

PHILIPPINE BIDDING DOCUMENTS
(As Harmonized with Development Partners)

**Procurement of
INFRASTRUCTURE
PROJECTS**

Government of the Republic of the Philippines

**Construction of Multi-Purpose Hall at Barangay Quibal,
Delfin Albano, Isabela**

**Sixth Edition
February 2021**

Preface

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

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

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

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

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

- a. All the documents listed in the Table of Contents are normally required for the procurement of Infrastructure Projects. However, they should be adapted as necessary to the circumstances of the particular Project.
- b. Specific details, such as the “*name of the Procuring Entity*” and “*address for bid submission,*” should be furnished in the Instructions to Bidders, Bid Data Sheet, and Special Conditions of Contract. The final documents should contain neither blank spaces nor options.
- c. This Preface and the footnotes or notes in italics included in the Invitation to Bid, BDS, General Conditions of Contract, Special Conditions of Contract, Specifications, Drawings, and Bill of Quantities are not part of the text of the final document, although they contain instructions that the Procuring Entity should strictly follow.
- d. The cover should be modified as required to identify the Bidding Documents as to the names of the Project, Contract, and Procuring Entity, in addition to date of issue.

- e. Modifications for specific Procurement Project details should be provided in the Special Conditions of Contract as amendments to the Conditions of Contract. For easy completion, whenever reference has to be made to specific clauses in the Bid Data Sheet or Special Conditions of Contract, these terms shall be printed in bold typeface on Sections I (Instructions to Bidders) and III (General Conditions of Contract), respectively.
- f. For guidelines on the use of Bidding Forms and the procurement of Foreign-Assisted Projects, these will be covered by a separate issuance of the Government Procurement Policy Board.

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Glossary of Terms, Abbreviations, and Acronyms

ABC – Approved Budget for the Contract.

ARCC – Allowable Range of Contract Cost.

BAC – Bids and Awards Committee.

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

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

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

BIR – Bureau of Internal Revenue.

BSP – Bangko Sentral ng Pilipinas.

CDA – Cooperative Development Authority.

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

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

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

CPI – Consumer Price Index.

DOLE – Department of Labor and Employment.

DTI – Department of Trade and Industry.

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

GFI – Government Financial Institution.

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

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

GOP – Government of the Philippines.

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

LGUs – Local Government Units.

NFCC – Net Financial Contracting Capacity.

NGA – National Government Agency.

PCAB – Philippine Contractors Accreditation Board.

PhilGEPS - Philippine Government Electronic Procurement System.

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

PSA – Philippine Statistics Authority.

SEC – Securities and Exchange Commission.

SLCC – Single Largest Completed Contract.

UN – United Nations.

Section I. Invitation to Bid

Notes on the Invitation to Bid

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

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

- a. The date of availability of the Bidding Documents, which shall be from the time the IB is first advertised/posted until the deadline for the submission and receipt of bids;
- b. The place where the Bidding Documents may be acquired or the website where it may be downloaded;
- c. The deadline for the submission and receipt of bids; and
- d. Any important bid evaluation criteria.

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

PROVINCIAL GOVERNMENT OF ISABELA

Invitation to Bid for Construction of Multi-Purpose Hall at Barangay Quibal, Delfin Albano, Isabela

