) in first class condition at all times.”

**A.2.2 Payment**

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

Payment for the provision of transportation for the Engineer’s use shall be due and payable for the entire period for which the Engineer makes use of such provision.

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

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
A.1.1	Office and Laboratories for the Engineer	Lot

**B.4(1) - CONSTRUCTION SURVEY AND STAKING**

**B.4.1 Description**

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

**B.4.2 Construction Requirements**

**B.4.2.1 General**

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

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

The Contractor shall be responsible for the true 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.

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

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

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

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

1. Surveying and staking methods
2. Stake marking/concrete monuments
3. Grade control for coursed of material
4. Referencing
5. Structural control
6. Any other procedures and controls necessary for the work

Established controls shall be within the tolerances shown in Table 1.

Table 1  
Construction Survey and Staking Tolerances<sup>(1)</sup>

Staking Phase	Horizontal	Vertical
Existing Government network control points	±20mm	±8mmx $\sqrt{K}$ <sup>(2)</sup>
Local supplemental control points set from existing Government network points	±10mm	±3mmx $\sqrt{N}$ <sup>(3)</sup>
Centerline points <sup>(4)</sup> – (PC), (PT), (POT), and (POC) including references	±10mm	±10mm
Other centerline points	±50mm	±50mm
Cross-section points and slope stakes <sup>(5)</sup>	±50mm	±50mm
Slope stakes reference <sup>(5)</sup>	±50mm	±50mm
Culverts, ditches, and minor drainage structures	±50mm	±20mm
Retaining walls and curb and gutter	±20mm	±10mm
Bridge substructures	±10mm <sup>(6)</sup>	±10mm
Bridge superstructures	±10mm <sup>(6)</sup>	±10mm
Clearing and grubbing limits	±500mm	-
Roadway subgrade finish stakes <sup>(7)</sup>	±50mm	±10mm
Roadway finish grade stakes <sup>(7)</sup>	±50mm	±10mm

- (1) At 95% confidence level. Tolerances are relative to existing Government networks control points.
- (2) K is the distance in kilometers.
- (3) N is the number of instrument setups.
- (4) Centerline points: PC – point of curve, PT -point of tangent, POT – point on tangent, POC – point on curve.
- (5) Take the cross-sections normal to the centerline + 1 degree.
- (6) Bridge control is established as a local network and the tolerances are relative to that network.
- (7) Include paved ditches.

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 is accepted.

The construction survey and staking work may be spot-checked by the Engineer for accuracy, and unacceptable portions of work may be rejected. Rejected work shall be resurveyed, and work that is not within the tolerances specified in Table 1 shall be corrected. Acceptance of the construction staking shall not relieve the Contractor of responsibility for correcting errors discovered during the work and for bearing all additional costs associated with the error, unless such error is based on incorrect data supplied in writing by the Engineer, in which case, the expense in rectifying the same shall be at the expense of the Government.

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

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

#### **B.4.2.2 Equipment**

Survey instruments 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 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 sufficient surface area above ground for necessary legible markings shall also be furnished.

#### **B.4.2.3 Survey and Staking Requirements**

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

##### **1. Control Points**

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

##### **2. Roadway Cross Sections**

Roadway cross-sections shall be taken normal or perpendicular to the centerline. When the centerline horizontal curve radius is less than or equal to 150 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 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 section including transition change to superelevated sections. Along each cross-section,

points shall be measured and recorded at breaks in topography and changes in typical roadway section including transition change to superelevated sections and shall be no further apart than 5 meters. 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 Reference

Slope stakes and references shall be set on both sides of centerlines at the cross-section locations. Slope stakes shall be established in the field as the actual point of intersection of the design roadway slope with the natural ground line. Slope stake references shall be set outside the clearing limits. All reference point and slope stake information shall be included on the reference stakes. When initial references are provided, slope stakes may be set from these points with verification of the slope stake location with field measurements. Slope stakes on any section that do not match with the staking report within the tolerances established in Table 1 shall be re-catched. Roadway cross-section data shall be taken between centerline and the new slope stake location. Additional references shall be set even when initial references are provided.

### 4. Clearing and Grubbing Limits

Clearing and grubbing limits shall be set on both sides of centerline at roadway cross-section locations, extending one (1) meter beyond the toe of the fill slopes or beyond 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.

### 5. Centerline Reestablishment

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 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 distance between centerline points shall be 20 meters.

### 6. Grade Finishing Stakes

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

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

The maximum longitudinal spacing between stakes shall be 10 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 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 longitudinal spacing between stakes shall be 20 meters. The maximum transverse spacing between stakes shall be 5 meters. Brushes or guard stakes shall be used at each stake.

## 7. Culverts

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 project plan.
- b. Determine the slope catch points at the inlet and outlet.
- c. Set reference points and record information necessary to determine culvert length and end treatments.
- d. Plot into scale the profile along the culvert centerline reflecting the natural ground elevation, invert elevation, the flow line, the roadway section, and the size, length and the degree of elbow of culvert, end treatments, grade and other appurtenances.
- e. Plot into scale the cross-section of inlet and outlet channel at not more than 5 meters interval.
- f. Submit the plotted Pipe Projection Plan for approval of final culvert length, alignment and headwall.
- g. When the Pipe Projection Plan has been approved, set drainage culvert structure survey and reference stakes and stake inlet and outlet to make the structure functional.

## 8. Culverts

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

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

## 9. Retaining Walls and Other Types of Slope Protection Works

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

## 10. Borrow and Waste Sites

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

#### 11. Permanent Monuments and Markers

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

#### 12. Miscellaneous Survey and Staking

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

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

### **B.4.3 method of Measurement**

Construction survey and staking shall be measured by the kilometer.

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

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

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

Culvert survey and staking shall be measured by the each.

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

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

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

**B.4.4 Basis of Payment**

The accepted quantities, measured as provided in Section B.4.3, shall be paid for at the contract unit price for each of the Pay Item listed below that is included in the Bill of Quantities.

Payment shall constitute full compensation for surveying, staking, calculating/processing by any means and recording data, for furnishing and placing all materials, and for furnishing all equipment, tools and incidentals necessary to complete the Item.

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

- a. 25% of the lumpsum, not to exceed 0.5% of the original contract amount, shall be paid following completion of the 10% of the original contract amount,
- b. Payment of the remaining portion of the lump sum shall be prorated based on the total work completed.

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

Payment 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

**SPL 1 - PROJECT BILLBOARD**

**Description**

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

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

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

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



## Material Requirements

### Tarpaulin

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

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

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

#### ANNEX 14 PROJECT BILLBOARD

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

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

### Post and Frame

Posts and frames/braces shall be made from good lumber with a 2X3 and 2x2 inches size respectively and shall be well-seasoned, straight and free of injurious defects. The

frame will be covered with 2 pieces ¼ inch thick marine plywood where the tarpaulin will be attached.

### **Concrete Foundation Blocks**

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

### **Construction Requirements**

#### **Excavation and Backfilling**

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

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

#### **Erection of Posts**

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

#### **Tarpaulin Installation**

Tarpaulin shall be installed in accordance with the details shown on the Plans. The frame should be covered with the marine plywood before the tarpaulin is attached.

#### **Method of Measurement**

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

#### **Basis of Payment**

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

Payment will be made under:

<b>Pay Item No.</b>	<b>Description</b>	<b>Unit of Measurement</b>
SPL 1	Project Billboard	Each

## SPL 2 – CONSTRUCTION SAFETY AND HEALTH

### HEALTH AND SAFETY

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

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

A Company Safety Policy which shall serve as the general guiding principles in the implementation of safety and health on site duly signed by the highest company official or his duly authorized representative who has the over---all control of project execution and should include the contractor's general policy towards occupational safety, worker's welfare and health, and environment.

A Safety policy, which shall include the commitment that the contractor shall comply with DOLE minimum safety requirements, including reporting requirements of the Occupational Health and Safety Standards (OSHS), and other relevant DOLE issuances. These may include, but are not limited to the following:

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

***1.2 Specific Construction Safety and Health Program*** shall contain the tendering agency's requirements in addition to the minimum requirements under the appropriate sections of D.O. No. 13 whenever deemed as applicable.

#### ***1.3 Composition of Construction Safety and Health Committee.***

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

#### ***1.4 Safety and Health Personnel.*** The following shall apply:

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

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

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

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

- a. Detailed information dissemination or advisories to the new employees prior to on-site assignment, e.g. conduct of safety orientation, company's health and safety policies, hazards related to the job safety measures, safe work procedures.
- b. Detailed programs on continuing education such as trainings and seminars, if any, that shall be given to employees, e.g. BOSH, refresher course, first aid training, refresher course toolbox meeting, construction safety training for site safety officers, 80-hour advance safety course prescribe.
- c. Arrangements for conveying information on safety and health IEC materials e.g. Posters/komics/flyers, safety signages, handbooks/manuals, bulletin boards.
- d. Arrangements for setting up sub-committees on safety and health, where necessary.
- e. Schedule of safety related activities, e.g. toolbox meeting, health and safety committee meeting.

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

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

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

- a. Measures in order to ensure the safety of the general public shall be pursuant to Rule 11 of the National Building Code---Implementing Rules and Regulations: Protection of Pedestrians During Construction or Demolition
- b. Appropriate provisions and rules of OSHS
  - Rule 1412.09: Protection of the Public
  - Rule 1412.12: Protection against collapse of Structure
  - Rule 1412.16: Traffic Control

- Rule 1413: Excavation
- Rule 1417: Demolition
- Rule 1060: Premises of Establishments
- D.O. 13, Section 9: Construction Safety Signs
- Other relevant provisions of OSHS.

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

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

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

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

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

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

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

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

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

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

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

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

--- Proper area guarding of storage facilities

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

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

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

- a. Rule 1160 --- Boiler
- b. Rule 1170 --- Unfired Pressure Vessels
- c. Rule 1210 --- Electrical Safety
- d. Rule 1220 --- Elevators and Related Equipment
- e. Rule 1410 --- Construction Safety
- f. Rule 1415.10 – Training and Examination of Lifting Appliance

**1.17 Workers skills and certification.** The following shall apply:

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

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

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

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

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

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

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

**1.21 Workers Welfare Facilities.** The following shall apply:

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

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

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

**1.23 Waste Disposal. The following shall apply:**

- a. Proposed method of clearing and disposal of waste.
- b. Provisions for permits and clearance where require in disposal of hazardous wastes.

**1.24 Disaster and Emergency Preparedness Contingency**

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

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

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

- a. Site Clearing
- b. Excavations
- c. Erection and dismantling of scaffolds and other temporary working platforms
- d. Temporary electrical connections/installations
- e. Use of scaffolds and other temporary working platforms
- f. Working at unprotected elevated working platforms or surfaces
- g. Work over water
- h. Use of power tools and equipment
- i. Gas and electric welding and cutting operations
- j. Working in confined spaces
- k. Use of internal combustion engines
- l. Handling hazardous and/or toxic chemical substances
- m. Use of hand tools

- n. Working with pressurized equipment
- o. Working in hot or cold environments
- p. Handling, storage, usage and disposal of explosives
- q. Use of mechanized lifting appliances for movement of materials
- r. Use of construction heavy equipment
- s. Demolition

**The hazard analysis shall contain the following:**

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

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

**2. Personal Protective Equipment by Type of Project**

**2.1 General Building Construction Project (GBC).** The following classifications shall apply:  
Classification: Air Navigation Facilities, Power Transmission & Distribution, Building and Housing, Communication facilities, Sewerage, water treatment plants and Site/Land development.

**2.2 General Engineering Construction Project.** The following classifications shall apply:  
Classifications: Roads and Airports (Horizontal structure), bridges, irrigation system, flood control and drainages, dams, tunneling, ports and harbor, water supply

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

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



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

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

The following shall apply:

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

### **4. Construction Heavy Equipment.** The following shall apply:

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

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

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

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

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

### **5. Signages and Barricades.** The following shall apply:

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

#### **5.1 Signage Procedures:** The signages shall be:

- a. Posted in prominent positions and at strategic locations.
- b. As far as practicable, be in the language understandable to most of the workers employed in the site.

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

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

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

**5.3 Barricading Procedures:** The following shall apply:

- a. The contractor shall provide all necessary barricades, safety tapes, safety cones or safety lines as required in isolating or protecting an unsafe work area from other workers, pedestrians or vehicular traffic.
- b. Barricades shall completely enclose the hazardous area and effectively limit unintentional or casual entry.
- c. Barricades shall be three (3) feet vertical height from the ground, when no other more practical height specification is available.
- d. Barricades shall be maintained in good condition to achieve its purpose.

- e. Barricades that are damaged; faded or that no longer apply as to purpose, site or meaning, shall be removed or shall be replaced by the safety officer.
- f. Barricade tape shall not be used on the floor as this presents a slipping hazard of its own.
- g. In addition to using the proper warning tape, the contractor shall use the appropriate safety signage when barricading an area.
- h. All barricades shall be removed after the hazard is completely eliminated.
- i. Upon work completion, if the hazard is still present, the barricade shall remain in place.

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

- a. hazardous areas
- b. trip hazard
- c. robotic movement
- d. energized electrical works
- e. overhead suspended load test
- f. critical high-pressure test
- g. chemical introduction
- h. fall exposure
- i. Emergency Response Zone
- j. Unsafe condition zone
- k. Danger zone
- l. Confined and enclosed space

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

**6.1 Composition**

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

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

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

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

## **6.2 Duties and responsibilities**

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

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

### **7.1 The Construction Safety and Health Report shall include:**

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

### **7.2 Submission of Reports.** The following shall apply:

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

on or before the 20th of the month following the date of occurrence of accident using the DOLE/BWC/HSD---IP---6 form.

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

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

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

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

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

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

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

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

***9.1 Workers shall be adequately and suitably:***

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

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

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

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

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

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

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

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

- a. Drivers and operators of lifting appliances, transport, earth---moving and materials-- handling equipment and machinery; or any equipment of specialized or dangerous nature.
- b. Workers engaged in the erection or dismantling of scaffolds.
- c. Workers engaged in excavations at least one (1) meter deep or deep enough to cause danger, shafts, earthworks, underground works or tunnels.
- d. Workers handling explosives or engaged in blasting operations.
- e. Workers engaged in pile---driving.
- f. Workers in compressed air cofferdams and caissons.
- g. Workers engaged in the erection of prefabricated parts of steel structural frames and tall chimneys, and in concrete work, form work and other such type of work.
- h. Workers handling hazardous substances and materials.
- i. Workers as signalers and riggers.
- j. Other types of workers as may be categorized by TESDA

**10. Welfare Facilities. The following shall apply:**

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

**10.1 *Adequate supply of safe drinking water:***

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

**10.2 *Adequate sanitary and washing facilities:***

- a. Adequate facilities for changing and for the storage and drying of work clothes.
- b. Adequate accommodation facilities for taking meals and for shelter.
- c. Adequate washing facilities regardless of sex for every 25 employees up to the first 100 and an additional of one (1) facility for every 40 additional workers.

- d. Suitable living accommodation for workers and as may be applicable for their families, such as separate sanitary, washing and sleeping facilities for men and women workers.

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

- a. Where the number of female workers exceeds 100, one (1) toilet and bath facilities for every 20 female workers up to the first 100 and one (1) toilet and bath facilities for every 30 additional female workers.
- b. Where the number of male workers exceeds 100 and sufficient urinals have been provided, one (1) toilet and bath facilities for every 25 sales up to the first 100 and one (1) more for every 40 additional male workers.
- c. Every toilet shall be provided with enclosure, partitioned off so as to provide/ensure privacy. If feasible, shall have a proper door and fastenings, so doors shall be tight fitting and self---closing.
- d. Urinals shall be placed or screened so as not to be visible from other parts of the site, or other workers.
- e. Rest rooms shall be so arranged so as to be conveniently accessible to the workers and shall be kept clean and orderly at all times.
- f. Adequate hand---washing facilities shall be so provided within or adjacent to the toilet facilities
- g. In cases where persons of both sexes are employed, toilet and bath facilities for each sex shall be situated or partitioned so that the interior will not be visible even when the door of any facility is opened from any place where persons of the other sex have to work or pass.
- h. If toilet and bath facilities for one sex adjoin those for the other sex, the approaches shall be separate, and toilet and bath facilities for each sex shall be properly indicated.

**Mode of Measurement**

Method of Measurement shall be paid for at the contract unit price for the Pay Items shown in the Bid Schedule which price and payment shall be full compensation for the provision of Personal Protective Equipment (PPE) and Devices, Medicines, Medical Supplies and other incidentals necessary to complete the item.

**Basis of Payment**

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

Payment will be made under:

<b>Pay Item No.</b>	<b>Description</b>	<b>Unit of Measurement</b>
SPL 2	Construction Safety and Health Program	Lot

### **SPL 3 - MOBILIZATION AND DEMOBILIZATION**

This item shall consist of the mobilization and demobilization of the required minimum essential equipment and labor force for the project.

#### **Method of payment**

Payment for complying with the provision of this item shall be as certified by the Engineer that all required the required minimum equipment has been delivered at the site and the time the same have been removed from the project site.

Payment for this item shall be made in two (2) installments, to wit: Seventy percent (70%) after the Contractor has totally mobilized his equipment plants and ready for use and the remaining thirty percent (30%) after the Contractor has finally completed the Payments shall be made under:

<b>Pay Item No.</b>	<b>Description</b>	<b>Unit of Measurement</b>
SPL 3	Mobilization & Demobilization of Heavy Equipment	Lot

### **ITEM 100 – CLEARING AND GRUBBING**

#### **100.1 Description**

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

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



## **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 mowing as required, except as provided below:

- (1) Removal of undisturbed stumps and roots and nonperishable solid objects with a minimum depth of one (1) meter below sub grade or slope of embankment will not be required.
- (2) In areas outside of the grading limits of cut and embankment areas, stumps and nonperishable solid objects shall be cut off not more than 150 mm (6 inches) above the ground line or low water level.
- (3) In areas to be rounded at the top of cut slopes, stumps shall be cut off flush with or below the surface of the final slope line.
- (4) Grubbing of pits, channel changes and ditches will be required only to the depth necessitated by the proposed excavation within such areas.
- (5) In areas covered by cogon / talahib, wild grass and other vegetations, top soil shall be cut to a maximum depth of 150 mm below the original ground surface or as designated by the Engineer, and disposed outside the clearing and grubbing limits as indicated in the typical roadway section.

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

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

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

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

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

copy of such agreement shall be furnished to the Engineer. The disposal areas shall be seeded, fertilized and mulched at the Contractor's expense.

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

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

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

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

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

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

### **100.3 Method of Measurement**

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

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

### **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, which price and payment shall be full compensation for furnishing all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
100	Clearing and Grubbing	Hectare

## **ITEM 101 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

### **101.1 Description**

This Item shall consist of the removal wholly or in part, and satisfactory disposal of all buildings, fences, structures, old pavements, abandoned pipe lines, and any other obstructions which are not designated or permitted to remain, except for the obstructions to be removed and disposed off under other items in the Contract. It shall also include the salvaging of designated materials and backfilling the resulting trenches, holes, and pits.

### **101.2 Construction Requirements**

#### **101.2.1 General**

The Contractor shall perform the work described above, within and adjacent to the roadway, on Government land or easement, as shown on the Plans or as directed by the Engineer. All designated salvable material shall be removed, without unnecessary damage, in sections or pieces which may be readily transported, and shall be stored by the Contractor at specified places on the project or as otherwise shown in the Special Provisions. Perishable material shall be handled as designated in Subsection 100.2.2. Nonperishable material may be disposed off outside the limits of view from the project with written permission of the property owner on whose property the material is placed. Copies of all agreements with property owners are to be furnished to the Engineer. Basements or cavities left by the structure removal shall be filled with acceptable material to the level of the surrounding ground and, if within the prism of construction, shall be compacted to the required density.

#### **101.2.2 Removal of Existing Bridges, Culverts, and other Drainage Structures**

All existing bridges, culverts and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic. The removal of existing culverts within embankment areas will be required only as necessary for the installation of new structures. Abandoned culverts shall be broken down, crushed and sealed or plugged. All retrieved culvert for future use as determined by the Engineer shall be carefully removed and all precautions shall be employed to avoid breakage or structural damage to any of its part. All sections of structures removed which are not designated for stockpiling or re-laying shall become the property of the Government and be removed from the project or disposed off in a manner approved by the Engineer.