1. The *Provincial Government of Isabela*, through the *AIP 2020 (EDF 2020)* intends to apply the sum of ***Two Million Five Hundred Thousand Pesos (Php 2,500,000.00)*** for the ***Construction of Multi-Purpose Hall at Barangay Quibal, Delfin Albano, Isabela and Project Identification Number 021-01 Lot 4***, being the Approved Budget for the Contract (ABC) to payments under the contract for each lot. Bids received in excess of the ABC for each lot shall be automatically rejected at bid opening.
2. The *Provincial Government of Isabela* now invites bids for the above Procurement Project. Completion of the Works is required *within One Hundred Fourteen (114) calendar days*. Bidders should have completed a contract similar to the Project. The description of an eligible bidder is contained in the Bidding Documents, particularly, in Section II (Instructions to Bidders).
3. Bidding will be conducted through open competitive bidding procedures using non-discretionary “*pass/fail*” criterion as specified in the 2016 revised Implementing Rules and Regulations (IRR) of Republic Act (RA) No. 9184.
4. Interested bidders may obtain further information from *Bids and Awards Committee (BAC)* and inspect the Bidding Documents at the address given below from 8:00 a.m. to 5:00 p.m.
5. A complete set of Bidding Documents may be acquired by interested bidders on *February 03, 2021* from given address and website/s below and upon payment of the applicable fee for the Bidding Documents, pursuant to the latest Guidelines issued by the GPPB, *in the amount of Five Thousand Pesos (Php 5,000.00)*. The Procuring Entity shall allow the bidder to present its proof of payment for the fees to be presented in person.
6. The *Provincial Government of Isabela* will hold a Pre-Bid Conference¹ on *February 15, 2021 at 10:00 a.m.* at BAC office, PGSO Bldg., Alibagu, City of Ilagan, Isabela, if applicable, and/or through videoconferencing/webcasting *via Zoom*, which shall be open to prospective bidders.
7. Bids must be duly received by the BAC Secretariat through manual submission at the office address as indicated below, on or before *10:00 A.M., March 01, 2021*. Late bids shall not be accepted.
8. All bids must be accompanied by a bid security in any of the acceptable forms and in the amount stated in **ITB** Clause 16.

¹ May be deleted in case the ABC is less than One Million Pesos (PhP1,000,000) where the Procuring Entity may not hold a pre-bid conference.

9. Bid opening shall be on *10:30 A.M., March 01, 2021* at the given address below. Bids will be opened in the presence of the bidders' representatives who choose to attend the activity.
10. The *Provincial Government of Isabela* reserves the right to reject any and all bids, declare a failure of bidding, or not award the contract at any time prior to contract award in accordance with Sections 35.6 and 41 of the 2016 revised Implementing Rules and Regulations (IRR) of RA No. 9184, without thereby incurring any liability to the affected bidder or bidders.
11. For further information, please refer to:

*MARY ANN T. BALLESTEROS
BAC Office, PGSO Bldg.,
Capitol City of Ilagan, Isabela
078-323-0570
pgso.isabelaprovince@yahoo.com.ph*

12. You may visit the following websites:

For downloading of Bidding Documents: *PhilGEPS Bid Opportunities of the Province of Isabela.*

February 03, 2021

(Sgd.) RODRIGO T. SAWIT

BAC Chairman

Section II. Instructions to Bidders

Notes on the Instructions to Bidders

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

1. Scope of Bid

The Procuring Entity, *Provincial Government of Isabela* invites Bids for the *Construction of Multi-Purpose Hall at Barangay Quibal, Delfin Albano, Isabela*, with Project Identification Number *021-01 Lot 4*.

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

2. Funding Information

2.1. The GOP through the source of funding as indicated below for *AIP 2020 (EDF 2020)* in the amount of *Two Million Five Hundred Thousand Pesos (Php 2,500,000.00)*.

2.2. The source of funding is:

a. LGUs, the Annual or Supplemental Budget, as approved by the Sanggunian.

3. Bidding Requirements

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

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

The Bidder, by the act of submitting its Bid, shall be deemed to have inspected the site, determined the general characteristics of the contracted Works and the conditions for this Project, such as the location and the nature of the work; (b) climatic conditions; (c) transportation facilities; (c) nature and condition of the terrain, geological conditions at the site communication facilities, requirements, location and availability of construction aggregates and other materials, labor, water, electric power and access roads; and (d) other factors that may affect the cost, duration and execution or implementation of the contract, project, or work and examine all instructions, forms, terms, and project requirements in the Bidding Documents.

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

The Procuring Entity, as well as the Bidders and Contractors, shall observe the highest standard of ethics during the procurement and execution of the contract. They or through an agent shall not engage in corrupt, fraudulent, collusive, coercive, and obstructive practices defined under Annex “I” of the 2016 revised IRR of RA No. 9184 or other integrity violations in competing for the Project.