Unless otherwise directed, the substructures of existing structures shall be removed down to the natural stream bottom and those parts outside of the stream shall be removed down to at least 300 mm (12 inches) below natural ground surface. Where such portions of existing structures lie wholly or in part within the limits for a new structure, they shall be removed as necessary to accommodate the construction of the proposed structure.

Steel bridges and wood bridges when specified to be salvaged shall be carefully dismantled without damaged. Steel members shall be match marked unless such match marking is waived by the Engineer. All salvaged material shall be stored as specified in Subsection 101.2.1.

Structures designated to become the property of the Contractor shall be removed from the right-of-way.

Blasting or other operations necessary for the removal of an existing structure or obstruction, which may damage new construction, shall be completed prior to placing the new work, unless otherwise provided in the Special Provisions.

### **101.2.3 Removal of Pipes Other than Pipe Culverts**

Unless otherwise provided, all pipes shall be carefully removed and every precaution taken to avoid breakage or damaged. Pipes to be relaid shall be removed and stored when necessary so that there will be no loss of damage before re-laying. The Contractor shall replace sections lost from storage or damage by negligence, at his own expense.

### **101.2.4 Removal of Existing Pavement, Sidewalks, Curbs, etc.**

All concrete pavement, base course, sidewalks, curbs, gutters, etc., designated for removal, shall be:

- (1) Broken into pieces and used for riprap on the project, or
- (2) Broken into pieces, the size of which shall not exceed 300 mm (12 inches) in any dimension and stockpiled at designated locations on the project for use by the Government, or
- (3) Otherwise demolished and disposed off as directed by the Engineer. When specified, ballast, gravel, bituminous materials or other surfacing or pavement materials shall be removed and stockpiled as required in Subsection 101.2.1, otherwise such materials shall be disposed off as directed.

There will be no separate payment for excavating for removal of structures and obstructions or for backfilling and compacting the remaining cavity.

### 101.3 Method of Measurement

When the Contract stipulates that payment will be made for removal of obstructions on lump-sum basis, the pay item will include all structures and obstructions encountered within the roadway. Where the contract stipulates that payment will be made for the removal of specific items on a unit basis, measurement will be made by the unit stipulated in the Contract.

Whenever the Bill of Quantities does not contain an item for any aforementioned removals, the work will not be paid for directly, but will be considered as a subsidiary obligation of the Contractor under other Contract Items.

### 101.4 Basis of Payment

The accepted quantities, measured as prescribed in Section 101.3, shall be paid for at the Contract unit price or lump sum price bid 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 removing and disposing of obstructions, including materials, labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item. The price shall also include backfilling, salvage of materials removed, their custody, preservation, storage on the right-of-way and disposal as provided herein.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
101(3)	Removal of Actual Structure/Obstruction, 0.15m thick PCCP (Unreinforced)	Square Meter

## ITEM 102 – EXCAVATION

### 102.1 Description

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

### **102.1.1 Roadway Excavation**

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

- (1) **Unclassified Excavation.** Unclassified excavation shall consist of the excavation and disposal of all materials regardless of its nature, not classified and included in the Bill of Quantities under other pay items.
- (2) **Rock Excavation.** Rock excavation shall consist of igneous, sedimentary and metamorphic rock which cannot be excavated without blasting or the use of rippers, and all boulders or other detached stones each having a volume of 1 cubic meter or more as determined by physical measurements or visually by the Engineer.
- (3) **Common Excavation.** Common excavations shall consist of all excavation not included in the Bill of Quantities under “rock excavation” or other pay items.
- (4) **Muck Excavation.** Muck excavation shall consist of the removal and disposal of deposits of saturated or unsaturated mixtures of soils and organic matter not suitable for foundation material regardless of moisture content.

### **102.1.2 Borrow Excavation**

Borrow excavation shall consist of the excavation and utilization of approved material required for the construction of embankments or for other portions of the work, and shall be obtained from approved sources, in accordance with Clause 61 and the following:

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

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

## **102.2 Construction Requirements**

### **102.2.1 General**

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

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

### **102.2.2 Conservation of Topsoil**

Where provided for on the Plans or in the Special Provisions, suitable topsoil encountered in excavation and on areas where embankment is to be placed shall be removed to such extent and to such depth as the Engineer may direct. The removed topsoil shall be transported and deposited in storage piles at locations approved by the Engineer. The topsoil shall be completely removed to the required depth from any designated area prior to the beginning of regular excavation or embankment work in the area and shall be kept separate from other excavated materials for later use.

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

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

The Engineer will designate as unsuitable those soils that cannot be properly compacted in embankments. All unsuitable material shall be disposed off as shown on the Plans or as directed without delay to the Contractor.

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

All excess material, including rock and boulders that cannot be used in embankments shall be disposed off as directed.

Material encountered in the excavation and determined by the Engineer as suitable for topping, road finishing, slope protection, or other purposes shall be conserved and utilized as directed by the Engineer.

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

### **102.2.4 Prewatering**

Excavation areas and borrow pits may be prewatered before excavating the material. When prewatering is used, the areas to be excavated shall be moistened to the full depth, from the surface to the bottom of the excavation. The water shall be controlled so that the excavated material will contain the proper moisture to permit compaction to the specified density with the use of standard compacting equipment. Prewatering shall be supplemented where necessary, by truck watering units, to ensure that the embankment material contains the proper moisture at the time of compaction.

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

### **102.2.5 Presplitting**

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

Presplitting to obtain faces in the rock and shale formations shall be performed by: (1) drilling holes at uniform intervals along the slope lines, (2) loading and stemming the holes with appropriate explosives and stemming material, and (3) detonating the holes simultaneously.

Prior to starting drilling operations for presplitting, the Contractor shall furnish the Engineer a plan outlining the position of all drill holes, depth of drilling, type of explosives to be used, loading pattern and sequence of firing. The drilling and blasting plan is for record purposes only and will not absolve the Contractor of his responsibility for using proper drilling and blasting procedures. Controlled blasting shall begin with a short test section of a length approved by the Engineer. The test section shall be presplit, production drilled and blasted and sufficient material excavated whereby the Engineer can determine if the Contractor's methods are satisfactory. The Engineer may order discontinuance of the presplitting when he determines that the materials encountered have become unsuitable for being presplit.

The holes shall be charged with explosives of the size, kind, strength, and at the spacing suitable for the formations being presplit, and with stemming material which passes a 9.5 mm (3/8 inch) standard sieve and which has the qualities for proper confinement of the explosives.

The finished presplit slope shall be reasonably uniform and free of loose rock. Variance from the true plane of the excavated back slope shall not exceed 300 mm (12 inches); however, localized irregularities or surface variations that do not constitute a safety hazard or an impairment to drainage courses or facilities will be permitted.

A maximum offset of 600 mm (24 inches) will be permitted for a construction working bench at the bottom of each lift for use in drilling the next lower presplitting pattern.

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

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

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

Furrow ditches shall be formed by plowing a continuous furrow along the line staked by the Engineer. Methods other than plowing may be used if acceptable to the Engineer. The



ditches shall be cleaned out by hand shovel work, by ditcher, or by some other suitable method, throwing all loose materials on the downhill side so that the bottom of the finished ditch shall be approximately 450 mm (18 inches) below the crest of the loose material piled on the downhill side. Hand finish will not be required, but the flow lines shall be in satisfactory shape to provide drainage without overflow.

#### **102.2.7 Excavation of Roadbed Level**

Rock shall be excavated to a depth of 150 mm (6 inches) below sub grade within the limits of the roadbed, and the excavation backfilled with material designated on the Plans or approved by the Engineer and compacted to the required density.

When excavation methods employed by the Contractor leave un drained pockets in the rock surface, the Contractor shall at his own expense, properly drain such depressions or when permitted by the Engineer fill the depressions with approved impermeable material.

Material below sub grade, other than solid rock shall be thoroughly scarified to a depth of 150 mm (6 inches) and the moisture content increased or reduced, as necessary, to bring the material throughout this 150 mm layer to the moisture content suitable for maximum compaction. This layer shall then be compacted in accordance with Subsection 104.3.3.

#### **102.2.8 Borrow Areas**

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

All borrow areas shall be bladed and left in such shape as to permit accurate measurements after excavation has been completed. The Contractor shall not excavate beyond the dimensions and elevations established, and no material shall be removed prior to the staking out and cross-sectioning of the site. The finished borrow areas shall be approximately true to line and grade established and specified and shall be finished, as prescribed in Clause 61, Standard Specifications for Public Works and Highways, Volume 1. When necessary to remove fencing, the fencing shall be replaced in at least as good condition as it was originally. The Contractor shall be responsible for the confinement of livestock when a portion of the fence is removed.

#### **102.2.9 Removal of Unsuitable Material**

Where the Plans show the top portion of the roadbed to be selected topping, all unsuitable materials shall be excavated to the depth necessary for replacement of the selected topping to the required compacted thickness.

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

The excavation of muck shall be handled in a manner that will not permit the entrapment of muck within the backfill. The material used for backfilling up to the ground line or water level, whichever is higher, shall be rock or other suitable granular material selected from the roadway excavation, if available. If not available, suitable material shall be obtained from other approved sources. Unsuitable material removed shall be disposed off in designated areas shown on the Plans or approved by the Engineer.

**102.3 Method of Measurement**

The cost of excavation of material which is incorporated in the Works or in other areas of fill shall be deemed to be included in the Items of Work where the material is used.

Measurement of Unsuitable or Surplus Material shall be the net volume in its original position.

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

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

**102.4 Basis of Payment**

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

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
102(2)	Surplus Roadway Excavation	Cubic Meter

**ITEM 103 – STRUCTURE EXCAVATION**

**103.1 Description**

This Item shall consist of the necessary excavation for pipe culverts, and drains provided for in the Specifications. Except as otherwise provided for pipe culverts, the backfilling of completed structures and the disposal of all excavated surplus materials, shall be in accordance

with these Specifications and in reasonably close conformity with the Plans or as established by the Engineer.

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

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

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

## **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 area shall have been performed in accordance with Item 100, Clearing and Grubbing.

### **103.2.2 Excavation**

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

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

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

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

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

material. This foundation fill shall be placed and compacted in 150 mm (6 inches) layers up to the foundation elevation.

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

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

Where rock, hardpan, or other unyielding material is encountered, it shall be removed below the foundation grade for a depth of at least 300 mm or 4 mm for each 100 mm of fill over the top of pipe, whichever is greater, but not to exceed three-quarters of the vertical inside diameter of the pipe. The width of the excavation shall be at least 300 mm (12 inches) greater than the horizontal outside diameter of the pipe. The excavation below grade shall be backfilled with selected fine compressible material, such as silty clay or loam, and lightly compacted in layers not over 150 mm (6 inches) in uncompacted depth to form a uniform but yielding foundation.

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

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

Where pipe culverts are to be placed in trenches excavated in embankments, the excavation of each trench shall be performed after the embankment has been constructed to a plane parallel to the proposed profile grade and to such height above the bottom of the pipe as shown on the Plans or directed by the Engineer.

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

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

### **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. If requested, the Contractor

shall submit drawings showing his proposed method of cofferdam construction, as directed by the Engineer.

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

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

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

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

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

### **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 stream bed adjacent to structure shall not be disturbed without permission from the Engineer. If any excavation or dredging is made at the side of the structure before caissons, cribs, or cofferdams are sunk in place, the Contractor shall, after the foundation base is in place, backfill all such excavations to the original ground surface or stream bed with material satisfactory to the Engineer.

### **103.2.6 Backfill and Embankment for Structures Other Than Pipe Culverts**

Excavated areas around structures shall be backfilled with free draining granular material approved by the Engineer and placed in horizontal layers not over 150 mm (6 inches) in thickness,

to the level of the original ground surface. Each layer shall be moistened or dried as required and thoroughly compacted with mechanical tampers.

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

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

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

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

### **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.

## **103.3 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, but in no case, except as noted, will any of the following volumes be included in the measurement for payment:

- (1) The volume outside of vertical planes 450 mm (18 inches) outside of and parallel to the neat lines of footings and the inside walls of pipe and pipe-arch culverts at their widest horizontal dimensions.
- (2) The volume of excavation for culvert and sections outside the vertical plane for culverts stipulated in (1) above.
- (3) The volume outside of neat lines of under drains as shown on the Plans, and outside the limits of foundation fill as ordered by the Engineer.

- (4) The volume included within the staked limits of the roadway excavation, contiguous channel changes, ditches, etc., for which payment is otherwise provided in the Specification.
- (5) Volume of water or other liquid resulting from construction operations and which can be pumped or drained away.
- (6) The volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed ground.
- (7) the volume of any material rehandled, except that where the Plans indicate or the Engineer directs the excavation after embankment has been placed and except that when installation of pipe culverts by the imperfect trench method specified in Item 500 is required, the volume of material re-excavated as directed will be included.
- (8) The volume of excavation for footings ordered at a depth more than 1.5 m (60 inches) below the lowest elevation for such footings shown on the original Contract Plans, unless the Bill of Quantities contains a pay item for excavation ordered below the elevations shown on the Plans for individual footings.

The volume of bridge excavation to be paid shall be the vertical 450 mm (18 inches) 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 structures as specified, complete in place and accepted.

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

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

### **103.3.5 Basis of Payment**

The accepted quantities, measured as prescribed in Section 103.3, shall be paid for at the contract unit price for each of the particular pay items listed below that is included in the Bill of Quantities. The payment shall constitute full compensation for the removal and disposal of excavated materials including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item, except as follows:

- (1) Any excavation for footings ordered at a depth more than 1.5 m below the lowest elevation shown on the original Contract Plans will be paid for as provided in Part K, Measurement and Payment, unless a pay item for excavation ordered below Plan elevation appears in the Bill of Quantities.
- (2) Concrete will be measured and paid for as provided under Item 405, Structural Concrete.
- (3) Any roadway or borrow excavation required in excess of the quantity excavated for structures will be measured and paid for as provided under Item 102.
- (4) Shoring, cribbing, and related work required for excavation ordered more than 1.5 m (60 inches) below Plan elevation will be paid for in accordance with Part K.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
103(1)	Structure Excavation (Common Soil)	Cubic Meter
103 (2)	Bridge Excavation (Common Soil)	Cubic Meter
103(6)	Pipe Culvert & Drain Excavation (Common Soil)	Cubic Meter

## **ITEM 104 – EMBANKMENT**

### **104.1 Description**

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

### **104.2 Material Requirements**

Embankments shall be constructed of suitable materials, in consonance with the following definitions:

7. 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.
8. Selected Borrow, for topping – soil of such gradation that all particles will pass a sieve with 75 mm (3 inches) square openings and not more than 15 mass percent will pass the 0.075 mm (No. 200) sieve, as determined by AASHTO T 11. The material shall have a plasticity index of not more than 6 as determined by ASSHTO T 90 and a liquid limit of not more than 30 as determined by AASHTO T 89.
9. Unsuitable Material – Material other than suitable materials such as:



- (b) Materials containing detrimental quantities of organic materials, such as grass, roots and sewerage.
- (c) Organic soils such as peat and muck.
- (d) Soils with liquid limit exceeding 80 and/or plasticity index exceeding 55.
- (e) Soils with a natural water content exceeding 100%.
- (f) Soils with very low natural density,  $800 \text{ kg/m}^3$  or lower.
- (g) Soils that cannot be properly compacted as determined by the Engineer.

### **104.3 Construction Requirements**

#### **104.3.1 General**

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

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

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

Where shown on the Plans or directed by the Engineer, the surface of the existing ground shall be compacted to a depth of 150 mm (6 inches) and to the specified requirements of this Item.

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

#### **104.3.2 Methods of Construction**

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

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

Unless shown otherwise on the Plans or special Provisions, where an embankment of less than 1.2 m (4 feet) below sub grade is to be made, all sod and vegetable matter shall be removed

from the surface upon which the embankment is to be placed, and the cleared surface shall be completely broken up by plowing, scarifying, or steeping to a minimum depth of 150 mm except as provided in Subsection 102.2.2. This area shall then be compacted as provided in Subsection 104.3.3. Sod not required to be removed shall be thoroughly disc harrowed or scarified before construction of embankment. Wherever a compacted road surface containing granular materials lies within 900 mm (36 inches) of the sub grade, such old road surface shall be scarified to a depth of at least 150 mm (6 inches) whenever directed by the Engineer. These scarified materials shall then be compacted as provided in Subsection 104.3.3.

When shoulder excavation is specified, the roadway shoulders shall be excavated to the depth and width shown on the Plans. The shoulder material shall be removed without disturbing the adjacent existing base course material, and all excess excavated materials shall be disposed off as provided in Subsection 102.2.3. If necessary, the areas shall be compacted before being backfilled.

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

Where embankment is to be constructed across low swampy ground that will not support the mass of trucks or other hauling equipment, the lower part of the fill may be constructed by dumping successive loads in a uniformly distributed layer of a thickness not greater than necessary to support the hauling equipment while placing subsequent layers.

When excavated material contains more than 25 mass percent of rock larger than 150 mm in greatest diameter and cannot be placed in layers of the thickness prescribed without crushing, pulverizing or further breaking down the pieces resulting from excavation methods, such materials may be placed on the embankment in layers not exceeding in thickness the approximate average size of the larger rocks, but not greater than 600 mm (24 inches).

Even though the thickness of layers is limited as provided above, the placing of individual rocks and boulders greater than 600 mm in diameter will be permitted provided that when placed, they do not exceed 1200 mm (48 inches) in height and provided they are carefully distributed, with the interstices filled with finer material to form a dense and compact mass.

Each layer shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments of earth. Lifts of material containing more than 25 mass percent of rock larger than 150 mm in greatest dimensions shall not be constructed above an elevation 300 mm (12 inches) below the finished sub grade. The balance of the embankment shall be composed of suitable material smoothed and placed in layers not exceeding 200 mm (8 inches) in loose thickness and compacted as specified for embankments.

Dumping and rolling areas shall be kept separate, and no lift shall be covered by another until compaction complies with the requirements of Subsection 104.3.3.

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

### **104.3.3 Compaction**

#### **Compaction Trials**

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

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

#### **Earth**

The Contractor shall compact the material placed in all embankment layers and the material scarified to the designated depth below sub grade in cut sections, until a uniform density of not less than 95 mass percent of the maximum dry density determined by AASHTO T 99 Method C, is attained, at a moisture content determined by Engineer to be suitable for such density. Acceptance of compaction may be based on adherence to an approved roller pattern developed as set forth in Item 106, Compaction Equipment and Density Control Strips.

The Engineer shall during progress of the Work, make density tests of compacted material in accordance with AASHTO T 191, T 205, or other approved field density tests, including the use of properly calibrated nuclear testing devices. A correction for coarse particles may be made in accordance with AASHTO T 224. If, by such tests, the Engineer determines that the specified density and moisture conditions have not been attained, the Contractor shall perform additional work as may be necessary to attain the specified conditions.

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

#### **Rock**

Density requirements will not apply to portions of embankments constructed of materials which cannot be tested in accordance with approved methods.

Embankment materials classified as rock shall be deposited, spread and leveled the full width of the fill with sufficient earth or other fine material so deposited to fill the interstices to produce a dense compact embankment. In addition, one of the rollers, vibrators, or compactors meeting the requirements set forth in Subsection 106.2.1, Compaction Equipment, shall compact the embankment full width with a minimum of three complete passes for each layer of embankment.

#### **104.3.4 Protection of Roadbed During Construction**

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

#### **104.3.5 Protection of Structure**

If embankment can be deposited on one side only of abutments, wing walls, piers or culvert headwalls, care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that it will cause overturning of, or excessive pressure against the structure. When noted on the Plans, the fill adjacent to the end bent of a bridge shall not be placed higher than the bottom of the backfill of the bent until the superstructure is in place. When embankment is to be placed on both sides of a concrete wall or box type structure, operations shall be so conducted that the embankment is always at approximately the same elevation on both sides of the structure.

#### **104.3.6 Rounding and Warping Slopes**

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

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

#### **104.3.7 Finishing Roadbed and Slopes**

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

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

#### **104.3.8 Serrated Slopes**

Cut slopes in rippable material (soft rock) having slope ratios between 0.75:1 and 2:1 shall be constructed so that the final slope line shall consist of a series of small horizontal steps. The step rise and tread dimensions shall be shown on the Plans. No scaling shall be performed on the stepped slopes except for removal of large rocks which will obviously be a safety hazard if they fall into the ditch line or roadway.

#### **104.3.9 Earth Berms**

When called for in the Contract, permanent earth berms shall be constructed of well graded materials with no rocks having a diameter greater than 0.25 the height of the berm. When local material is not acceptable, acceptable material shall be imported, as directed by the Engineer.

Compacted berm construction shall consist of moistening or drying and placing material as necessary in locations shown on the drawings or as established by the Engineer. Material shall contain no frozen material, roots, sod, or other deleterious materials. **Compacted Berm** Contractor shall take precaution to prevent material from escaping over the embankment slope. Shoulder surface beneath berm will be roughened to provide a bond between the berm and shoulder when completed. The Contractor shall compact the material placed until at least 90 mass percent of the maximum density is obtained as determined by AASHTO T 99, Method C. The cross-section of the finished compacted berm shall reasonably conform to the typical cross-section as shown on the Plans.

Uncompacted berm construction shall consist of drying, if necessary and placing material in locations shown on the Plans or as established by the Engineer. Material shall contain no frozen material, roots, sod or other deleterious materials. **Uncompacted Berm** Contractor shall take precautions to prevent material from escaping over the embankment slope.

#### **104.4 Method of Measurement**

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

Material from excavation per Item 102 which is used in embankment and accepted by the Engineer will be paid under Embankment and such payment will be deemed to include the cost of excavating, hauling, stockpiling and all other costs incidental to the work.

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

#### **104.5 Basis of Payment**

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

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
104(1)	Embankment (from road way excavation)	Cubic Meter

## **ITEM 105 – SUBGRADE PREPARATION**

### **105.1 Description**

This Item shall consist of the preparation of the sub grade for the support of overlying structural layers. It shall extend to full width of the roadway. Unless authorized by the Engineer, sub grade 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 sub grade is in rock cut, all materials below sub grade level to a depth 150 mm or to such greater depth as may be specified shall meet the requirements of Section 104.2, Selected Borrow for Topping.

### **105.3 Construction Requirements**

#### **105.3.1 Prior Works**

Prior to commencing preparation of the sub grade, 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 Sub grade shall not be started unless prior work herein described shall have been approved by the Engineer.

#### **105.3.2 Sub grade Level Tolerances**

The finished compacted surface of the sub grade 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	±	0.5 %
Permitted variation from	±	0.1 %
design LONGITUDINAL GRADE over 25 m length		

#### **105.3.3 Sub grade in Common Excavation**

Unless otherwise specified, all materials below sub grade level in earth cuts to a depth 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 off in accordance with the requirements of Subsection 102.2.9.

Where material has been removed from below sub grade level, the resulting surface shall be compacted to a depth of 150 mm and in accordance with other requirements of Subsection 104.3.3.

All materials immediately below sub grade 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.

### **105.3.4 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 recompacting 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.

### **105.3.5 Templates and Straight-edges**

The Contractor shall provide for use of the Engineer, approved templates and straight-edges 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 recompacting 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.

**105.4.2** Payment for all work for the preparation of the subgrade, including shaping to the required levels and tolerances, other than as specified above shall be deemed to be included in the Pay Item for Embankment.

## **105.5 Basis of Payment**

The accepted quantities, measured as prescribed in Section 105.4, shall be paid for at the appropriate contract unit price for Pay Item listed below that is included in the Bill of Quantities which price and payment shall be full compensation for the placing or removal and disposal of 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>Description</b>	<b>Unit of Measurement</b>
105(1)	Subgrade Preparation (Common Soil)	Square Meter

## ITEM 200 – AGGREGATE SUBBASE COURSE

### 200.1 Description

This item shall consist of furnishing, placing and compacting an aggregate sub base course on a prepared sub grade 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 sub base shall consist of hard, durable particles or fragments of crushed stone, crushed slag, or crushed or natural gravel and filler of natural or crushed sand or other finely divided mineral matter. The composite material shall be free from vegetable matter and lumps or balls of clay and shall be of such nature that it can be compacted readily to form a firm, stable sub base.

The sub base material shall conform to Table 200.1, Grading Requirements

**Table 200.1 – Grading Requirements**

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

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

The fraction passing the 0.425 mm (No. 40) sieve shall have a liquid limit not greater than 35 and plasticity index not greater than 12 as determined by AASHTO T 89 and T 90, respectively.

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

The material shall have a soaked CBR value of not less than 25% as determined by AASHTO T 193. The CBR value shall be obtained at the maximum dry density and determined by AASHTO T 180, Method D.

### 200.3 Construction Requirements

#### 200.3.1 Preparation of Existing Surface

The existing surface shall be graded and finished as provided under Item 105, Sub grade Preparation, before placing the sub base material.



### **200.3.2 Placing**

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

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

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

### **200.3.3 Spreading and Compacting**

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

Where the required thickness is 150 mm or less, the material may be spread and compacted in one layer. Where the required thickness is more than 150 mm, the aggregate sub base 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 sub base material shall, if necessary, be adjusted prior to compaction by watering with approved sprinklers mounted on trucks or by drying out, as required in order to obtain the required compaction.

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

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

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

### **200.3.4 Trial Sections**

Before sub base construction is started, the Contractor shall spread and compact trial sections as directed by the Engineer. The purpose of the trial sections is to check the suitability of the materials and the efficiency of the equipment and construction method which is proposed

to be used by the Contractor. Therefore, the Contractor must use the same material, equipment and procedures that he proposes to use for the main work. One trial section of about 500 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 sub base, 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.

### **200.3.4 Tolerances**

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

Permitted variation from design THICKNESS OF LAYER	± 20 mm
Permitted variation from design LEVEL OF SURFACE	+10 mm -20 mm
Permitted 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 Sub 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 will be given for materials placed outside the design limits shown on the cross-sections. Trial sections shall not be measured separately but shall be included in the quantity of sub base 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 Sub base 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	Aggregate Subbase Course	Cubic Meter

## ITEM 311 – PORTLAND CEMENT CONCRETE PAVEMENT

### 311.1 Description

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

### 311.2 Material Requirements

#### 311.2.1 Portland Cement

It shall conform to the applicable requirements of Item 700, Hydraulic Cement. Only Type I Portland Cement shall be used unless otherwise provided for in the Special Provisions. Different brands or the same brands from different mills shall not be mixed nor shall they be used alternately unless the mix is approved by the Engineer. However, the use of Portland Pozzolan Cement Type IP meeting the requirements of AASHTO M 240/ASTM C 695, Specifications for Blended Hydraulic Cement shall be allowed, provided that trial mixes shall be done and that the mixes meet the concrete strength requirements, the AASHTO/ASTM provisions pertinent to the use of Portland Pozzolan Type IP shall be adopted.

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

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

#### 311.2.2 Fine Aggregate

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

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

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

The fine aggregate shall be free from injurious amounts of organic impurities. If subjected to the colorimetric test for organic impurities and a color darker than the standard is

produced, it shall be rejected. However, when tested for the effect of organic impurities of strength of mortar by AASHTO T 71, the fine aggregate may be used if the relative strength at 7 and 28 days is not less than 95 mass percent.

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

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

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

### 311.2.3 Coarse Aggregate

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

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

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

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

If the slag is used, its density shall not be less than 1120 kg/m<sup>3</sup> (70 lb./cu. ft.). The gradation of the coarse aggregate shall conform to Table 311.2. Only one grading specification shall be used from any one source.

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

Sieve Designation		Mass Percent Passing		
Standard Mm	Alternate U. S. Standard	Grading A	Grading B	Grading C
75.00	3 in.	100	-	-
63.00	2-1/2 in.	90-100	100	100
50.00	2 in.	-	90-100	95-100
37.5	1-1/2 in.	25-60	35-70	-

25.0	1 in.	-	0-15	35-70
19.0	¾ in.	0-10	-	-
12.5	½ in.	0-5	0-5	10-30
4.75	No. 4	-	-	0-5

#### **311.2.4 Water**

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

#### **311.2.5 Reinforcing Steel**

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

The sleeves for dowel bars shall be metal of approved design to cover 50 mm (2 inches), plus or minus 5 mm (1/4 inch) of the dowel, with a closed end, and with a suitable stop to hold the end of the sleeve at least 25 mm (1 inch) from the end of the dowel. Sleeves shall be of such design that they do not collapse during construction.

#### **311.2.6 Joint Fillers**

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

Preformed joint filler shall conform to the applicable requirements of Item 705. It shall be punched to admit the dowels where called for in the Plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint.

#### **311.2.7 Admixtures**

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

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

Fly Ash, if specified or permitted as a mineral admixture and as 20% partial replacement of Portland Cement in concrete mix shall conform to the requirements of ASTM C 618.

Admixture should be added only to the concrete mix to produce some desired modifications to the properties of concrete where necessary, but not as partial replacement of cement.

### **311.2.8 Curing Materials**

Curing materials shall conform to the following requirements as specified;

- a) Burlap cloth - AASHTO M 182
- b) Liquid membrane forming compounds - AASHTO M 148  
- AASHTO M 171
- c) Sheeting (film) materials

Cotton mats and water-proof paper can be used.

### **311.2.9 Calcium Chloride/Calcium Nitrate**

It shall conform to AASHTO M 144, if specified or permitted by the Engineer, as accelerator.

### **311.2.10 Storage of Cement and Aggregate**

All cement shall be stored, immediately upon delivery at the Site, in weatherproof building which will protect the cement from dampness. The floor shall be raised from the ground. The buildings shall be placed in locations approved by the Engineer. Provisions for storage shall be ample, and the shipments of cement as received shall be separately stored in such a manner as to allow the earliest deliveries to be used first and to provide easy access for identification and inspection of each shipment. Storage buildings shall have capacity for storage of a sufficient quantity of cement to allow sampling at least twelve (12) days before the cement is to be used. Bulk cement, if used, shall be transferred to elevated air tight and weatherproof bins. Stored cement shall meet the test requirements at any time after storage when retest is ordered by the Engineer. At the time of use, all cement shall be free-flowing and free of lumps.

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

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

### **311.2.11 Proportioning, Consistency and Strength of Concrete**

The Contractor shall prepare the design mix based on the absolute volume method as outlined in the American Concrete Institute (ACI) Standard 211.1, "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete".

It is the intent of this Specification to require at least 364 kg of cement per cubic meter of concrete to meet the minimum strength requirements. The Engineer shall determine from laboratory tests of the materials to be used, the cement content and the proportions of aggregate and water that will produce workable concrete having a slump of between 40 and 75 mm (1-1/2 and 3 inches) if not vibrated or between 10 and 40 mm (1/2 and 1-1/2 inches) if vibrated, and a flexural strength of not less than 3.8 MPa (550 psi) when tested by the third-point method or 4.5

MPa (650 psi) when tested by the mid-point method at fourteen (14) days in accordance with AASHTO 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 AASHTO T24.

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 design mix.

### **311.3 Construction Requirements**

#### **311.3.1 Quality Control of Concrete**

##### 1. General

The Contractor shall be responsible for the quality control of all materials during the handling, blending, and mixing and placement operations.

##### 2. Quality Control Plan

The Contractor shall furnish the Engineer a Quality Control Plan detailing his production control procedures and the type and frequency of sampling and testing to ensure that the concrete 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.

##### 3. Qualification of Workmen

Experienced and qualified personnel shall perform all batching or mixing operation for the concrete mix and shall be present at the plant and job site to control the concrete productions whenever the plant is in operation. They shall be identified and duties defined as follows:

- a. Concrete Batcher. The person performing the batching or mixing operation shall be capable of accurately conducting aggregate surface moisture determination and establishing correct scale weights for concrete materials. He shall be capable of assuring that the proportioned batch weights of materials are in accordance with the mix design.
- b. Concrete Technician. The person responsible for concrete production control and sampling and testing for quality control shall be proficient in concrete technology and shall have a sound knowledge of the Specifications as they relate to concrete production. He shall be capable of conducting tests on

concrete and concrete materials in accordance with these Specifications. He shall be capable of adjusting concrete mix designs for improving workability and Specification compliance and preparing trial mix designs. He shall be qualified to act as the concrete batcher in the batcher's absence.

#### 4. Quality Control Testing

The Contractor shall perform all sampling, testing and inspection necessary to assure quality control of the component materials and the concrete.

The Contractor shall be responsible for determining the gradation of fine and coarse aggregates and for testing the concrete mixture for slump, air content, water-cement ratio and temperature. He shall conduct his operations so as to produce a mix conforming to the approved mix design.

#### 5. Documentation

The Contractor shall maintain adequate records of all inspections and tests. The records shall indicate the nature and number of observations made, the number and type of deficiencies found, the quantities approved and rejected, and nature of any corrective action taken.

The Engineer may take independent assurance samples at random location for acceptance purposes as he deems necessary.

### **311.3.2 Equipment**

Equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the Engineer as to design, capacity and mechanical condition. The equipment shall be at the jobsite sufficiently ahead of the start of construction operations to be examined thoroughly and approved.

#### 1. Batching Plant and Equipment

- a. General. The batching shall include bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. If cement is used in bulk, a bin, a hopper, and separate scale for cement shall be included. The weighing hopper shall be properly sealed and vented to preclude dusting operation. The batch plant shall be equipped with a suitable non-resettable batch counter which will correctly indicate the number of batches proportioned.
- b. Bins and Hoppers. Bins with adequate separate compartments for fine aggregate and for each size of coarse aggregate shall be provided in the batching plant.
- c. Scales. Scales for weighing aggregates and cement shall be of either the beam type or the spring less-dial type. They shall be accurate within one-half percent (0.5%) throughout the range of use. Poises shall be designed to be locked in any position and to prevent unauthorized change. Scales shall be inspected and sealed as often as the Engineer may deem necessary to assure their continued accuracy.



- d. Automatic Weighing Devices. Unless otherwise allowed on the Contract, batching plants shall be equipped with automatic weighing devices of an approved type to proportion aggregates and bulk cement.
2. Mixers.
- a. General. Concrete may be mixed at the Site of construction or at a central plant, or wholly or in part in truck mixers. Each mixer shall have a manufacturer's plate attached in a prominent place showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.
  - b. Mixers at Site of Construction. Mixing shall be done in an approved mixer capable of combining the aggregates, cement and water into a thoroughly mixed and uniform mass within the specified mixing period and discharging and distributing the mixture without segregation on the prepared grade. The mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum has been charged and released it at the end of the mixing period. In case of failure of the timing device, the mixer may be used for the balance of the day while it is being repaired, provided that each batch is mixed 90 seconds. The mixer shall be equipped with a suitable non-resettable batch counter which shall correctly indicate the number of the batches mixed.
  - c. Truck Mixer and Truck Agitators. Truck mixers used for mixing and hauling concrete, and truck agitators used for hauling central-mixed concrete, shall conform to the requirements of AASHTO M 157.
  - d. Non-Agitator Truck. Bodies of non-agitating hauling equipment for concrete shall be smooth, mortar-tight metal containers and shall be capable of discharging the concrete at a satisfactory controlled rate without segregation.

### 3. Paving and Finishing Equipment

The concrete shall be placed with an approved paver designed to spread, consolidate, screed and float finish the freshly placed concrete in one complete pass of the machine in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous pavement in conformance with the Plans and Specifications.

The finishing machine shall be equipped with at least two (2) oscillating type transverse screed. Vibrators shall operate at a frequency of 8,300 to 9,600 impulses per minute under load at a maximum spacing of 60 cm.

### 4. Concrete Saw

The Contractor shall provide sawing equipment in adequate number of units and power to complete the sawing with a water-cooled diamond edge saw blade or an abrasive wheel to the required dimensions and at the required rate. He shall provide at least one (1) stand-by saw in good working condition and with an ample supply of saw blades.

## 5. Forms

Forms shall be of steel, of an approved section, and of depth equal to the thickness of the pavement at the edge. The base of the forms shall be of sufficient width to provide necessary stability in all directions. The flange braces must extend outward on the base to not less than  $2/3$  the height of the form.

All forms shall be rigidly supported on bed of thoroughly compacted material during the entire operation of placing and finishing the concrete. Forms shall be provided with adequate devices for secure setting so that when in place, they will withstand, without visible spring or settlement, the impact and vibration of the consolidation and finishing or paving equipment.

### **311.3.3 Preparation of Grade**

After the sub grade of base has been placed and compacted to the required density, the areas which will support the paving machine and the grade on which the pavement is to be constructed shall be trimmed to the proper elevation by means of a properly designed machine extending the prepared work areas compacted at least 60 cm beyond each edge of the proposed concrete pavement. If loss of density results from the trimming operations, it shall be restored by additional compaction before concrete is placed. If any traffic is allowed to use the prepared sub grade or base, the surface shall be checked and corrected immediately ahead of the placing concrete.

The sub grade or base shall be uniformly moist when the concrete is placed.

### **311.3.4 Setting Forms**

#### 1. Base Support.

The foundation under the forms shall be hard and true to grade so that the form when set will be firmly in contact for its whole length and at the specified grade. (Any roadbed, which at the form line is found below established grade, shall be filled with approved granular materials to grade in lifts of three (3) cm or less, and thoroughly rerolled or tamped.) Imperfections or variations above grade shall be corrected by tamping or by cutting as necessary.

#### 2. Form Setting

Forms shall be set sufficiently in advance of the point where concrete is being placed. After the forms have been set to correct grade, the grade shall be thoroughly tamped, mechanically or by hand, at both the inside and outside edges of the base of the forms. The forms shall not deviate from true line by more than one (1) cm at any point.

#### 3. Grade and Alignment

The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete. Testing as to

crown and elevation, prior to placing of concrete can be made by means of holding an approved template in a vertical position and moved backward and forward on the forms. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

### **311.3.5 Conditioning of Sub grade or Base Course**

When side forms have been securely set to grade, the sub grade 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 sub grade or base course cover material is specified, the sub grade or base course shall be uniformly moist when the concrete is placed. If it subsequently becomes too dry, the sub grade or base course shall be sprinkled, but the method of sprinkling shall not be such as to form mud or pools of water.

### **311.3.6 Handling, Measuring and Batching Materials**

The batch plant site, layout, equipment and provisions for transporting material shall be such as to assure a continuous supply of material to the work.

Stockpiles shall be built up in layers of not more than one (1) meter in thickness. Each layer shall be completely in place before beginning the next which shall not be allowed to “cone” down over the next lower layer. Aggregates from different sources and of different grading shall not be stockpiled together.

All washed aggregates and aggregates produced or handled by hydraulic methods, shall be stockpiled or binned for draining at least twelve (12) hours before being batched.

When mixing is done at the side of the work, aggregates shall be transported from the batching plant to the mixer in batch boxes, vehicle bodies, or other containers of adequate capacity and construction to properly carry the volume required. Partitions separating batches shall be adequate and effective to prevent spilling from one compartment to another while in transit or being dumped. When bulk cement is used, the Contractor shall use a suitable method of handling the cement from weighing hopper to transporting container or into the batch itself for transportation to the mixer, with chute, boot or other approved device, to prevent loss of cement, and to provide positive assurance of the actual presence in each batch of the entire cement content specified.

Bulk cement shall be transported to the mixer in tight compartments carrying the full amount of cement required for the batch. However, if allowed in the Special Provisions, it may be transported between the fine and coarse aggregate. When cement is placed in contact with the aggregates, batches may be rejected unless mixed within 1-1/2 hours of such contact. Cement in original shipping packages may be transported on top of the aggregates, each batch containing the number of sacks required by the job mix.

The mixer shall be charged without loss of cement. Batching shall be so conducted as to result in the weight to each material required within a tolerance of one (1) percent for the cement and two (2) percent for aggregates.