5. Eligible Bidders

- 5.1. Only Bids of Bidders found to be legally, technically, and financially capable will be evaluated.
- 5.2. The Bidder must have an experience of having completed a Single Largest Completed Contract (SLCC) that is similar to this Project, equivalent to at least fifty percent (50%) of the ABC adjusted, if necessary, by the Bidder to current prices using the PSA's CPI, except under conditions provided for in Section 23.4.2.4 of the 2016 revised IRR of RA No. 9184.

A contract is considered to be "similar" to the contract to be bid if it has the major categories of work stated in the **BDS**.
- 5.3. For Foreign-funded Procurement, the Procuring Entity and the foreign government/foreign or international financing institution may agree on another track record requirement, as specified in the Bidding Document prepared for this purpose.
- 5.4. The Bidders shall comply with the eligibility criteria under Section 23.4.2 of the 2016 IRR of RA No. 9184.

6. Origin of Associated Goods

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

7. Subcontracts

- 7.1. The Bidder may subcontract portions of the Project to the extent allowed by the Procuring Entity as stated herein, but in no case more than fifty percent (50%) of the Project.

The Procuring Entity has prescribed that:

- a. Subcontracting is not allowed.

8. Pre-Bid Conference

The Procuring Entity will hold a pre-bid conference for this Project on the specified date and time and either at its physical address at BAC office, PGSO Bldg., Alibagu, City of Ilagan, Isabela, if applicable, and/or through videoconferencing/webcasting } as indicated in paragraph 6 of the **IB**.

9. Clarification and Amendment of Bidding Documents

Prospective bidders may request for clarification on and/or interpretation of any part of the Bidding Documents. Such requests must be in writing and received by the Procuring Entity, either at its given address or through electronic mail indicated in the

IB, at least ten (10) calendar days before the deadline set for the submission and receipt of Bids.

10. Documents Comprising the Bid: Eligibility and Technical Components

- 10.1. The first envelope shall contain the eligibility and technical documents of the Bid as specified in **Section IX. Checklist of Technical and Financial Documents**.
- 10.2. If the eligibility requirements or statements, the bids, and all other documents for submission to the BAC are in foreign language other than English, it must be accompanied by a translation in English, which shall be authenticated by the appropriate Philippine foreign service establishment, post, or the equivalent office having jurisdiction over the foreign bidder's affairs in the Philippines. For Contracting Parties to the Apostille Convention, only the translated documents shall be authenticated through an apostille pursuant to GPPB Resolution No. 13-2019 dated 23 May 2019. The English translation shall govern, for purposes of interpretation of the bid.
- 10.3. A valid PCAB License is required, and in case of joint ventures, a valid special PCAB License, and registration for the type and cost of the contract for this Project. Any additional type of Contractor license or permit shall be indicated in the **BDS**.
- 10.4. A List of Contractor's key personnel (e.g., Project Manager, Project Engineers, Materials Engineers, and Foremen) assigned to the contract to be bid, with their complete qualification and experience data shall be provided. These key personnel must meet the required minimum years of experience set in the **BDS**.
- 10.5. A List of Contractor's major equipment units, which are owned, leased, and/or under purchase agreements, supported by proof of ownership, certification of availability of equipment from the equipment lessor/vendor for the duration of the project, as the case may be, must meet the minimum requirements for the contract set in the **BDS**.

11. Documents Comprising the Bid: Financial Component

- 11.1. The second bid envelope shall contain the financial documents for the Bid as specified in **Section IX. Checklist of Technical and Financial Documents**.
- 11.2. Any bid exceeding the ABC indicated in paragraph 1 of the **IB** shall not be accepted.
- 11.3. For Foreign-funded procurement, a ceiling may be applied to bid prices provided the conditions are met under Section 31.2 of the 2016 revised IRR of RA No. 9184.

12. Alternative Bids

Bidders shall submit offers that comply with the requirements of the Bidding Documents, including the basic technical design as indicated in the drawings and specifications. Unless there is a value engineering clause in the **BDS**, alternative Bids shall not be accepted.

13. Bid Prices

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

14. Bid and Payment Currencies

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

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

- a. Philippine Pesos.