Water may be measured either by volume or by weight. The accuracy of measuring the water shall be within a range of error of not over than one (1) percent. Unless the water is to be weighed, the water-measuring equipment shall include an auxiliary tank from which the measuring tank shall be equipped with an outside tap and valve to provide checking the setting, unless other means are provided for readily and accurately determining the amount of water in the tank. The volume of the auxiliary tank shall be at least equal to that of the measuring tank.

### **311.3.7 Mixing Concrete**

The concrete may be mixed at the site of the work in a central-mix plant, or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time will be measured from the time all materials, except water, are in the drum. Ready-mixed concrete shall be mixed and delivered in accordance with requirements of AASHTO M 157, except that the minimum required revolutions at the mixing speed for transit-mixed concrete may be reduced to not less than that recommended by the mixer manufacturer. The number of revolutions recommended by the mixer manufacturer shall be indicated on the manufacturer's serial plate attached to the mixer. The Contractor shall furnish test data acceptable to the Engineer verifying that the make and model of the mixer will produce uniform concrete conforming to the provision of AASHTO M 157 at the reduced number of revolutions shown on the serial plate.

When mixed at the site or in a central mixing plant, the mixing time shall not be less than fifty (50) seconds nor more than ninety (90) seconds, unless mixer performance tests prove adequate mixing of the concrete is a shorter time period.

Four (4) seconds shall be added to the specified mixing time if timing starts at the instant the skip reaches its maximum raised positions. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

The mixer shall be operated at the drum speed as shown on the manufacturer's name plate attached on the mixer. Any concrete mixed less than the specified time shall be discarded and disposed off by the Contractor at his expense. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic meter, as shown on the manufacturer's standard rating plate on the mixer, except that an overload up to ten (10) percent above the mixer's nominal capacity may be permitted provided concrete test data for strength, segregation, and uniform consistency are satisfactory, and provided no spillage of concrete takes place.

The batches shall be so charged into the drum that a portion of the mixing water shall be entered in advance of the cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first fifteen (15) seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators or non-agitating truck specified in Subsection 311.3.2, Equipment. The time elapsed from the time water is added to the mix until the concrete is deposited in place at the Site shall not exceed forty-five (45) minutes when the concrete is hauled in non-agitating trucks, nor ninety (90) minutes when hauled in truck mixers or truck agitators, except that in hot weather or under

other conditions contributing to quick hardening of the concrete, the maximum allowable time may be reduced by the Engineer.

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

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

Retampering 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<sup>0</sup>F (32<sup>0</sup>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. Retampering 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 re handling. Unless truck mixers or non-agitating hauling equipment are equipped with means to discharge concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade in such a manner as to prevent segregation. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances.

When concrete is to be placed adjoining a previously constructed lane and mechanical equipment will be operated upon the existing lane, that previously constructed lane shall have

attained the strength for fourteen (14) day concrete. If only finishing equipment is carried on the existing lane, paving in adjoining lanes may be permitted after three (3) days.

Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies, by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than fifteen (15) seconds in any one location.

Concrete shall be deposited as near as possible to the expansion and contraction joints without disturbing them but shall not be dumped from the discharge bucket or hopper into a joint assembly unless the hopper is well centered on the joint assembly. Should any concrete material fall on or be worked into the surface of a complete slab, it shall be removed immediately.

### **311.3.10 Test Specimens**

As work progresses, at least one (1) set consisting of three (3) concrete beam test specimens, 150 mm x 150 mm x 525 mm or 900 mm shall be taken from each 330 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 the steel with the concrete.

### **311.3.12 Joints**

Joints shall be constructed of the type and dimensions, and at the locations required by the Plans or Special Provisions. All joints shall be protected from the intrusion of injurious foreign material until sealed.

1. Longitudinal Joint

Deformed steel tie bars of specified length, size, spacing and materials shall be placed perpendicular to the longitudinal joints, they shall be placed by approved mechanical equipment or rigidly secured by chair or other approved supports to prevent displacement. Tie bars shall not be painted or coated with asphalt or other materials or enclosed in tubes or sleeves. When shown on the Plans and when adjacent lanes of pavement are constructed separately, steel side forms shall be used which will form a keyway along the construction joint. Tie bars, except those made of rail steel, may be bent at right angles against the form of the first lane constructed and straightened into final position before the concrete of the adjacent lane is placed, or in lieu of bent tie bars, approved two-piece connectors may be used.

Longitudinal formed joints shall consist of a groove or cleft, extending downward from and normal to, the surface of the pavement. These joints shall be effected or formed by an approved mechanically or manually operated device to the dimensions and line indicated on the Plans and while the concrete is in a plastic state. The groove or cleft shall be filled with either a pre-molded 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 sub grade 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 discontinued 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, to over and beyond the joints causes segregation of concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the front screed is approximately 20 cm (8 inches) from the joint. Segregated concrete shall be removed from in front of and off the joint. The front screed shall be lifted and set directly on top of the joint and the forward motion of the finishing machine resumed. When the second screed is close enough to permit the excess mortar in front of it to flow over the joint, it shall be lifted and carried over the joint. Thereafter, the finishing machine may be run over the joint without lifting the screeds, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

#### **3. Machine Finishing**

- a. **Non-vibratory Method.** The concrete shall be distributed or spread as soon as placed. As soon as the concrete has been placed, it shall be struck off and screeded by an approved finishing machine. The machine shall go over each area of pavement as many times and at such intervals as necessary to give the proper compaction and leave a surface of uniform texture. Excessive operation over a given area shall be avoided. The tops of the forms shall be kept clean by an effective device attached to the machine and the travel of the machine on the forms shall be maintained true without wobbling or other

variation tending to affect the precision finish. During the first pass of the finishing machine, a uniform ridge of concrete shall be maintained ahead of the front screed in its entire length.

- b. **Vibratory Method.** When vibration is specified, vibrators for full width vibration of concrete paving slabs, shall meet the requirements in Subsection 311.3.2, Equipment. If uniform and satisfactory density of the concrete is not obtained by the vibratory method at joints, along forms, at structures, and throughout the pavement, the Contractor will be required to furnish equipment and method which will produce pavement conforming to the Specifications. All provisions in item (a) above not in conflict with the provisions for the vibratory method shall govern.

### 3. 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.

### 4. 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 areas 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 methods of floating, long handled floats having blades not less than 150 cm (5 feet) in length and 15 cm (6 inches) in width may be used to smooth and fill in open-textured areas in the pavement. Long-handled floats shall not be used to float the entire surface of the pavement in lieu of, or supplementing, one of the preceding methods of floating. When strike off and consolidation are done by the hand method and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of the long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance shall be removed from the surface of the pavement by a 3-m straight-edge or more in length. Successive drags shall be lapped one-half the length of the blade.

## 5. 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 have 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 advance 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 be substituted.

Regardless of the method used for final finish, the hardened surface of pavement shall have a coefficient of friction of 0.25 or more. Completed pavement that is found to have a coefficient of friction less than 0.25 shall be ground or scored by the Contractor at his expense to provide the required coefficient of friction.

## 8. Edging at Forms and Joints

After the final finish, but before the concrete has taken its initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, formed joints, transverse construction joints, and emergency construction joints, shall be worked with an approved tool and rounded to the radius required by the Plans. A well – defined and continuous radius shall be produced and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting the tool during the use. At all joints, any tool marks appearing on the slab adjacent to the joints shall be

eliminated by brooming the surface. In doing this, the rounding of the corner of the slab shall not be disturbed. All concrete on top of the joint filler shall be completely removed.

All joints shall be tested with a straight-edge before the concrete has set and correction made if one edge of the joint is higher than the other.

#### **311.3.14 Surface Test**

As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 3-m straight-edge or other specified device. Areas showing high spots of more than 3 mm but not exceeding 12 mm in 3 m shall be marked and immediately ground down with an approved grinding tool to an elevation where the area or spot will not show surface deviations in excess of 3 mm when tested with 3 m straight-edge. Where the departure from correct cross-section exceeds 12 mm, the pavement shall be removed and replaced by and at the expense of the Contractor.

Any area or section so removed shall be not less than 1.5 m in length and not less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 1.5 m in length, shall also be removed and replaced.

#### **311.3.15 Curing**

Immediately after the finishing operations have been completed and the concrete has sufficiently set, the entire surface of the newly placed concrete shall be cured in accordance with either one of the methods described herein. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or the lack of water to adequately take care of both curing and other requirements, shall be a cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than ½ hour between stages of curing or during the curing period.

In all congested places, concrete works should be designed so that the designed strength is attained.

##### **1. Cotton or Burlap Mats**

The surface of the pavement shall be entirely covered with mats. The mats used shall be of such length (or width) that as laid they will extend at least twice the thickness of the pavement beyond the edges of the slab. The mat shall be placed so that the entire surface and the edges of the slab are completely covered. Prior to being placed, the mats shall be saturated thoroughly with water. The mat shall be so placed and weighted down so as to cause them to remain in intimate contact with the covered surface. The mat shall be maintained fully wetted and in position for 72 hours after the concrete has been placed unless otherwise specified.

##### **2. Waterproof Paper**

The top surface and sides of the pavement shall be entirely covered with waterproof paper, the units shall be lapped at least 45 cm. The paper shall be so placed and weighted down so as to cause it to remain in intimate contact with the

surface covered. The paper shall have such dimension but each unit as laid will extend beyond the edges of the slab at least twice the thickness of the pavement, or at pavement width and 60 cm strips of paper for the edges. If laid longitudinally, paper not manufactured in sizes which will provide this width shall be securely sewed or cemented together, the joints being securely sealed in such a manner that they do not open up or separate during the curing period. Unless otherwise specified, the covering shall be maintained in place for 72 hours after the concrete has been placed. The surface of the pavement shall be thoroughly wetted prior to the placing of the paper.

### 3. Straw Curing

When this type of curing is used, the pavement shall be cured initially with burlap or cotton mats, until after final set of the concrete or, in any case, for 12 hours after placing the concrete. As soon as the mats are removed, the surface and sides of the pavement shall be thoroughly wetted and covered with at least 20 cm of straw or hay, thickness of which is to be measured after wetting. If the straw or hay covering becomes displaced during the curing period, it shall be replaced to the original depth and saturated. It shall be kept thoroughly saturated with water for 72 hours and thoroughly wetted down during the morning of the fourth day, and the cover shall remain in place until the concrete has attained the required strength.

### 4. Impervious Membrane Method

The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place, or if the pavement is cured initially with jute or cotton mats, it may be applied upon removal of the mass. The curing compound shall not be applied during rain. Curing compound shall be applied under pressure at the rate 4 L to not more than 14 m<sup>2</sup> by mechanical sprayers. The spraying equipment shall be equipped with a wind guard. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by effective mechanical means. Hand spraying of odd widths or shapes and concrete surface exposed by the removal of forms will be permitted. Curing compound shall not be applied to the inside faces of joints to be sealed, but approved means shall be used to insure proper curing at least 72 hours and to prevent the intrusion of foreign material into the joint before sealing has been completed. The curing compound shall be of such character that the film will harden within 30 minutes after application. Should the film be damaged from any cause within the 72-hour curing period, the damaged portions shall be repaired immediately with additional compound.

### 6. White Polyethylene Sheet

The top surface and sides of the pavement shall be entirely covered with polyethylene sheeting. The units used shall be lapped at least 45 cm. The sheeting shall be so placed and weighted down so as to cause it to remain intimate contact with the surface covered. The sheeting as prepared for use shall have such dimension that each unit as laid will extend beyond the edges of the slab at least

twice the thickness of the pavement. Unless otherwise specified, the covering shall be maintained in place for 72 hours after the concrete has been placed.

### **311.3.16 Removal of Forms**

After forms for concrete shall remain in place undisturbed for not less than twenty-four (24) hours after concrete pouring. In the removal of forms, crowbars should be used in pulling out nails and pins. Care should be taken so as not to break the edges of the pavement. In case portions of the concrete are spalled, they shall be immediately repaired with fresh mortar mixed in the proportion of one part of Portland Cement and two parts fine aggregates. Major honeycomb areas will be considered as defective work and shall be removed and replaced at the expense of the Contractor. Any area or section so removed shall not be less than the distance between weakened plane joint nor less than the full width of the lane involved.

### **311.3.17 Sealing Joints**

Joints shall be sealed with asphalt sealant soon after completion of the curing period and before the pavement is opened to traffic, including the Contractor's equipment. Just prior to sealing, each joint shall be thoroughly cleaned of all foreign materials including membrane curing compound and the joint faces shall be clean and surface dry when the seal is applied.

The sealing material shall be applied to each joint opening to conform to the details shown on the Plans or as directed by the Engineer. Material for seal applied hot shall be stirred during heating so that localized overheating does not occur. The pouring shall be done in such a manner that the material will not be spilled on the exposed surfaces of the concrete. The use of sand or similar material as a cover for the seal will not be permitted.

Preformed elastomeric gaskets for sealing joints shall be of the cross-sectional dimensions shown on the Plans. Seals shall be installed by suitable tools, without elongation and secured in placed with an approved lubricant adhesive which shall cover both sides of the concrete joints. The seals shall be installed in a compressive condition and shall at time of placement be below the level of the pavement surface by approximately 6 mm.

The seals shall be in one piece for the full width of each transverse joint.

### **311.3.18 Protection of Pavement**

The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by his own employees and agents. This shall include watchmen to direct traffic and the erection of and maintenance of warning signs, lights, pavement bridges or cross-over, 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 attractive 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.

**311.3.22 Acceptance of Concrete**

The strength level of the concrete will be considered satisfactory if the averages of all sets of three (3) consecutive strength test results equal or exceed the specified strength,  $f_c'$  and no individual strength test result is deficient by more than 15% of the specified strength,  $f_c'$ .

Concrete deemed to be not acceptable using the above criteria may be rejected unless the Contractor can provide evidence, by means of core tests, that the quality of concrete represented by failed test results is acceptable in place. At least three (3) representative cores shall be taken from each member or area of concrete in place that is considered deficient. The location of cores shall be determined by the Engineer so that there will be at least impairment of strength of the structure. The obtaining and testing of drilled cores shall be in accordance with AASHTO T 24.

Concrete in the area represented by the cores will be considered adequate if the average strength of the cores is equal to at least 85% of, and if no single core is less than 75% of, the specified strength,  $f_c'$ .

If the strength of control specimens does not meet the requirements of this Subsection, and it is not feasible or not advisable to obtain cores from the structure due to structural considerations, payment of the concrete will be made at an adjusted price due to strength deficiency of concrete specimens as specified hereunder:

Deficiency in Strength of Concrete Specimens, Percent (%)	Percent (%) of Contract Price Allowed
Less than 5	100

5 to less than 10	80
10 to less than 15	70
15 to less than 20	60
20 to less than 25	50
25 or more	0

### 311.3.23 Opening to Traffic

The Engineer will decide when the pavement may be opened to traffic. The road will not be opened to traffic until test specimens molded and cured in accordance with AASHTO T 23 have attained the minimum strength requirements in Subsection 311.2.11. If such tests are not conducted prior to the specified age the pavement shall not be operated to traffic until 14 days after the concrete was placed. Before opening to traffic, the pavement shall be cleaned and joint sealing completed.

### 311.3.24 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 ½ of the normal lot length. If the length of the last unit is shorter than ½ of the normal lot length, it shall be included in the previous lot.

Other areas such as intersections, entrances, crossovers, ramp, etc., will be grouped together to form a lot. Small irregular areas may be included with other unit areas to form a lot.

Each lot will be divided into five (5) equal segments and one core will be obtained from each segment in accordance with AASHTO T 24.

#### 2. Pavement Thickness

It is the intent of this Specification that the pavement has a uniform thickness as called for on the Plans for the average of each lot as defined. After the pavement has met all surface smoothness requirements, cores for thickness measurements will be taken.

In calculating the average thickness of the pavement, individual measurements which are in excess of the specified thickness by more than 5 mm will be considered as the specified thickness plus 5 mm and 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 25 mm.

3. Adjustment for Thickness

When the average thickness of the pavement per lot is deficient, payment for the lot shall be adjusted as follows:

Deficiency in the Average Thickness per lot (mm)	Percent (%) of Contract Price Per Lot
0 – 5	100% payment
6 – 10	95% payment
11 – 15	85% payment
16 – 20	70% payment
21 – 25	50% payment
More than 25	Remove and replace/ No payment

No acceptance and final payment shall be made on completed pavement unless core test for thickness determination is conducted, except for Barangay Roads where the implementing office is allowed to waive such test.

**311.4 Method of Measurement**

The area to be paid for under this Item shall be the number of square meters (m<sup>2</sup>) of concrete pavement placed and accepted in the completed pavement. The width for measurements will be the width from outside edge to outside edge of completed pavement as placed in accordance with the Plans or as otherwise required by the Engineer in writing. The length will be measured horizontally along the 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, which price and payment shall be full compensation for preparation of roadbed and finishing of shoulders, unless otherwise provided by the Special Provisions, furnishing all materials, for mixing, placing, finishing and curing all concrete, for furnishing and placing all joint materials, for sawing weakened plane joints, for fitting the prefabricated center metal joint, for facilitating and controlling traffic, and for furnishing all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
311(1)	Portland Cement Concrete Pavement, 200mm Thick	Square meter

## **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.

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 cast-in-place concrete piles are specified on the Plans, the Engineer will not furnish the Contractor an itemized list showing the number and length of piles. When test piles and load tests are required in conformance with Sub-section 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 sub-soil 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.

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

#### **400.1.2 Test Piles**

For his own information, the Contractor may drive 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, Load Tests. The Contractor shall furnish and drive 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 foundation piles.

When the Engineer requests a load test to determine a bearing value, the first load test pile shall be driven to the specified bearing value as determined by the applicable formula in Subsection 400.1.4 for Timber Pile Bearing Value by Formula. Subsequent test piles to be load-tested shall be driven to the specified bearing value as determined by the applicable formula modified by the results of prior test loads and foundation data. The ground at each test pile shall be excavated to the elevation of the bottom of the footing before the pile is driven.

### **400.1.3 Load Tests**

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

When load tests are specified, the number and location of piles to be tested will be designated by the Engineer. Load tests shall be done by methods approved by the Engineer. The Contractor shall submit to the Engineer for approval detailed plans of the loading apparatus he intends to use. The apparatus shall be so constructed as to allow the 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 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 re-driven to original grade and bearing.

#### **400.1.3.1 Static Testing**

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

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

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

Each load increment shall be held for an interval of two and one-half minutes. Each succeeding increment shall be as directed by the Engineer or as shown on the Plans and shall be applied immediately after the two and one-half minute interval readings have been made.

When a load-settlement curve obtained from these data shows that the pile has failed; i.e., the load can be held only by the constant pumping and the pile or shaft is being driven into the ground, pumping shall cease. Gross settlement readings, loads and other data shall be recorded immediately after pumping has ceased and again after an interval of two and one-half minutes for a total period of five (5) minutes. All loads shall then be removed and the member allowed to recover. Gross settlement readings shall be made immediately after all loads have been removed and at each interval of two and one-half minutes for a total period of five (5) minutes.

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

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

When diesel or other types of hammers requiring calibration are to be used, the Contractor shall make load tests even though no load tests are called for in the Bill of Quantities, except that load tests will not be required when the hammer is to be used only for driving piles to refusal, rock or a fixed tip elevation or the hammer is of a type and model that has been previously calibrated for similar type, size and length of pile, and foundation material. Calibration data must have been obtained from sources acceptable to 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 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-5882-96. 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 Testing**

Pile Integrity testing by High-Strain Dynamic Method shall conform to ASTM D4945-97. High-Strain Dynamic Method shall be applied to confirm the design parameters and capacities assumed for the piles as well as to confirm the normal integrity of testing of the piles. It is considered supplemental to the low-strain and sonic-type integrity testing of the cast-in-place piles. It is a non-destructive relatively quick test and it is intended that the test shaft be left in a condition suitable for use in production. The shaft used for the test will be instrumented and tested by the testing specialist, as approved by the Engineer, meeting requirements in accordance to ASTM D4945-97.

### 400.1.3.2.3 Cross-Hole Sonic Logging of Bored Holes

By sending ultrasonic pulses through concrete from one probe to another (probes located in parallel tubes), the Cross-hole Sonic Logging (CSL) procedure inspects the drilled shaft structural integrity, and extent and location of defects, 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 Timber Pile Bearing Value by Formula

When load tests are called for in the Bill of Quantities and when diesel or other hammers to be calibrated are used, the minimum number of hammer blows per unit of pile penetration needed to obtain the specified bearing value of piles shall be determined by load tests, as provided in Subsections 400.1.2 and 400.1.3. In the absence of load tests, the safe bearing value of each timber pile shall be determined by whichever of the following approximate formulas is applicable:

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

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

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

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

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

For diesel or steam hammers on very heavy piles,

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

Where:

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

The above formula are applicable only when:

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

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

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



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

#### 400.1.5 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 (KN)
- $W$  = height of fall of ram (mm)
- $H$  = weight of pile (KN)
- $W_p$  = average penetration for the last ten blows (mm)
- $S$  = 10 mm (unless otherwise observed/computed during

K = driving)  
 factor of safety (min. = 3)  
 FS =

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).

$$R_u = \frac{efWH (W)}{S+1/2 (C_1+C_2+C_3)} \times \frac{(W + n^2 W_p)}{(W + W_p)}$$

$$R_a = \frac{R_u}{FS}$$

where:

- R<sub>u</sub> = ultimate capacity of pile (KN)
- R<sub>a</sub> = capacity of pile (KN)
- ef = efficiency of hammer (refer to table)
- W = weight of ram (KN)
- W<sub>p</sub> = weight of pile (KN)
- H = height of fall of ram (mm)
- S = average penetration for last ten blows (mm)

- C1 = temporary compression allowance for pile head and cap (refer to table)
- C2 =  $RuL/AE_p$
- C3 = 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)
- length of pile
- cross-sectional area of pile
- =
- L = modulus of elasticity of pile
- =
- A = coefficient of restitution (refer to table)
- =
- $E_p$  = factor of safety (min. = 3)
- =
- n =
- =
- FS =

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.

Temporary Compression Allowance C1 for Pile Head and Cap

**Values of C1 for Hiley Formula**

Materials to which blow is applied	Easy Driving: P1 = 3.45 MPa (500 psi) on Pile Butt If no cushion, mm (in.)	Medium Driving: P1 = 6.90 MPa (1000 psi) on Head or Cap. mm (in.)	Hard Driving: P1 = 10.34 MPa (1500 psi) on Head or Cap. mm (in.)	Very Hard Driving: P1 = 13.88 MPa (2000 psi) on Head or Cap. mm (in.)
Head of timber pile	1.27 (0.05)	2.54 (0.10)	3.81 (0.15)	5.08 (0.20)
76–100mm (3-4 in.) packing inside cap on head of precast concrete piles	1.27 + 1.778 <sup>b</sup> (0.05 + 0.07) <sup>b</sup>	2.54 + 3.81 <sup>b</sup> (0.10 + 0.15) <sup>b</sup>	3.81 + 5.588 <sup>b</sup> (0.015 + 0.22) <sup>b</sup>	5.08 + 7.62 <sup>b</sup> (0.20 + 0.30) <sup>b</sup>
Concrete Pile	0.635 (0.025)	1.27 (0.05)	1.905 (0.075)	2.54 (0.10)
Steel-covered cap. containing wood packing but steel piling at pipe	1.016 (0.04)	2.032 (0.08)	3.048 (0.12)	4.064 (0.16)
4.76mm (3/16 in.) red electrical tuber disk between two 10mm (3/8") steel plates, for use with severe				

driving on Monotube pile	0.508 (0.02)	1.016 (0.04)		2.032 (0.08)
Head of steel piling of pipe	0	0	1.524 (0.06)	0
			0	

<sup>b</sup> The first figure represent the compression of the cap and wood dolly or packing above the cap, whereas the second figure represent the compression of the wood packing between the cap and the pile head.

$$P1 = Ru/A$$

Values of Efficiency of Hammer,  $e_f$

Hammer Type	$e_f$
Drop Hammer released by trigger	1.00
Drop Hammer actuated by rope and friction winch	0.75
McKiernan-Terry Single-acting hammers	0.85
Warrington-Vulcan Single –acting hammers	0.75
Differential-acting hammers	0.75
McKiernan-Terry, Industrial B. Ownhoist, National and Union double-acting hammers	0.85
Diesel Hammers	1.00

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

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

In all cases when the bearing 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.

#### 400.1.6 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.

#### **400.1.7 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 test blows.

#### **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 Untreated Timber Piles**

Timber shall conform to the requirements of Item 713, Treated and Untreated Timber. The specie shall be specified on the Plans. Unless otherwise noted on the Plans or Special Provisions, only the best grade shall be used. It shall be free from loose knots, splits, wormholes, decay, warp, ring separation or any defect which will impair its strength or render it unfit for its intended use. Any specie specified on the Plans may be used for untreated timber and if the specie is not available, a specie of equivalent strength and durability may be used if authorized by the Engineer.

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

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

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

The pile sizes shall conform to the dimensions shown in Table 400.1.

Table 400.1 – Dimension of Piles

Length of Pile	Diameter (1 metre from the Butt)		Minimum Tip Diameter, mm
	Minimum mm	Maximum mm	
Less than 12 metres	300	450	200
12 to 18 metres	320	450	180
More than 18 metres	350	500	150

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

Square piles shall have the dimensions shown on the Plans.

#### 400.2.2 Treated Timber Piles

Timber shall conform to the requirements of Item 713, Treated and Untreated Timber. Treatment shall consist of the forcing of either creosote oil or creosote petroleum oil mixture into the outer fibers of the timber by a heat and pressure process. The process shall be in accordance with ASTM D-1760 Standard Specification for Pressure Treatment of Timber Products, but with such changes as temperatures, pressures, duration of treatment and other factors affecting the final treatment that experience has shown to be necessary in the treatment of structural timbers sawn from woods native to the Philippines. The treatment shall be so regulated that the curing process will not induce excessive checking. The minimum penetration of the preservative into the surface of the timber shall be 20 mm. All piles shall retain the minimum amount of preservative specified in Table 400.2.

Table 400.2 – Minimum Preservative Per Cubic Metre of Wood

	Type of Processing
--	--------------------



Use	Empty Cell Process	Full Cell Process
General Use	195 kg	
Marine Use		320 kg

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

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

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

#### **400.2.3 Concrete Piles**

Concrete shall conform to the requirements of Item 405, Structural Concrete. Concrete shall be Class "C" unless otherwise specified in the Plans.

Concrete shall be proportioned to achieve a range of 6"-8" (150 mm to 200 mm) slump, self-compacting mix.

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.

#### **400.2.4 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.

#### **400.2.5 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 4.76mm.

#### **400.2.6 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.

#### **400.2.7 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 water-tight when the piles are in place.

#### **400.2.8 Pile Shoes**

Pile shoes shall be as called for on the Plans.

#### **400.2.9 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.

#### **400.2.10 Paint**

It shall conform to Item 709, Paints.

### **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 metre 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 19 mm (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 Timber Piles**

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

Treated piles shall be strapped after treatment.

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

#### **400.3.5 Timber Pile Bents**

Piles for any one bent shall be carefully selected as to size, to avoid undue bending or distortion of the sway bracing. Care shall be exercised in the distribution of piles of various sizes to obtain uniform strength and rigidity in the bents of any given structure.

Cut offs shall be made accurately to insure full bearing between caps and piles of bents.

### **400.3.6 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 water-tight 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.

### **400.3.7 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 3m 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 12.5mm 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 underreamed) to improve the load capacity of end bearing shafts on less than desirable soils, or to increase the uplift resistance of floating shafts.

Effects of ground and ground water conditions on shaft construction operations 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 15.24cm (6-inch diameter increments with a minimum diameter of 45.72cm (18")). The diameter of a shaft socketed into rock should be a minimum of 15.24cm (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 76.20cm (30").

Drilled shafts constructed in dry, non-caving soils can usually be excavated without lateral support of the hole. Other ground conditions where caving, squeezing or sloughing soils are present require installation of a steel casing or use of a slurry for support of the hole. Such conditions and techniques may result in loosening of soil around the shaft, or altering of frictional resistance between the concrete 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 spacings 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. The construction of the pile or shaft in a wet condition while the walls of the excavation are stabilized by hydrostatic pressure of water or a mineral slurry until the concrete is placed by tremie methods for the full length of the pile.

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° [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:

- a) Increase density values by 0.314 KN/m<sup>3</sup> (2 pcf) in salt water.
- b) 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 12.5mm of sediment and at no place on the base more than 37.5mm 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 noncorrosive 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 7.62cm (6”) 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.
- b. After all the shaft concrete is placed, the top of the reinforcing steel cage shall be no more than 15.24 cm (6”) above and no more than 7.62 cm (3”) below plan position.
- c. 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”).
- d. 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.

- e. The top elevation of the shaft shall be within 2.54 cm (1 inch) of the plan top of shaft elevation.
- f. 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.

#### **400.3.8 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.

#### **400.3.9 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	6.5 mm	9.5 mm

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

#### **400.3.10 Splicing**

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

## 1. Precast Concrete Piles

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

Splicing of prestressed precast piles will generally not be permitted, but when permitted, it shall be made in accordance with (1) above, but only after driving has been completed. Reinforcement bars shall be included in the pile head for splicing to the extension bars. No additional driving 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.

### **400.3.11 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 400.3.10 or as approved by the Engineer.

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

#### **400.3.12 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.

#### **400.3.13 Protecting Untreated Timber Trestle Piles**

The heads of untreated piles shall be treated as follows:

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

**400.3.14 Protecting Treated Timber Trestle Piles**

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

**400.3.15 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.

**400.3.16 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
1. Pile type and dimension  2. Date of casting and concrete quality (for concrete piles)  3. Date of driving  4. Driving equipment: type, weight & efficiency of hammer, etc.	1. Date of boring or driving (For steel shell) & casting  2. Pile type and nominal dimension  3. Length of finished pile and tip elevation  4. Details of penetration during boring or driving of steel shell (driving records as for driven piles)



<p>5. Description of cushion on pile head</p> <p>6. Depth driven and tip elevation</p> <p>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)</p> <p>8. For gravity and single-acting hammers: the height of drop</p> <p>9. For double acting-hammers --- the frequency of blows</p> <p>10. Details of any interruption in driving</p> <p>11. Level of pile top immediately after driving and the level when all piles in the group are driven</p> <p>12. Details of re-driving</p>	<p>5. Concrete quality and consistency</p> <p>6. Time interval between boring or driving and concreting</p> <p>7. Volume of concrete placed in concrete</p>
--	---

#### **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 metres of the piles of the several types and lengths ordered in writing by the Engineer, furnished in compliance with these Specifications and stockpiles 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 site of work.

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

## 2. Piles Driven

The quantity to be paid for 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 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 may be necessary to suit the Contractor's method of construction and were driven at his option.

Unless otherwise provided for, pre-boring, jetting or other methods used for facilitating pile driving operations will not be measured directly but will be considered subsidiary to pay items.

### **400.4.2 Cast-In-Place Concrete Piles**

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

### **400.4.3 Pile Shoes**

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

### **400.4.4 Load Tests**

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

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.

#### 400.4.5 Splices

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

#### 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, which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment tools and incidentals as well as temporary works, staging areas or craneway necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
400(12)	Structural Steel Sheet Piles, Furnished and Driven	Linear Meter
400(17)c	Concrete Piles Cast in Drilled Holes, 1.20mØ (Ordinary Soil Condition)	Linear Meter
400(17)f	Concrete Piles Cast in Drilled Holes, 1.80mØ (Ordinary Soil Condition)	Linear Meter
400(22)a	Pile Integrity Testing (Sonic), Ordinary Soil Condition	Each
400(22)b	High Strain Dynamic Testing (PDA), Ordinary Soil Condition	Each
400(24)c	Permanent Steel Casing, 1.20mØ (10mm thk)	Linear Meter
400(24)f	Permanent Steel Casing, 1.80mØ (10mm thk)	Linear Meter

## **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 on the Plans. Railings 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 710, 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 Timber**

It shall conform to the requirements of Item 713, Treated and Untreated Timber.

#### **401.2.6 Stones and Bricks**

These shall conform to the requirements of Item 505, Stone Masonry and Item 704, Masonry Units.

#### **401.2.7 Paint**

It shall conform to the requirements of Item 709, Paints.

### **401.3 Construction Requirements**

#### **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 posts shall be set plumb in hand or mechanically dug holes, unless driving is permitted. In the latter case, the manner of driving shall be such as to avoid battering or distorting of post. Post holes 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 placed on a span until centering or falsework has been removed, rendering the span self-supporting.

Rail elements shall be erected according to Plans and in a manner resulting in a smooth, continuous installation with laps in the direction of traffic flow. All bolts except adjustment bolts shall be drawn tight. Bolts shall be of sufficient length to extend beyond the nuts by more than 25 mm.

Where painting of railing component is specified, any damage 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 the 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 Metal Railing**

Fabrication and erection shall be done in accordance with the requirements of Item 403, Metal Structures. In the case of welded railings, all exposed joints shall be finished by grinding or filing after welding to give a neat appearance.

Metal railing shall be carefully adjusted prior to fixing in-place to insure proper matching of abutting joints, correct alignment and camber throughout their length. Holes for field connection shall be drilled with the railing in-place in the structure at proper grade and alignment. Welding may be substituted for rivets or bolts in field connections with the approval of the Engineer.

### **401.3.3 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 at least ten (10) days. Any member that shows checking or soft corners of surfaces shall be rejected.

Expansion joints 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 a sharp chisel.

### **401.3.4 Wooden Railing**

Wooden railing shall be constructed in accordance with the requirements of Item 402, Timber Structures.

### **401.3.5 Stone and Brick Railing**

The materials used in masonry brick railing and parapet and the work to be done shall conform to the requirements of this Specification. The workmanship shall be first class and the finished construction shall be neat in appearance and true to line and grade.

**401.4 Method of Measurement**

The quantity to be paid for shall be the number of linear meters of specified railing actually completed and accepted measured from center to center of end posts.

**401.5 Basis of Payment**

The accepted quality, 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.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
401	Reinforced Concrete Railing	Meter

**ITEM 404 – REINFORCING STEEL**

**404.1 Description**

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

**404.2 Material Requirements**

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

**4.4.3 Construction Requirements**

### 404.3.1 Order Lists

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

### 404.3.2 Protection of Material

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

### 404.3.3 Bending

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

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

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

### 404.3.4 Placing and Fastening

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



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

#### **404.3.5 Splicing**

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

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

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

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

#### **404.3.6 Lapping of Bar Mat**

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

#### **404.4 Method of Measurement**

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

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

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

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

#### **404.5 Basis of Payment**

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

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
404	Reinforcing Steel Bar, Grade 40	Kilogram

### **ITEM 405 – STRUCTURAL CONCRETE**

#### **405.1 Description**

##### **405.1.1 Scope**

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

##### **405.1.2 Classes and Uses of Concrete**

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

The classes of concrete will generally be used as follows:

Class A – All superstructures and heavily reinforced substructures. The important parts of the structure included are slabs, beams, girders, columns, arch ribs, box culverts, reinforced abutments, retaining walls, and reinforced footings.

Class B – Footings, pedestals, massive pier shafts, pipe bedding, and gravity walls, unreinforced or with only a small amount of reinforcement.

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

Class P – Prestressed concrete structures and members.

Seal – Concrete deposited in water.

## **405.2 Material Requirements**

### **405.2.1 Portland Cement**

It shall conform to all the requirements of Subsection 311.2.1.

### **405.2.2 Fine Aggregate**

It shall conform to all the requirements of Subsection 311.2.2.

### **405.2.3 Coarse Aggregate**

It shall conform all the requirements of Subsection 311.2.3 except that gradation shall conform to Table 405.1.

Table 405.1 – Grading Requirements for Coarse Aggregate

Sieve Designation		Mass Percent Passing				
Standard Mm	Alternate US Standard	Class A	Class B	Class C	Class P	Class Seal
63	2-1/2"		100			
50	2"	100	95 – 100			
37.5	1-1/2"	95 – 100	-			100
25	1"	-	35 – 70		100	95 – 100
19.0	3/4"	35 – 70	-	100	95 – 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 Materials**

Expansion joint materials shall be:

1. Preformed Sponge Rubber and Cork, conforming to AASHTO M 153.
2. Hot-Poured Elastic Type, conforming to AASHTO M 173.
3. Preformed Fillers, conforming to AASHTO M 213.

#### **405.2.9 Elastomeric Compression Joint Seals**

These shall conform to AASHTO M 220.

#### **405.2.10 Elastomeric Bearing Pads**

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

#### **405.2.11 Storage of Cement and Aggregates**

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

#### **405.3 Sampling and Testing of Structural Concrete**

As work progresses, at least one (1) sample consisting of three (3) concrete cylinder test specimens, 150 x 300mm (6 x 12 inches), shall be taken from each seventy-five (75) cubic meters of each class of concrete or fraction thereof placed each day.

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

Sampling of fresh concrete	T 141
Weight per cubic metre and air content (gravi- Metric) of concrete	T 121
Sieve analysis of fine and coarse aggregates	T 27
Slump of Portland Cement Concrete	T 119
Specific gravity and absorption of fine aggregate	T 84

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

Making and curing concrete compressive and flexural tests specimens in the field	T 23
Compressive strength of molded concrete Cylinders	T 22

#### **405.4 Production Requirements**

##### **405.4.1 Proportioning and Strength of Structural Concrete**

The concrete materials shall be proportioned in accordance with the requirements for each class of concrete as specified in Table 405.2, using the absolute volume method as outlined in the American Concrete Institute (ACI) Standard 211.1. "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete". Other methods of proportioning may be

employed in the mix design with prior approval of the Engineer. The mix shall either be designed or approved by the Engineer. A change in the source of materials during the progress of work may necessitate a new mix design.

The strength requirements for each class of concrete shall be as specified in Table 405.2.

Table 405.2 - Composition and Strength of Concrete for Use in Structures

Class Of Concrete	Minimum Cement Content Per m <sup>3</sup> kg (bag**)	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	360 (9 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 hopper shall be properly sealed and vented to preclude dusting operation. The discharge chute shall not be suspended from the weighing hopper and shall be so arranged that cement will neither be lodged in it nor leak from it.

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

##### **2. Water**

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

##### **3. Aggregates**

Stockpiling of aggregates shall be in accordance with Subsection 311.2.10. All aggregates whether produced or handled by hydraulic methods or washed, shall be stockpiled or binned for draining for at least 12 hours prior to batching. Rail shipment



requiring more than 12 hours will be accepted as adequate binning only if the car bodies permit free drainage. If the aggregates contain high or non-uniform moisture content, storage or stockpile period in excess of 12 hours may be required by the Engineer.

Batching shall be conducted as to result in a 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 ensure their accuracy.

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

## 2. Mixing Concrete at Site

Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended

by the manufacturer. The pick-up and throw-over blades of mixers shall be restored or replaced when any part or section is worn 20mm or more below the original height of the manufacturer's design. Mixers and agitators which have an accumulation of hard concrete or mortar shall not be used.

When bulk cement is used and volume of the batch is 0.5m<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 other-wise directed be continued for not less than 100 revolutions after all ingredients, including water, are in the drum. The mixing speed shall not be less than 4 rpm, nor more than 6 rpm.

Mixing shall begin within 30 minutes after the cement has been added either to the water or aggregate, but when cement is charged into a mixer drum containing water or surface wet aggregate and when the temperature is above 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's guaranteed capacity. They shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

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

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

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

#### 6. Delivery of Mixed Concrete

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

#### **405.5 Method of Measurement**

The quantity of structural concrete to be paid for will be the final quantity placed and accepted in the completed structure. No deduction will be made for the volume occupied by pipe less than 100mm (4 inches) in diameter or by reinforcing steel, anchors, conduits, weep holes or expansion joint materials.