15. Bid Security

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

15.2. The Bid and bid security shall be valid until **May 30, 2021**. Any bid not accompanied by an acceptable bid security shall be rejected by the Procuring Entity as non-responsive.

16. Sealing and Marking of Bids

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

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

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

17. **Deadline for Submission of Bids**

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

18. **Opening and Preliminary Examination of Bids**

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

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

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

19. **Detailed Evaluation and Comparison of Bids**

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

19.2. If the Project allows partial bids, all Bids and combinations of Bids as indicated in the **BDS** shall be received by the same deadline and opened and evaluated simultaneously so as to determine the Bid or combination of Bids offering the lowest calculated cost to the Procuring Entity. Bid Security as required by **ITB** Clause 16 shall be submitted for each contract (lot) separately.

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

20. **Post Qualification**

Within a non-extendible period of five (5) calendar days from receipt by the Bidder of the notice from the BAC that it submitted the Lowest Calculated Bid, the Bidder shall submit its latest income and business tax returns filed and paid through the BIR Electronic Filing and Payment System (eFPS), and other appropriate licenses and permits required by law and stated in the **BDS**.

21. **Signing of the Contract**

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

Section III. Bid Data Sheet

Notes on the Bid Data Sheet (BDS)

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

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

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

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

Bid Data Sheet

ITB Clause			
5.2	For this purpose, contracts similar to the Project refer to contracts which have the same major categories of work, which shall be: <i>Item 803 – Structure Excavation</i> <i>Item 804 - Embankment</i> <i>Item 900 – Concrete Works</i> <i>Item 902 – Reinforcing Steel Bars</i> <i>Item 903 – Formworks and Falseworks</i> <i>Item 1046 – Masonry Works</i> <i>Item 1027 – Cement Plaster Finish</i> <i>Item 1014 – Pre-Painted Metal Sheets</i> <i>Item 1013 – Fabricated Roofing Accessories</i> <i>Item 1047 – Metal Structures</i> <i>Item 1032 – Painting Works</i> <i>Item 1100 – Electrical Works</i> <i>Item 1103 – Lighting Fixtures</i>		
7.1	<i>Subcontracting is not allowed.</i>		
10.3	<i>No Further Instructions</i>		
10.4	The key personnel must meet the required minimum years of experience set below:		
	<u>Key Personnel</u>	<u>General Experience</u>	<u>Relevant Experience</u>
	1. Project Engineer (PE)	Minimum of five (5) years' experience as Licensed Civil	With a minimum of Two (2) Building Construction projects handled as Project Engineer
	2. Materials Engineer (ME)	Licensed Civil Engineer	Materials Engineer duly accredited by DPWH
10.5	The minimum major equipment requirements are the following:		
	Minimum Required Equipment	Owned	Leased
	1. One Bagger Mixer	1	0
	2. Concrete Vibrator	1	0
	3. Bar Cutter	1	0
	4. Welding Machine	1	0
	TOTAL	4	0
12	<i>No Further Instructions</i>		
15.1	The bid security shall be in the form of a Bid Securing Declaration or any of the following forms and amounts: <ol style="list-style-type: none"> a. The amount of not less than <i>Fifty Thousand Pesos (Php50,000.00)</i>, if bid security is in cash, cashier's/manager's check, bank draft/guarantee or irrevocable letter of credit; 		

	b. The amount of not less than <i>One Hundred Twenty Five Thousand Pesos (Php 125,000.00)</i> if bid security is in Surety Bond.
19.2	Partial bids are allowed, as follows: <i>[Partial bids not allowed]</i>
20	<i>Latest income and business tax returns filed and paid through the BIR Electronic Filing and Payment System (eFPS)</i>
21	Additional contract documents relevant to the Project that may be required by existing laws and/or the Procuring Entity, such as construction schedule and S-curve, manpower schedule, construction methods, equipment utilization schedule, construction safety and health program approved by the DOLE, and other acceptable tools of project scheduling.