#### **405.6 Basis of Payment**

The accepted quantities, measured as prescribed in Section 405.5, shall be paid for at the contract unit price for each of the Pay Item listed below that is included in the Bill of Quantities.

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

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
405 (1)	Structural Concrete, Class A	Cubic Meter

## **ITEM 407 – CONCRETE STRUCTURES**

### **407.1 Description**

This item shall consist of the general description of the materials, equipment workmanship and construction requirements of concrete structures and the 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 Special Provisions, concrete shall be of Class A.

2. Reinforcing Steel

Reinforcing steel shall conform to the requirement 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 or 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

Curing compound shall conform to the requirements of AASHTO M 148 Liquid membrane-forming compounds for curing concrete.

## 8. Joint Filler

Unless otherwise shown on the Plans or in Special Provisions, materials for expansion joint filler shall conform to the requirements of the following specifications:

- a. AASHTO M 33 Preformed expansion joint filler for concrete.
- b. AASHTO M 153 Preformed sponge rubber and cork expansion joint fillers for concrete paving and structural construction.
- c. AASHTO M 173 Concrete joint sealer hot poured elastic type.
- d. AASHTO M 213 Preformed expansion joint filler for concrete paving and structural construction non-extruding and resilient bituminous types.
- e. AASHTO M220 Preformed elastomeric compression joint seals for concrete.

### **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.

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 1.5m concrete shall be conveyed through street 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 3m 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 equipment 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 Seal concrete with a minimum cement content of 380 kg/m<sup>3</sup> of concrete. The slump of the concrete shall be maintained between 4 and 8 cm, whichever is called for in the Bill of Quantities or as directed by the Engineer. 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 250mm constructed in sections having flanged couplings fitted with gaskets with a hopper at the top. The tremie shall be supported so as to be above the 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 contact with 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 compaction. 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 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 3cm slump over a radius of at least 50cm. A sufficient number of vibrators 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 in to 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 placed 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 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 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 placing the 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 slopes 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 super-structure 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 ensure 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 shall 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-Bea, 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 damage 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 shall be in contact with new concrete shall be washed with water to this satisfaction. To ensure 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, wingwalls, 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, sides of inferior 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. Wingwalls 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 Finished

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 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 straight-edge. For the purpose, the Contractor shall furnish and use an accurate 3 m straight-edge swing handleless 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 not more than one-half of 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 has 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 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. 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 shall 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 compounds may be sampled by the Engineer at the source of supply and on 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 specifications 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 100 mm.

The sheets shall be securely weighed down by placing a bank of earth on the edges of the sheets or by 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 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 of 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 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 jets shall be low pressure and in 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<sup>0</sup> C per hour. The curing temperature throughout the enclosure shall not exceed 65<sup>0</sup> 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 on 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 or 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 footing 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 manufacturer’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 overhang 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 ensure 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 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 drawing shall include a superstructure placing diagram showing proposed concrete placing sequence and construction joint locations, except that were 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 opening 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 settlement over 20 mm which 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 settlements 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 measure 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 as required by the Engineer and with the surface finish as specified.

Formworks 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 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 are present, 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 excessive undulation, its use shall be discontinued until modifications satisfactory to the Engineer have been made. Portions of concrete structures with surface undulation 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 surface 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.

Forms 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 forms supports to concrete will not be permitted.

#### **407.3.14 Removal of Forms and Falsework**

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 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.

<b>Part of Structure</b>	<b>Minimum Time</b>	<b>Minimum Percentage Design Strength</b>
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 the 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 conditions 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 the 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 quantities measured as provided in Section 407.4, Method of Measurement shall be paid for at the contract price for the several Pay Items which price and payment shall be full compensation for furnishing, preparing, fabricating, placing, curing and for all labor, equipment, tools and incidentals necessary to complete the Item. Such payment shall constitute full payment for the completed structure ready for use.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
407 (8)	Lean Concrete, Class B, 16.5 Mpa (Refer to Item 901)	Cubis Meter

#### **ITEM 411 – PAINT**



## 411.1 Description

This Item shall consist of furnishing and applying all paint materials including vehicles, pigments, pastes, driers, thinners and mixed paints for steel and wooden structures; sampling testing and packing; preparation of the surface and application of paint to structures.

## 411.2 Materials Requirements

### 411.2.1 General

Paint, except aluminum paint, shall consist of pigments of the required fineness and composition ground to the desired consistency in linseed oil in a suitable grinding machine, to which shall be added additional oil, thinner and drier as required.

Aluminum paint shall consist of aluminum powder or paste of the required fineness and composition to which shall be added the specified amount of vehicle.

The paint shall be furnished for use in ready mixed, paste or powder form.

All paints shall meet the following general requirements:

1. The paint shall show no excessive settling and shall easily redisperse with a paddle to a smooth, homogeneous state. The paint shall show no curdling, livering, caking or color separation and shall be free from lumps and skins.
2. The paint as received shall brush easily, possess good leveling properties and shall show no running or sagging when applied to a smooth vertical surface.
3. The paint shall dry to a smooth uniform finish, free from roughness grit, unevenness and other imperfections.
4. The paint shall not skin within 48 hours in a  $\frac{3}{4}$  filled tightly closed container.

**411.2.2** The paint shall conform to the requirements of the Specifications indicated as follows:

Ready Mixed Red Lead Paint	AASHTO M 72 and PNS Type I, II, III & IV
Aluminum Paint	AASHTO M 69 and PNS Type I & II

White & Tinted Ready Mixed Paint	AASHTO M 70
Foliage Green Bridge Paint	AASHTO M 67
Black Paint for Bridges And Timber Structures	AASHTO M 68
Basic Lead-Silico-Chromate Ready Mixed Primer	AASHTO M 229
Ready Mixed Aluminum Paint	AASHTO M 260 and PNS

### 411.2.3 Drier

This Specification covers both straight oil drier (material free from resins and gums), and Japan drier (material containing varnish gums). The drier shall be composed of lead manganese or cobalt or a mixture of any of these elements, combined with a suitable fatty oil, with or without resins or gums, and mineral spirits or turpentine, or a mixture of these solvents. The drier shall conform to the following requirements:

1. Appearance – Free from sediment and suspended matter.
2. Flash Point – (Tag Close Up) Not less than 30°C.
3. Elasticity – The drier when flowed on metal and baked for 2 hours at 100°C shall have an elastic film.
4. Drying – It shall mix with pure raw linseed oil in the proportion of 1 volume of drier to 19 volumes of oil without curdling and the resulting mixture when flowed on glass shall dry in not more than 18 hours.
5. Color – When mixed with pure, raw linseed oil in the proportion of 1 volume of drier to 8 volumes of oil, the resulting mixture shall be darker than a solution of 6 grams of Potassium Dichromate in 13 cc of pure Sulfuric Acid (sp.gr. 1.84).

### 411.3 Construction Requirements

#### 411.3.1 Proportion of Mixing

It is the intent of this Specification to provide a paint of proper brushing consistency, which will not run, streak or sag and which will have satisfactory drying qualities.

### **411.3.2 Aluminum Paint, Field Coats on Structural Steel**

The paint shall be mixed in the proportion of 240 grams of aluminum powder or paste per liter of vehicle of long oil spar varnish. This makes a paint containing 21 percent pigment and 79 percent vehicle. The weighed amount of powder or paste shall be placed in a suitable mixing container and the measured volume of vehicle poured over it. The paste or powder shall be incorporated in the paint by vigorous stirring with a paddle. The powder or paste will readily disperse in the vehicle. Before removing any paint from the container, the paint shall be thoroughly stirred to ensure a uniform mixture, and the paint shall be suitably stirred during use. The paint shall be mixed on the job and only enough for one day's use shall be mixed at one time.

When two field coats of aluminum paint are specified, the first coat shall be tinted with lampblack paste or Prussian blue paste in the quantity of 24 grams/liter of paint. The exact quantity used shall be sufficient to give a contrast in color which can be readily distinguished. When three field coats of aluminum paint are specified, the second coat shall be tinted.

### **411.3.3 Aluminum Paint, Field Coats on Creosoted Timber**

The paint shall be mixed as specified for Aluminum Paint for Structural Steel except that the proportions shall be 270 grams of aluminum powder or paste to one litre of vehicle.

Other paint composition may be used when and as stipulated in the Special Provisions.

### **411.3.4 Containers and Markings**

All paints shall be shipped to strong substantial containers plainly marked with the weight, color and volume in liters of the paint content, a true statement of the percentage composition of the pigment, the proportions of the pigment to vehicle, the name and address of the manufacturers, and the stencil of the authorized inspecting agency. Any package or container not so marked will not be accepted for use.

### **411.3.5 Sampling and Testing**

Method of sampling shall be as follows:

1. One 20-litre can sample in original unopened container shall be obtained for 100 cans of the delivered material or 10% fraction thereof.
2. One 4-litre can sample in original unopened container shall be obtained for every 100 cans or fraction thereof of the delivered material.

Methods of testing will be in accordance with the applicable AASHTO or ASTM Methods.

### **411.3.6 Painting**

#### **411.3.6.1**

The painting of structure shall include the proper preparation of the surface; the application, protection and drying of the paint coatings, the protection of the pedestrians, vehicular or other traffic upon or underneath the structures, the protection of all parts of the structure (both superstructure and substructure) against disfigurement by spatters, splashes and smirches of paint or of paint materials; and the supplying of all tools, tackle, scaffolding labor, paint and materials necessary for the entire work.

Paint shall not be applied during rain, storms or when the air is misty, or when, in the opinion of the Engineer, conditions are otherwise unsatisfactory for the work. Paint shall not be applied upon damp surfaces or upon metal which has absorbed heat sufficient to cause the paint to blister and produce a pervious paint film.

No wide flat brush shall be used. All brushes preferably shall be either round or oval but if flat brushes are used, they shall not exceed 100 mm in width.

The paint when applied shall be so manipulated as to produce a uniform even coating in close contact with the surface being painted, and shall be worked into all corners and crevices.

On surfaces inaccessible to brushes, the paint shall be applied by spray gun or with sheepskin daubers specially constructed for the purposes.

Paint shall be thoroughly stirred, preferably by means of mechanical mixers, before being removed from the containers, and, to keep the pigments in suspension, shall be kept stirred while being applied.

When a paint gun is used, the equipment used shall be of an approved type and shall have provision for agitation of paint in the spray container. In the case of aluminum paint, the pressure used shall be only that necessary to secure adequate atomization. If in the opinion of the Engineer unsatisfactory results are obtained from the use of a spray gun, its use shall be discontinued and the painting completed by the use of brushes.

#### **411.3.6.2 Painting Structural Steel**

Surfaces of metals to be painted shall be thoroughly cleaned of rust, loose mill, scale, dirt, oil or grease, and other foreign substances. Unless cleaning is to be done by sandblasting, all weld areas, before cleaning is begun, shall be neutralized with a proper chemical, after which they shall be thoroughly rinsed with water. Cleaning may be by any of the following three methods:

1. Hand Cleaning

The removal of rust, scale and dirt shall be done by the use of metal brushes, scrapers, chisels, hammers or other effective means. Oil and grease shall be removed by the use of gasoline or benzene. Bristle or wood fiber brushes shall be used for removing loose dust.

2. Sandblasting

Sandblasting shall remove all scale and other substances down to the base metal. Special attention shall be given to the cleaning of corners and re-entrant angles. Before painting, sand adhering to the steel in corners and elsewhere shall be removed. The cleaning shall be approved by the Engineer prior to any painting. The material shall be painted before the rust forms and not later than 2 hours after cleaning.

3. Flame Cleaning

Oil and grease shall be removed by washing with suitable solvent. Excess solvent shall be wiped from the work before proceeding with subsequent operation. The surface to be painted shall be cleaned and dehydrated (freed of occluded moisture) by the passage of oxyacetylene flames which have an oxygen to acetylene of at least one. The inner cones of these flames shall have a ratio length to port diameter of at least 8 and shall not be more than 4 mm center to center. The oxyacetylene flames shall be traversed over the surface of the steel in such manner and at such speed that the surface is dehydrated, and dirt, rust, loose scale, scale in the form of blisters or scabs, and similar foreign matter are freed by the rapid intense heating by the flames. The flames shall not be traversed so slowly that loose scale or other foreign matter is fused to the surface of the steel. The number, arrangement and manipulation of the flames shall be such that all parts of the surface are adequately cleaned and dehydrated. Promptly after the application of the flames, the surface of the steel shall be wire-brushed, hand scraped wherever necessary and then swept and dusted to remove all free materials and foreign particles. Compressed air shall not be used for this operation. Paint shall be applied promptly after the steel has been cleaned and while the temperature of the steel is still above that of the surrounding atmosphere, so that there will be no recondensation of moisture on the cleaned surfaces.

4. Shop Painting of Structural Steel

When all fabrication work is completed and has been tentatively accepted, all surfaces not painted before assembling shall be given two coats of Red Lead Shop

Paint conforming to the requirements of this Specification. (The inside of top chords for trusses and laced members or inaccessible parts, except contact surfaces, may be painted before assembling). Shipping pieces shall not be located for shipment until thoroughly dry. No painting shall be done after loading the materials on transport vehicles.

Erection marks for field identifications of members shall be painted upon previously painted surfaces.

With the exception of abutting joints and base plates, machine-finished surface shall be coated, as soon as practicable after acceptance with a hot mixture of white lead and tallow before removal from the shop. The composition used for coating machine-finished surface shall be mixed in the following proportions:

Pure Tallow	1,915 grams
Pure White Lead	958 grams
Pure Linseed Oil	1.0 liter

#### 5. Field Painting of Structural Steel

When the erection work is complete including riveting and straightening of bent metal; all adhering rust, scale, dirt, grease or other foreign material shall be removed as specified under cleaning of surfaces.

As soon as the Engineer has examined and approved all field rivets, the heads of such rivets and field bolts, all welds and any surfaces from which the shop coat of paint has become worn off or has otherwise become defective, shall be cleaned and thoroughly covered with one coat of shop coat paint.

When the paint applied for “touching up” rivet heads and abraded surfaces has become thoroughly dry, such field coats as called for shall be applied. In no case shall a succeeding coat be applied until the previous coat has dried throughout the full thickness of the film. All small cracks and cavities which were not sealed in water-tight manner by the first field coat shall be filled with a pasty mixture of red lead and linseed oil before the second field coat is applied.

The following provisions shall apply to the application of all field coats. To secure a maximum coating on edges of plates or shapes, rivet heads and other parts subjected to special wear and attack, these parts shall first be stripped, followed immediately by the general painting of the whole surface, including the edges and rivet heads.

The application of the final coats shall be deferred until adjoining concrete work has been placed and finished. If concreting operations have damaged that paint, the surface shall be recleaned and repainted.

#### **411.3.6.3 Painting and Timber Structures**

Timber structures shown on the Plans to be painted, shall be given two coats of the specified materials, which shall be thoroughly brushed in. Additional coats shall be required when so specified on the Plans. All surfaces shall be thoroughly dry before painting, and each coat shall be allowed to stand for three or four days, or until thoroughly dry before applying the succeeding coat.

Timber which required painting must be seasoned timber surfaced on 4 sides. It shall be either untreated or salt-treated timber as specified on the Plans.

The entire surface of all untreated timber that is to be painted, shall be given a priming coat immediately after the material is delivered to the project. All contact surfaces shall receive the second coat paint.

Special care shall be taken during construction and handling so that the pieces to be painted do not come in contact, except when required, with the creosoted materials and that no oil is brushed on the same during construction operations. The Contractor shall be required to pile such pieces separately from the creosoted materials and keep them from contact with same until ready for erection.

Creosoted materials such as guardrails and guide posts which are to be painted, shall be painted with aluminum paint as specified above.

#### **411.3.6.4 Painting Galvanized Surface**

For the purpose of conditioning the surface of galvanized surfaces to be painted, the painting shall be deferred as long as possible in order that the surface may weather.

Before painting galvanized surfaces, they shall be treated as follows:

1. In 4 liters of soft water, dissolve 60 ml of copper chloride, copper nitrate, and sal ammonia, then add 60 ml of commercial muriatic acid. This should be done in earthenware or glass vessel, never in tin or other metal receptacle. Apply the solution with a wide flat brush to the galvanized surface, when it will assume a dark almost black color which on drying becomes a grayish film.

2. The surfaces, when dry, may then be painted as described.

#### **411.3.6.5 Repainting Existing Structures**

When called for on the Plans or in the Special Provisions, existing structures shall be given the number and kind of coats of field paint as stipulated. The surface to be repainted shall be cleaned as specified under Subsection 411.3.6.2, Painting Structural Steel, with the added provisions that all dead or loose paint shall be removed by scraping, chipping, or brushing as may be necessary. Timber railings, name plates, planking and other interfering parts shall be removed before cleaning is begun and shall be replaced after the painting has been completed and the last coat has thoroughly dried. The application of the coat shall be as specified under Subsection 411.3.6.2, (5), Field Painting of Structural Steel.

#### **411.4 Measurement and Payment**

Painting shall not be measured and paid for separately, but the cost thereof shall be considered as included in the contract unit price of the items were called for.

### **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 gage.

### **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 load plate.

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)				
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**

<b>Mm</b>	
Overall vertical dimensions	
Design thickness 32 mm (1 ¼ in) or less	-0, +3
Design thickness over 32 mm (1 ¼)	-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, staffed 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 form (K) by more than 10%.
5. For each bearing that fails to meet the requirements in (1), two additional bearings maybe 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	Elastomeric Bearing Pads	Each

## ITEM 500 – PIPE CULVERTS AND STORM DRAINS

### 500.1 Description

This item shall consist of the construction or reconstruction of pipe culverts 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 requirements specified in the following specifications:

Zinc coated (galvanized) corrugated iron or steel culverts and underdrains	AASHTO M 36
Cast iron culvert pipe	AASHTO M 64
Concrete sewer, storm drain and culvert pipe	AASHTO M 86
Reinforced concrete culvert, storm drain and sewer pipe	AASHTO M 170
Bituminous coated corrugated metal culvert pipe and pipe arches	AASHTO M 190
Reinforced concrete arch culvert, storm drain and sewer pipe	AASHTO M 206
Reinforced concrete elliptical culvert, storm drain and sewer pipe	AASHTO M 207
Asbestos cement pipe for culverts and storm drains	AASHTO M 217

Joint Mortar – Joint mortar for concrete pipes shall consist of 1 part, by volume of Portland Cement and two (2) parts of approved sand with water as necessary to obtain the required consistency.

Portland Cement and sand shall conform to the requirements of Item 405, Structural Concrete. Mortar shall be used within 30 minutes after its preparation.

Rubber gaskets	AASHTO M 198
----------------	--------------

Oakum – Oakum for joints in bell and spigot pipes shall be made from hemp (*Cannabis Sativa*) line or Benares Sunn fiber or from a combination of these fibers. The oakum shall be thoroughly corded and finished and practically free from lumps, dirt and extraneous matter.

Bedding material shall conform to the requirements of Subsection 500.3.2, Bedding.  
Backfill material shall conform to the requirements of Subsection 500.3.6, Backfilling.

When the location of manufacturing plants allow, the plants will be inspected periodically for compliance with specified manufacturing methods, and material samples will be obtained for laboratory testing for compliance with materials quality requirements. This shall be the basis for acceptance of manufacturing lots as to quality.

Prior to and during incorporation of materials in the work, these materials will be subjected to the latest inspection and approval of the Engineer.

### **500.3 Construction Requirements**

#### **500.3.1 Trenches 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. Where feasible, trench wall shall be vertical.

The completed trench bottom shall be firm for its full length and width. Where required, in the case of crop drains, the trench shall have a longitudinal camber of the magnitude specified.

When so specified on the Plans, the excavation for conduits placed in embankment fill, shall be made after the embankment has been completed to the specified or directed height above the designed grade of the conduit.

#### **500.3.2 Bedding**

The bedding shall conform to one of the classes specified. When no bedding class is specified, the requirements for Class C bedding shall apply.

Class A bedding shall consist of a continuous concrete cradle conforming to the plan details.