Section IV. General Conditions of Contract

Notes on the General Conditions of Contract

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

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

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

1. **Scope of Contract**

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

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

2. **Sectional Completion of Works**

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

3. **Possession of Site**

4.1. The Procuring Entity shall give possession of all or parts of the Site to the Contractor based on the schedule of delivery indicated in the **SCC**, which corresponds to the execution of the Works. If the Contractor suffers delay or incurs cost from failure on the part of the Procuring Entity to give possession in accordance with the terms of this clause, the Procuring Entity's Representative shall give the Contractor a Contract Time Extension and certify such sum as fair to cover the cost incurred, which sum shall be paid by Procuring Entity.

4.2. If possession of a portion is not given by the above date, the Procuring Entity will be deemed to have delayed the start of the relevant activities. The resulting adjustments in contract time to address such delay may be addressed through contract extension provided under Annex "E" of the 2016 revised IRR of RA No. 9184.

4. **The Contractor's Obligations**

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

The Procuring Entity will approve any proposed replacement of key personnel only if their relevant qualifications and abilities are equal to or better than those of the personnel listed in the Schedule.

5. **Performance Security**

- 5.1. Within ten (10) calendar days from receipt of the Notice of Award from the Procuring Entity but in no case later than the signing of the contract by both parties, the successful Bidder shall furnish the performance security in any of the forms prescribed in Section 39 of the 2016 revised IRR.
- 5.2. The Contractor, by entering into the Contract with the Procuring Entity, acknowledges the right of the Procuring Entity to institute action pursuant to RA No. 3688 against any subcontractor be they an individual, firm, partnership, corporation, or association supplying the Contractor with labor, materials and/or equipment for the performance of this Contract.

6. Site Investigation Reports

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

7. Warranty

- 7.1. In case the Contractor fails to undertake the repair works under Section 62.2.2 of the 2016 revised IRR, the Procuring Entity shall forfeit its performance security, subject its property(ies) to attachment or garnishment proceedings, and perpetually disqualify it from participating in any public bidding. All payables of the GOP in his favor shall be offset to recover the costs.
- 7.2. The warranty against Structural Defects/Failures, except that occasioned-on force majeure, shall cover the period from the date of issuance of the Certificate of Final Acceptance by the Procuring Entity. Specific duration of the warranty is found in the SCC.

8. Liability of the Contractor

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

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

9. Termination for Other Causes

Contract termination shall be initiated in case it is determined *prima facie* by the Procuring Entity that the Contractor has engaged, before, or during the implementation of the contract, in unlawful deeds and behaviors relative to contract acquisition and implementation, such as, but not limited to corrupt, fraudulent, collusive, coercive, and obstructive practices as stated in ITB Clause 4.

10. Dayworks

Subject to the guidelines on Variation Order in Annex “E” of the 2016 revised IRR of RA No. 9184, and if applicable as indicated in the **SCC**, the Dayworks rates in the Contractor’s Bid shall be used for small additional amounts of work only when the Procuring Entity’s Representative has given written instructions in advance for additional work to be paid for in that way.

11. Program of Work

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

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

12. Instructions, Inspections and Audits

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

13. Advance Payment

The Procuring Entity shall, upon a written request of the Contractor which shall be submitted as a Contract document, make an advance payment to the Contractor in an amount not exceeding fifteen percent (15%) of the total contract price, to be made in lump sum, or at the most two installments according to a schedule specified in the **SCC**, subject to the requirements in Annex “E” of the 2016 revised IRR of RA No. 9184.

14. Progress Payments

The Contractor may submit a request for payment for Work accomplished. Such requests for payment shall be verified and certified by the Procuring Entity’s Representative/Project Engineer. Except as otherwise stipulated in the **SCC**, materials and equipment delivered on the site but not completely put in place shall not be included for payment.