Class B bedding shall consist of bedding the conduit to a depth of not less than 30 percent of the vertical outside diameter of the conduit. 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 passes a 9.5 mm sieve and not more than 10 percent of which passes a 0.075 mm sieve. The layer of the bedding material shall be shaped to fit the conduit for at least 15 percent of its total height. Recesses in the trench bottom shall be shaped to accommodate the bell when bell and spigot type conduit is used.

Class C bedding shall consist of bedding the conduit to a depth of not less than 10 percent of its total height. The foundation surface, completed in accordance with Item 103, Structure Excavation, shall be shaped to fit the conduit and shall have recesses shaped to receive the bells,

if any. For flexible pipe, the bed shall be roughly shaped and a bedding blanket of sand or fine granular material as specified above shall be provided as follows:

Pipe Corrugation Depth	Minimum Bedding Depth
10 mm	25 mm
25 mm	50 mm
50 mm	75 mm

For large diameter structural plate pipes the shaped bed need not exceed the width of bottom plate.

### **500.3.3 Laying Conduit**

The conduit laying shall begin at the downstream end of the conduit line. The lower segment of the conduit shall be in contact with the shaped bedding throughout its full length. Bell or groove ends of rigid conduits and outside circumferential laps of flexible conduits shall be placed facing upstream. Flexible conduit shall be placed with longitudinal laps or seams at the sides.

Paved or partially-lined conduit shall be laid such that the longitudinal center line of the paved segment coincides with the flow line. Elliptical and elliptically reinforced conduits shall be placed with the major axis within 5 degrees of a vertical plane through the longitudinal axis of the conduit.

### **500.3.4 Jointing Conduit**

Rigid conduits may either be of bell and spigot or tongue and groove design unless another type is specified. The method of joining conduit sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even.

Joints shall be made with (a) Portland Cement mortar, (b) Portland Cement grout, (c) rubber gaskets, (d) oakum and mortar, (e) oakum and joint compound, (f) plastic sealing compound, or by a combination of these types, or any other type, as may be specified. Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the conduit and finished smooth on the inside. For grouted joints, molds or runners shall be used to retain the poured grout. Rubber ring gaskets shall be installed so as to form a flexible water-tight seal. Where oakum is used, the joint shall be called with this material and then sealed with the specified material.

When Portland Cement mixtures are used, the completed joints shall be protected against rapid drying by any suitable covering material.

Flexible conduits shall be firmly joined by coupling bands.

Conduits shall be inspected before any backfill is placed. Any pipe found to be out of alignment, unduly settled, or damaged shall be taken up and re-laid or replaced.

### **500.3.5 Field Strutting**



When required by the Plans, vertical diameter of round flexible conduit shall be increased 5 percent by shop elongation or by means of jacks applied after the entire line of conduit has been installed on the bending but before backfilling. The vertical elongation shall be maintained by means of sills and struts or by horizontal ties shall be used on paved invert pipe.

Ties and struts shall be 300 mm in place until the embankment is completed and compacted, unless otherwise shown on the Plans.

These construction specifications shall also apply in the case of re-laid conduits. In addition, all conduits salvaged for relaying shall be cleaned of all foreign materials prior to reinstallation.

### **500.3.6 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 compatible soil or granular material selected from excavation or from a source of the Contractor's choice, 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 percent passing a 12.5 mm sieve and not less than 95 percent retained on a 4.75 mm sieve. Oversized material, if present, shall be removed at the source of the material, except as directed by the Engineer.

When the top of the conduit is flushed with or below the top of the trench, backfill material shall be placed at or near optimum moisture content and compacted in layers not exceeding 150 mm (compacted) on both sides to an elevation 300 mm above the top of the conduit. Care shall be exercised to thoroughly compact the backfill under the haunches of the conduit. The backfill shall be brought up evenly on both sides of the conduit for the full required length. Except where negative projecting embankment-type installation is specified, the backfill material shall be placed and compacted for the full depth of the trench.

When the top of the conduit is above the top of the trench, backfill shall be placed at or near optimum moisture content and compacted in layers not exceeding 300 mm (compacted) and shall be brought up evenly on both sides of the conduit for its full length to an elevation 300 mm above the top of the conduit. The width of the backfill on each side of the conduit for the portion above the top of the trench shall be equal to twice the diameter of the conduit or 3.5 m, whichever is less. The backfill material used in the trench section and the portion above the top of the trench for a distance on each side of the conduit equal to the horizontal inside diameter and to 300 mm above the top of the conduit shall conform to the requirements for backfill materials in this Subsection. The remainder of the backfill shall consist of materials from excavation and borrow that is suitable for embankment construction.

Compaction to the density specified in Item 104, Embankment, shall be achieved by use of mechanical tampers or by rolling.

All conduits after being bedded and backfill as specified in this Subsection shall be protected by one-meter cover of fill before heavy equipment is permitted to cross during construction of the roadway.

### **500.3.7 Imperfect Trench**

Under this method, for rigid conduit, the embankment shall be completed as described in Subsection 500.3.6, Backfilling, to a height above the conduit equal to the vertical outside diameter of the conduit plus 300 mm. A trench equal in width to the outside horizontal diameter of the conduit and to the length shown on the plans or as directed by the Engineer shall then be excavated to within 300 mm of the top of the conduit, trench walls being as nearly vertical as possible. The trench shall be loosely filled with highly compressible soil. Construction of embankment above shall then proceed in a normal manner.

#### **500.4 Method of Measurement**

Conduit of the different types and sizes, both new and re-laid, will be measured by the linear meter in place. Conduit with sloped or skewed ends will be measured along the invert.

Each section will be measured by the number of units installed.

Branch connection and elbows will be included in the length measurement for conduit, or they may be measured by the number of units installed.

Class B bedding material placed and approved shall be measured by the cubic meter in place.

When the Bid Schedule contains an estimated quantity for “Furnishing and Placing Backfill Material, Pipe Culvert”, the quantity to be paid for will be the number of cubic meter complete in place and accepted, measured in final position between limits as follows:

1. Measurement shall include backfill material in the trench up to the top of the original ground line but will not include any material placed outside of vertical planes 450 mm up outside of and parallel to the inside wall of pipe at its widest horizontal dimension.
2. When the original ground line is less than 300 mm above the top of the pipe, the measurement will also include the placing of all backfill materials, above the original ground line adjacent to the pipe for a height of 300 mm above the top of pipe and for a distance on each side of the pipe not greater than the widest horizontal dimension of the pipe.
3. The measurement shall include the placing of backfill material in all trenches of the imperfect trench method. Materials re-excavated for imperfect trench construction will be measured for payment under Item 103, Structure Excavation.

#### **500.5 Basis of Payment**

The accepted quantities of conduit, determined as provided 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 complete in place. End sections and, when so specified, branch connections and elbows, shall be paid for at the contract unit price per piece for the kind and size specified complete in place.

Excavation for culverts and storm drains, including excavation below flow line grade and for imperfect trench, shall be measured and paid for as provided in Item 103, Structure Excavation.

Concrete for Class A bedding will be paid for under Item 405, Structural Concrete.

When the Bid Schedule does not contain as estimated quantity for “Furnishing and Placing Backfill Material, Pipe Culvert” payment for placing backfill material around pipe culverts will be considered as included in the payment for excavation of the backfill material.

Payment will be made under:

<b>Payment Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
500(1)	Reinforced Concrete Pipe Culvert (RCPC), 910mm dia.	Linear Meter

## **ITEM 506 – STONE MASONRY**

### **506.1 Description**

This Item shall consist of stone masonry in minor structures, in headwalls for culverts, in retaining walls at the toes of slopes, and at other places called for on the Plans, constructed on the prepared foundation bed, in accordance with this Specification and in conformity with the lines, grades, sections, and dimensions shown on the Plans or as ordered in writing by the Engineer.

### **506.2 Material Requirements**

#### **506.2.1 Stone**

The stone shall be clean, hard, and durable and shall be subject to the Engineer’s approval. Adobe stone shall not be used unless otherwise specified.

Sizes and Shapes – Unless other sizes are shown on the Plans, stones have a thickness of not less than 150 mm, and widths of not less than one and one-half times their respective thickness, and lengths of not less than one and one-half times their respective widths. Each stone shall be of good shape and be free of depressions and projections that might weaken or prevent it from being properly bedded.

Dressing – The stone shall be dressed to remove any thin or weak portions. Face stones shall be dressed to provide bed and joint lines that do not vary more than 20 mm from the true lines and to ensure the meeting of bed and joint lines without the rounding of corners of the stones in excess of 30 mm in radius. Bed surfaces of the face stones shall be approximately normal to the face of the stones for about 80 mm and from this point may depart from a normal plane not to exceed 50 mm in 300 mm.

Finish for Exposed Faces – Face stones shall be pitched to the line along the beds and joints. The maximum projection of rock faces beyond the pitch lines shall not be more than 50 mm.

#### **506.2.2 Mortar**

Cement, fine aggregate, and water shall conform to the respective requirements for those materials as specified under Item 405, Structural Concrete, except as to the grading of fine aggregate which shall all pass the 2.36 mm (No. 8) sieve, not less than 15 nor more than 40 percent shall pass the 0.3 mm (No. 50) sieve, and not more than 10 percent shall pass the 0.15 mm (No.100) sieve.

The mortar for the masonry shall be composed of one part of Portland Cement and two parts of fine aggregate by volume and sufficient water to make the mortar of such consistency that it can be handled easily and spread with a trowel. Mortar shall be mixed only in those quantities required for immediate use. Unless an approved mortar mixing machine is used, the fine aggregate and cement shall be mixed dry in a tight box until the mixture assumes a uniform color, after which, water shall be added as the mixing continues until the mortar attains the proper consistency. Mortar that is not used within 90 minutes after the water has been added shall be discarded. Retampering of mortar will not be permitted.

### **506.3 Construction Requirement**

#### **506.3.1 Selection and Placing**

When the masonry is to be placed on a prepared foundation bed, the bed shall be firm and normal to, or in steps normal to, the face of the wall, and shall have been approved by the Engineer before any stone is placed.

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 which is to receive them 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 joints shall be flushed with mortar.

The exposed faces of individual stones shall be parallel to the faces of the walls in which the stones are set.

The stones shall be so handled as not to jar displace the stones already set. Suitable equipment shall be provided for setting stones larger than those that can be handled by two men. The rolling or turning of stones on the walls will not be permitted. If a stone is loosened after the mortar has taken initial set, it shall be removed, the mortar cleaned off, and the stone re-laid with fresh mortar.

#### **506.3.2 Bed and Joints**

Beds for face stones may vary from 20 mm to 50 mm in thickness. They shall not extend an unbroken line through more than 5 stones. Joints may vary from 20 mm to 50 mm in thickness. They shall not extend in an unbroken line through more than two stones. They may be at angles with the vertical from 0° to 45°. Face stone shall bond at least 150 mm longitudinally and 50 mm vertically. At no place shall corners of four stones be adjacent to each other.

Cross beds for vertical faced walls shall be level, and for battered walls may vary from level to normal to the batter line of the face of the wall.

### **506.3.3 Headers**

Headers shall be distributed uniformly throughout the walls of the structures so as to form at least one-fifth of the exposed faces. They shall be of such lengths as to extend from the front face of the wall into the backing of at least 300 mm. When a wall is 450 mm or less in thickness, the headers shall extend entirely from front to back face.

### **506.3.4 Backing.**

Backing shall be built mostly of large stones as shown in the approved Plans or as directed by the Engineer. The individual stones composing the backing and hearting shall be well bonded with the stones in the face wall and with each other. All openings and interstices in the backing shall be filled completely with mortar or with spalls surrounded completely by mortar

### **506.3.5 Pointing**

Both bed and vertical joints shall be finished as shown on the Plans or as directed by the Engineer. The mortar in joints on top of surface of masonry shall be crowned slightly at the center of the masonry to provide drainage.

### **506.3.6 Coping**

Copings, if called for, shall be finished as shown on the Plans. Where copings are not called for, the top of the wall shall be finished with stones wide enough to cover the top of the wall from 450 mm to 1000 mm in length, and of random heights, with a minimum height of 150 mm. Stone shall be laid in such a manner that the top course is an integral part of the wall. The tops of top course of stone shall be pitched to line, in both vertical and horizontal planes.

### **506.3.7 Weep holes**

It shall conform to the requirements of Item 504, Riprap and Grouted Riprap under Subsection 504.3.4, Weep holes.

### **506.3.8 Cleaning Exposed Faces**

Immediately after being laid, and while the mortar is fresh, all face stones shall be thoroughly cleaned of mortar stains and shall be kept clean until the work is completed.

### **506.3.9 Curing**

In hot or dry weather, the masonry shall be satisfactory protected from the sun and shall be kept wet for a period of at least three days after completion.

## **506.4 Method of Measurement**

The quantity to be paid for shall be the number of cubic meters of stone masonry complete in place and accepted. Projections extending beyond the faces of the walls shall not be included. In computing the quantity for payment, the dimensions used shall be those shown on the Plans or

ordered in writing by the Engineer. No deductions shall be made for weepholes, drain pipes or other openings of less than one square meter in area.

**506.5 Basis of Payment**

The quantity of masonry, determined as provided in Section 506.4, Method of Measurement, shall be paid for at the contract unit price per cubic meter for Stone Masonry, which price and payment shall be full compensation for furnishing and placing all materials, including mortar for masonry, for all necessary excavations, and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
506a	Stone Masonry (Slope Protection & RCPC Headwalls)	Cubic Meter
506b	Stone Masonry (Bridge)	Cubic Meter

**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**





Timber guardrail shall be well-seasoned, straight and free of injurious defects. They shall be dressed and of sufficient length so that joints shall be on the rail posts.

Guardrail Hardware. Offset brackets of the resilient and non-resilient types shall be of the type specified, or as shown on the Plans, and shall meet the strength requirements specified.

Splices and end connections shall be of the type and design specified or as shown on the Plans, and shall be of such strength as to develop the full design strength of the rail elements.

Unless otherwise specified, all fittings, bolts, washers and other accessories shall be galvanized in accordance with the requirements of AASHTO M 111 or ASTM A 153, whichever may apply. All galvanizing shall be done after fabrication.

Guardrail Post. Posts shall be of either wood, steel, or concrete, as may be specified. Only one kind of post shall be used for any one continuous guardrail.

Wood post shall be fabricated from an approved or specified timber specie and shall be of the quality, diameter or section and length as specified, or as shown on the Plans.

Steel post shall be of the section and length as specified, or as shown on the Plans. They shall be of a copper bearing steel when so specified. Steel shall conform to the requirements of AASHTO M 183 for the grade specified. The posts shall be galvanized or shop painted as may be specified.

Pre-cast reinforced concrete posts shall be of a section and length as specified or as shown on the Plans. Concrete shall conform with the requirements of Item 405, Structural Concrete, for class specified. Reinforcement shall conform with the requirements of AASHTO M 31 Grade 60. All bars shall be of the deformed type.

Concrete deadmen for end anchorages shall be as specified, or as shown on the Plans. Concrete and reinforcement shall conform to the requirements as stated above the precast reinforced concrete posts.

Paints for steel and wood shall be specified and conform to the requirements specified in Item 411, Paint.

### **603.3 Construction Requirements**

#### **603.3.1 Posts**

Posts shall be set vertically in the position shown on the Plans and, where embedded in a concrete foundation block, shall remain undisturbed for a minimum of 48 hours. The space around the post shall be backfilled to the ground line with approved material in layers not exceeding 100 mm and each layer shall be moistened and thoroughly compacted.

### **603.3.2 Rail Elements**

Rail elements shall be erected in a manner resulting in a smooth continuous installation. All bolts, except adjustment bolts, shall be drawn tight. Bolts shall be of sufficient length to extend beyond the nuts at least 5 mm but not more than 10 mm.

Where painting of railing components is specified, any damage to the shop coat of paint shall be corrected by an application of an approved rust-inhibitive primer prior to further painting. Any surface inaccessible to painting after erection shall be given the specified number of coats of paint uniformly applied by thorough brushing using an approved pressure spray.

Galvanized surfaces which have been abraded so that the base material is exposed, threaded portions of all fittings and fasteners and cut ends of bolts shall be protected in a manner as may be specified or directed.

The surfaces and sawed edges of untreated or salt-treated guardrail shall be painted with three coats of white paint to within 200 mm of the ground line. The first 200 mm of posts above the ground shall be painted with two coats of black paint. Painting shall be done only when the timber is dry and clean. Each coat of paint shall be thoroughly dry before the next coat is applied. Paint shall be applied in heavy coats, completely covering every part of the surface and shall be worked well into the joints and open spaces. It shall be thoroughly and evenly spread that no excess paint collects at any point.

Guardrail and posts, after erection has been completed, shall be stained with two applications of approved creosote stain, covering the rails and the exposed portions of the posts. The wood shall be dry before being stained. The first coat shall be thoroughly dry before the second is applied. Stain shall not be applied in damp weather.

For beam type guardrails, metal works not galvanized shall be given one shop coat of red lead, zinc chromate paint or an approved fast-drying rust-inhibitive primer and two field coats of white or aluminum paint. Untreated wood posts shall be given three coats of paints of the color indicated on the Plans, or as specified. Painting shall conform to the requirements of Item 411, Paint.

### **603.4 Method of Measurement**

Guardrail shall be measured by linear meter from center to center of end posts, except where end connections are made on masonry or steel structures, in which case measurement will be to the face of such structures.

End anchorages and terminal sections will be measured as units of each kind shown in Bid Schedule. If no pay item for anchorages or terminal sections appears in the Bid Schedule, measurement therefore shall be included in the linear meter measurement for completed guardrail.

### **603.5 Basis of Payment**

The accepted quantities of guardrail, determined in Subsection 603.4, Method of Measurement, shall be paid for at the contract unit price per linear meter for the type specified, complete in place, 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 Item. When so specified, end anchorages and terminal sections will be paid for at the contract unit price for each of the kind specified and completed in place.

Payment will be made under:

<b>Pay Item No.</b>	<b>Description</b>	<b>Unit of Measurement</b>
603 (3a)	Metal Guardrail (Metal beam) Including Post	Linear Meter
603 (3b)	Metal Beam End Piece	Each

## **ITEM 605 – ROAD SIGN**

### **605.1 Description**

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

The road signs shall comply in all respects with the “Philippine International Road Signs Manual” published by the Department of Public Works and Highways, Manila. The categories of road signs are designated in the Manual, namely, danger warning signs, regulatory signs and informative signs, or guide signs. These are referred to in the Contract as warning signs and informatory signs, respectively.

Road signs shall be classified as standard or non-standard. Standard signs consist of all warning signs, regulatory signs and informatory signs with the exception of direction signs, place identification signs and the line. Non-standard signs consist of all informatory signs which are not classified as standard signs.

The size of warning and regulatory signs is the length of the side of triangular signs (measured from the points of intersection of the extension of the edges), the horizontal width of octagonal signs and the diameter of circular signs.

## 605.2 Material Requirements

### 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

The reflective sheeting used on the road signs shall consist of spherical lens elements embedded within a transparent plastic having a smooth, flat surface with a protected precoat adhesive which shall be pressure sensitive for manual application, or tack free heat activated for mechanical vacuum-heat application.

The minimum reflective brightness values of the reflective sheeting as compared to a magnesium oxide (MgO) shall be as given in Table 605.1. The brightness of the reflective sheeting totally wet by rain, shall be not less than 90% of the given values.

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 <sup>0</sup>	0.5 <sup>0</sup>	15
	20 <sup>0</sup>	0.5 <sup>0</sup>	10
	50 <sup>0</sup>	0.5 <sup>0</sup>	3
White	-4 <sup>0</sup>	0.5 <sup>0</sup>	75
	20 <sup>0</sup>	0.5 <sup>0</sup>	70
	50 <sup>0</sup>	0.5 <sup>0</sup>	70

Yellow	-4 <sup>0</sup>	0.5 <sup>0</sup>	35
	20 <sup>0</sup>	0.5 <sup>0</sup>	35
	50 <sup>0</sup>	0.5 <sup>0</sup>	10
Blue	-4 <sup>0</sup>	0.5 <sup>0</sup>	6
	20 <sup>0</sup>	0.5 <sup>0</sup>	4.5
	50 <sup>0</sup>	0.5 <sup>0</sup>	0.5

The reflective sheeting shall be sufficiently flexible to permit application and adhesion to a moderately embossed surface. It shall show no damage when bent 90<sup>0</sup> over a 50 mm diameter mandrel.

The sheeting shall be solvent-resistant so as to be capable of withstanding cleaning with petrol, diesel fuel, mineral spirits, turpentine methanol.

The sheeting shall show no cracking or reduction in reflectivity after being subjected to the dropping of a 25 mm diameter steel ball from a height of 2 m into its surface.

The adhesive shall permit the reflective sheeting to adhere accurately 48 hours after application of temperatures of up to 90<sup>0</sup>.

The reflective material shall be weather-resistant and, following cleaning in accordance with manufacturer's recommendations, shall show no discoloration, cracking, blistering, peeling or any dimensional change.

Samples of reflective sheeting shall be submitted to the Engineer for approval.

### **605.2.3 Posts and Frames**

Wide flange posts and frames shall be fabricated from structural steel 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.

#### **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.

### **605.3 Construction Requirements**

#### **605.3.1 Excavation and Backfilling**

Holes 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 150 mm in depth. Surplus excavated material shall be disposed of by the Contractor as directed by the Engineer.

#### **605.3.2 Erection of Posts**

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

#### **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 replacement 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 background color.

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 road signs shall be the number of such signs of the size specified, including the necessary posts and supports erected and accepted.

The quantities for standard reflective informatory signs and non-standard reflective informatory signs shall be the number of such, including the necessary posts and supports, erected and accepted.

#### **605.5 Basis of Payment**

The quantities measured as determined in Subsection 605.4, Method of Measurement, shall be paid for at the contract unit price for the Pay Items shown in the Bid Schedule which price and payment shall be full compensation for furnishing and installing road signs, for excavation, backfilling and construction of foundation blocks, and all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

<b>Pay Item No.</b>	<b>Description</b>	<b>Unit of Measurement</b>
605(1)	Standard Warning Signs (900mm, Triangle)	Each

### **ITEM 612 – REFLECTIVE THERMOPLASTIC STRIPPING MATERIALS (SOLID FORM)**

#### **612.1 Description**

This standard specifies the requirement for reflectorized thermoplastic pavement striping material conforming to AASHTO M 249 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 Materials Requirements**

1. Reflectorized Thermoplastic Pavement Material shall be homogeneously composed of pigment, filler, resins and glass reflectorizing spheres.

The thermoplastic material shall be available to both white and yellow.

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 Requirement

Component	White	Yellow
Binder, min.	18.0	18.0
Glass Beads:		
min.	30	30
max.	40	40
Titanium 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.	10.0	
Bond Strength to Portland Cement Concrete after heating for four (4) hours $\pm 5$ min. @ 218°C, MPa, max.	1.24	
Cracking Resistance @ low temp. after heating for four (4) hours $\pm 5$ min. @ 218 $\pm 2$ °C.	No cracks	
Impact Resistance after heating for four (4) hours $\pm 5$ min. @ 218 $\pm 2$ °C and forming test specimens, mm/kg, min.	115	
Softening Point after heating for four (4) hours $\pm 5$ min. @ 218 $\pm 2$ °C.	102.5 $\pm$ 9.5°C	
Daylight reflectant @ 45 Degrees – 0 degrees, % min.	75	45

#### 612.4 Application Properties

The material shall readily extrude at a temperature of 211  $\pm$  7°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 methods shall be at a rate of not less than 350 g/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 retained on 250 um (#60) sieve, %	80 – 100
--	----------

a) Preparation of Road Surface – 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, and with the approval of the Engineer.

b) Preparation of Thermoplastic Materials – 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 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 molden condition for more than 4 hours.

c) Laying – Center lines, lane lines and edges lines shall be applied by approved mechanical means and shall be laid in 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 3 mm or more than 6 mm unless authorized by the Engineer when laid over an existing markings. In the case of sprayed application, the material shall be laid to thickness of not less than 1.5 mm unless authorized by the Engineer. In all cases the surface produced shall be uniform and appreciably free from bubbles and steaks. Where the Contractor Documents require or the Engineer direct that ballotini 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 ballotini firmly embedded and retained in the surface after completion complies with the requirements of Sub-section 606.2.2, Material 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 Plans.

d) Re-use of Thermoplastic Materials – At the end of day’s as much as possible the material remaining 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 that the total time during which it is a molden condition does not exceed the requirements of Sub-section 606.2.3, Construction Requirements.

#### **612.4.1 Defective Materials or Workmanship**

Materials which are defective or have been applied in an unsatisfactory manner or to incorrect dimensions or in a wrong location shall be removed, the road pavement shall be made good and materials replaced, reconstructed and/or properly located, all at the Contractor's expenses and to the satisfaction 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 container 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 as shown on the Plans of painted traffic line of the stated width and the area as shown on the plans of symbols, lettering, hatching and the like, 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 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 Subsection 612.8, Method of Measurement, shall be paid for at the appropriate contract unit price for the Pay Items shown in the Bid Schedule 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:

<b>Pay Item Number</b>	<b>Description</b>	<b>Unit of Measurement</b>
612(1)	Reflectorized Thermoplastic Pavement Markings (White)	Square Meter
612(2)	Reflectorized Thermoplastic Pavement Markings (Yellow)	Square Meter

**ITEM 622 - COCONET BIO-ENGINEERING SOLUTIONS**

**622.1 Description**

This item covers installation of coconut coil' fiber made into geonets such as coconets, coco-logs, coco twines and coco peat as bioengineering materials for controlling soil erosion and slope stabilization in accordance with the cross section shown on the Plans or as directed by the Engineer.

**622.2 Definition**

For the purpose of this item, the following terms shall be defined:

- a) Coconut Geonets - Any coconut coil' fiber-based material such as Coconets, Cocologs, Coco peat, placed in sloping lands and embankments to hold the vulnerable soil and permit vegetative growth to control surface erosion and conserve the productivity of the soil.

- b) Coconet - Handspun Coconut coil' fiber twine woven into blankets of different density.
- c) Coco-log - a tubular structure of coconut coil' fiber blankets of different diameter filled with coco coil', and/or coco peat.
- d) Coco coil' twine - a string made of coconut coil' strands twisted together.
- e) Coco coil' peat - a natural and residual materials from coconut coil' which serves as soil conditioner

### 622.3 Material Requirements

#### 622.3.1 Coconut Coir

Coconut coil' fiber materials for use in fabrication of coconut geonets shall be a multi-cellular fiber with 12 to 24 microns in diameter and the ratio of length to diameter shall be 35. The fiber shall also be hygroscopic, with moisture content of 10% to 12% at 65% humidity and 22% to 55% at 95% relative humidity.

#### 622.3.2 Coco-net and Coco-log/Fascine

Coco-net and Coco-log shall conform to Table 1 and Table 2 respectively.

**Table 1**

**Physical Properties of Coco-net**

<b>PROPERTIES</b>	<b>COCONET 400</b>	<b>COCONET 700</b>	<b>COCONET 900</b>
Thickness,mm	10.0 Min.		
Width,m	1.0 Min.		

Length,m.		25.0 Min.		
Unit Weight 1g/m <sup>2</sup>		400 ± 20	700 ± 35	900 ± 45
Diameter of Twine,mm <i>Hand spun</i>		5.0 mm ± 0.50 mm		
No. of Twines/m	<i>Crosswise Direction</i>	40 Min	40 Min	70 Min
	<i>Lengthwise Direction</i>			
Material		Woven Netting made from High Strength 100% Coconut fiber twine		
Color		Natural Earth Tone		
Tensile, Strength, N/twine		150 Min.		
Elongation	<i>(Machine Direction) %</i>	26 Min.	34 Min.	42 Min.
	<i>(Cross Machine Direction) %</i>	32 Min.	38 Min.	32 Min.
“C” Factor		0.002		
Water Velocity, m/sec.		27 Min.	3.35 Min.	4.26 Min
Water Absorption, %		163 Min.	146 Min.	132 Min.
Slope Inclination, H:V		≤ 1:1	1:1 to 60°	75°

“ C” Factor – Safety Factor

**Table 2**  
**Physical Properties of Coco-log**

<b>Type of Coco-log/Fascine</b>	<b>Diameter (mm)</b>	<b>Weight (Min.) (Kg/m)</b>
Cocolog 100	100	2.0

Cocolog 200	200	4.5
Cocolog 300	300	10
Cocolog 400	400	20
Cocolog 500	500	30

### **622.3.3 Backfill**

Backfill shall be in accordance with the approved Plan and shall conform to the requirements of Item 104 - Embankment.

### **622.3.4 Bamboo Stakes**

Bamboo stakes shall be mature and shall be 30 to 40 mm in width and 300 mm long.

### **622.3.5 Live Plant Stakes (Live Kakuate or Ipil-ipil or Equivalent Species)**

Live plant stakes shall be kept moist and installed the same day they were prepared and shall be 50 to 150 mm in diameter and 500 mm to 1000 mm in length.

## **622.4 Construction Requirements**

### **622.4.1 Quality Control**

The coconut geonets manufacturer shall be responsible for establishing and maintaining a quality control program to assure compliance with the requirements of this specification.

### **622.4.2 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.

### **622.4.3 Site Measurement**

Site measurements shall be done to prepare specific lengths of the coco-nets to conform the necessary area requirements and the necessary length for coco-logs to be installed/placed.

### **622.4.4 Preparation of Bed**

Site for net installation shall be graded and sloped to the approved design and any runoff control such as diversions, dikes and berms shall be completed prior to installation. All depression/gullies and eroded portions shall be backfilled for the coco-nets to snugly come in contact with the soil surface. The face of the slope shall be smoothened. Rocks, clods, vegetation (deemed detrimental to the erosion control system to be installed), and other obstructions shall be removed from tip to toe of the slope to ensure complete contact of the coco-nets with the soil.

Existing vegetations that are considered not detrimental shall be retained, but shall be trimmed down to facilitate the installation of the coconut geonets.

### **622.4.5 Anchoring**

#### **1. Common Soil**

The coconut geonets shall be secured to the ground using bamboo pegs. An average of 3 pegs per square meter shall be used to ensure uniform contact of coco-net to the ground surface. For loose soils, longer pegs shall be used to have sufficient ground penetration to resist pullout.

#### **2. Compacted Soil**

A combination of bamboo pegs and U-shaped wire staples may be used for compacted, hard to penetrate soil. An average of 3 pegs/staples per square meter shall be used to ensure uniform contact of coco-net to the ground surface.



### 3. Hard Rock

The coconut geonets shall be anchored to solid rock surfaces using metal stake pins with a minimum diameter of 8.0 mm and length of 200 to 300 mm.

#### **622.4.6 Installation/Placing of Coconut Geonets**

The coconut geonets shall be used on critical cut slopes, embankments and disturbed soils generally steeper than 3:1, where water velocities are likely to wash out soils and new vegetation. Coco-nets shall be placed and anchored on the graded surface of the slope to maximize net contact with the slope surface. Installation shall begin at the top of the slope with the coco-net laid down and securely anchored 1.0 meter from the edge of the slope by folding underneath the leading edges of the coco-net to ensure that no twines would come loose. After which the coco-nets shall then be unrolled downslope in the direction of the water flow. Adjacent coco-nets shall be installed side-by-side and shall be sewn together using coco coir twine. The coco-nets shall be laid loosely (not stretched) on the ground. Coco-net shall then be fastened and secured firmly to the ground in accordance to Subsection 622.4.5, Anchoring. Anchoring shall be at right angle to the ground surface.

When necessary, coco-log/fascines shall be used in conjunction with coco-nets installation to reduce long slopes and as major stopper of downward movement of soil as rainwater carries them downslope. It shall be placed across the slope on contour and shall be pegged with live stakes (622.3.5) to the ground at 1.0 m intervals. For slopes with loose soil, the coco-logs/fascines shall be installed on trenches. The trench shall be deep enough to accommodate half the diameter of the coco-logs. Contour interval shall be 1.0 m to 8.0 m depending on the steepness of the slope and the erodibility of the soil.

#### **622.4.7 Placing of Coco Coir Peat (Soil Conditioner)**

After the installation of coconut geonets, coco coir peat-soil mixture shall be distributed evenly on the net protected slope. Thumping and raking shall follow to make the mix settle underneath to ensure appropriate soil moisture and nutrient release as grasses and other planting materials shall be planted.

#### **622.4.8 Vegetation**

1. Vetiver Grass Hedgerow

Live hedgerow of vetiver grass (or any local suitable species) slips shall be planted on the slopes at 150 mm plant interval depending on the erosivity of the soil, the steepness of the slope, and the design waterflow. Row distance shall likewise depend on the steepness of the slope, and shall range from 1.0 to 4.0 m.

## 2. Grass cover

Fast growing leguminous creeping/twining grass cover shall be used for slope faces requiring immediate vegetative cover. It shall be applied to the soil at a rate depending on the desired plant density and the calculated on-site mortality rate of the plants.

## 3. Trees

If trees shall be used to stabilize a slope, species that have sturdy, long, and deep-penetrating roots shall be selected.

Whereas, in water channels or rivers, appropriate plants that can thrive in water or water saturated condition, while functioning to prevent bank erosion shall be used. Numerous other considerations shall be taken into account in choosing the proper planting materials. These plant properties shall include, drought resistance, effect on local ecology, aesthetics, etc.

### **622.4.9 Performance Monitoring**

Post project monitoring shall include checking on any breaks of the installed coconut geonets especially at the point of junctions, the growth of grasses and the manifestation of any failure of germination of plants and the sudden outburst of rain that might have inflicted damaged to some sections. Repair works shall be done on damaged sections of the slope and replacement shall be done in case of plant mortality.

Watering, weeding and fertilization may be done subject to the discretion of the contractor's bioengineer or plant specialist. Maintenance activities shall be terminated upon the recommendation of the bioengineer and approval of the owner.

### **622.5 Certification**

The manufacturer shall file with the purchaser a certificate stating the name of the manufacturer, the composition of the coconut geonets as bioengineering materials and other

pertinent information so as to fully describe the coir materials. The manufacturer shall include in the certificate a guarantee stating that the bioengineering materials that are furnished meet the required specifications. The certificate shall be attested by a person having legal authority to bind the company. Either mismarking or misrepresentation by the manufacturer shall be reason to discontinue acceptance under these specifications. The discontinuance of acceptance will be considered to be notice to all wholesaler, jobbers, distributors, agents and other intermediates handling the manufacturer's product.

**622.6 Method of Measurement**

The area to be paid for under this Item shall be the number of square meter (rrr') of coconet, linear meter for coco-log, square meter (m ') of live vetiver grass hedgerow and square meter (m") of effective vegetative growth for grass cover, installed/placed and accepted into the completed project.

**622.7 Basis of Payment**

The accepted quantity, measured as prescribed in Section 622.6 shall be paid for at the contract unit price for coconut geonets, which price and payment shall be full compensation for preparation of bed and furnishing of all materials for placing/installation of coconut geonets and for furnishing all labor, maintenance of plants, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
620	Coco Net with Vegetation	Square Meter

**HANDTOOLS**

Brand new hand tools will be turned over by the contractor during completion of the project for the operation and maintenance of “*Construction of Brgy. San Roque- San Antonio Magcopa-San Pablo Suha-Doongan Ilaya Farm to Market Road with Two (2) Bridge*”. This project will be considered as Indirect Cost of the Project.

1. **Shovel (8 units)** - Heavy duty, lightweight, one-piece shovel scoop ideal for material

handling and industrial applications.

Key Specifications/Special Features:

- Steel blade and heat treatment
- D-shaped PP handle
- Total size: 41-3/4 inches
- Cubic feet: 1.78 feet
- Length: 38 inches

2. **Wheel Barrow (4 units)** -10.5kg. Wheel Barrow with 78L Water Capacity and 5cbf Sand Capacity

Key Specifications/Special Features:

- Load: 160kg
- Weight: 10.5kg
- Water capacity: 78L
- Sand capacity: 5cbf
- Wheel: 13 x 3 inches

3. **Brush Cutter (4 units)** – 43cc Gasoline Brush Cutter, used for cutting Shrub and Grass with Metal Blade

Key Specifications/Special Features:

- Engine: two-stroke, air-cooled single cylinder
- Displacement: 43cc
- Maximum power: 1.64kW/7,500rpm
- Fuel tank capacity: 1,000mL
- Working shaft length: 1,650mm
- Mass without cutter and empty tanks: 7.5kg
- Cutter type: metal blade
- Diversified blade cutter and belt can be chosen
- EPA emission configuration is available
- GS/CE approvals
- Anti-vibration, fast-idle control
- Fully adjustable, automatic chain oiling pump
- Adjustable open handle

4. **Rakes (8 units)** - Steel lawn rake with Steel Handle and PVC Grip Key

Specifications/Special Features:

- Steel blade
- Heat treatment
- Aluminum handle with PVC grip
- Total size: 69-1/2 inches

5. **Garden Knife (8 pieces)** - Garden Knife with 2.0mm SK 5 Steel Blade and Nylon Bag

**Key Specifications/Special Features:**

- 2.0mm SK 5 steel blade Black finish and anti-rust.

## Section VII. Drawings

**Subproject Name: Construction of Brgy. San Roque-San Antonio Magcopa-San Pablo Suha – Doongan Ilaya Farm to Market Road with Two (2) Bridge**

**Detailed Engineering Design LINK:**

<https://drive.google.com/drive/folders/15TWDWrpNwifTZfYjGzxwHKn4Eo6GzzIR>

<b>TITLE</b>	<b>PAGE/SHEET NO.</b>
<b>COVER PAGE</b>	<b>1</b>
<b>INDEX OF DRAWINGS, SUMMARY OF QUANTITIES</b>	<b>2</b>
<b>LOCATION PLAN</b>	<b>3</b>
<b>SITE DEVELOPMENT PLAN</b>	<b>4</b>
<b>GENERAL NOTES, LEGEND &amp; ABBREVIATION, GEOMETRIC DESIGN</b>	<b>5</b>
<b>PAVEMENT MARKINGS, ROAD SIGNAGE, BILLBOARD DETAIL</b>	<b>6</b>
<b>DETAIL OF GUARDRAILS</b>	<b>7</b>
<b>SITE OFFICE</b>	<b>8</b>
<b>SPECIFICATIONS</b>	<b>9-11</b>
<b>PARCELLARY</b>	<b>12-16</b>
<b>SCHEDULE OF QUANTITY</b>	<b>17-20</b>
<b>ROAD SECTION DETAILS, ROAD SECTION</b>	<b>21-22</b>
<b>ROAD SECTION DETAILS, LINE CANAL &amp; SLOPE PROTECTION DETAILS</b>	<b>23</b>
<b>DETAIL OF BIO-ENG'G SOLUTIONS, PCCP JOINT CONNECTION</b>	<b>24</b>
<b>PAVEMENT PLAN, CONCRETE SHOULDER JOINT DETAILS, CATCH BASIN &amp; COVERED CANAL DETAILS</b>	<b>25</b>
<b>ROADWAY SECTION @ STEEP GRADIENT, ROADWAY INTERSECTION, MITRE DRAIN &amp; CRANEWAY DETAILS</b>	<b>26</b>
<b>DETAILS OF RCPC</b>	<b>27-29</b>
<b>DETAIL OF BOX CULVERT</b>	<b>30-33</b>
<b>PLAN AND PROFILE</b>	<b>34-47</b>
<b>CROSS-SECTION</b>	<b>48-67</b>
<b>STRAIGHT LINE DIAGRAM</b>	<b>68-74</b>
<b>SUHA BRIDGE PLANS</b>	<b>75-92</b>
<b>DOONGAN ILAYA BRIDGE PLANS</b>	<b>93-114</b>

## Section VIII. Bill of Quantities

*Please follow the link:*

### **Bill Of Quantities for Catanauan Subproject**

*for downloadable and editable Bill of Quantities.*

## **Section IX. BIDDING FORMS**

*Please follow the link <https://bit.ly/SectionIX-BiddingForms> for downloadable and editable templates.*