15. Operating and Maintenance Manuals

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

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

Section V. Special Conditions of Contract

Notes on the Special Conditions of Contract

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

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

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

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

Special Conditions of Contract

GCC Clause	
2	<i>Intended Completion date is One Hundred Fourteen Calendar Days (114) starting seven (7) calendar days upon receipt of Notice to Proceed.</i>
4.1	<i>Upon receipt of Notice to Proceed.</i>
6	The site investigation reports are: <i>The site is cleared of any obstruction and right of way issues.</i>
7.2	<i>[In case of permanent structures, such as buildings of types 4 and 5 as classified under the National Building Code of the Philippines and other structures made of steel, iron, or concrete which comply with relevant structural codes (e.g., DPWH Standard Specifications), such as, but not limited to, steel/concrete bridges, flyovers, aircraft movement areas, ports, dams, tunnels, filtration and treatment plants, sewerage systems, power plants, transmission and communication towers, railway system, and other similar permanent structures:] Fifteen (15) years.</i>
10	Dayworks are applicable at the rate shown in the Contractor's original Bid.
11.1	The Contractor shall submit the Program of Work to the Procuring Entity's Representative within <i>Thirty (30)</i> days of delivery of the Notice of Award.
11.2	The amount to be withheld for late submission of an updated Program of Work is <i>[1/10 of 1% of Contract Amount]</i> .
13	The amount of the advance payment is <i>[15% of the total contract price and schedule of payment]</i> .
14	Materials and equipment delivered on the site but not completely put in place shall not be included for payment.
15.1	The date by which operating and maintenance manuals are required is <i>[One year after completion date]</i> . The date by which "as built" drawings are required is <i>[within thirty days upon completion]</i> .
15.2	The amount to be withheld for failing to produce "as built" drawings and/or operating and maintenance manuals by the date required is <i>[1/10 of 1% of Contract Amount]</i> .

Section VI. Specifications

TABLE OF CONTENT

ITEM NO.	DESCRIPTION
B.5	Project Billboards/Signboards
B.7	Occupational safety and Health
B.9	Mobilization/Demobilization
803(1)	Structure Excavation (Common Soil)
804	Embankment
900(1)	Structural Concrete
902(1)	Reinforcing Steel Bars
903	Formworks and Falseworks
1046	150mm CHB Non Load Bearing
1047	Structural Steel
1014	Pre-Painted Metal Sheets (Rib Type)
1013	Metal Structure Accessories
1027	Cement Plaster Finish
1032	Painting Works
1038	Reflective Insulation
SPL A	Rubberized Painting
1001(6)	Catch Basin
1100	Electrical Works
1102	Panel Board
1103	Lighting Fixtures

B.5 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.

**ANNEX 14
PROJECT BILLBOARD**

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

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

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

Post and Frame

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

Concrete Foundation Blocks

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

Construction Requirements

Excavation and Backfilling

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

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

Erection of Posts

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

Tarpaulin Installation

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

Method of Measurement

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

Basis of Payment

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

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
B.5	Project Billboard	Each

B.7 CONSTRUCTION SAFETY & HEALTH PROGRAM

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

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

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

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

- a. Registration (Rule 1020 and DO 18---02)

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

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

1.3 Composition of Construction Safety and Health Committee.

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

1.4 Safety and Health Personnel. The following shall apply:

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

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

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

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

- a. Detailed information dissemination or advisories to the new employees prior to on-site assignment, e.g. conduct of safety orientation, company's health and safety policies, hazards related to the job safety measures, safe work procedures.
- b. Detailed programs on continuing education such as trainings and seminars, if any, that shall be given to employees, e.g. BOSH, refresher course, first aid training, refresher course toolbox meeting, construction safety training for site safety officers, 80-hour advance safety course prescribe.
- c. Arrangements for conveying information on safety and health IEC materials e.g. Posters/comics/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/or present 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 is no other more practicable height placement.
- f. Regularly inspected and maintained in good condition to achieve its purpose. Signages that are damaged; illegible or that no longer apply as to purpose, site or language, shall be removed or be replaced by the safety officer when needed.
- g. Removed after the hazard is completely eliminated. If upon work completion the hazard is still present, the signage shall remain in place.
- h. Designed and constructed following the Overall Dimensions of Safety Signs Formula as required by the OSHS

- i. Specific with the type of hazard and should indicate the name of the contaminant/ substance involved (for chemical hazards), and the type of PPE or respiratory equipment to be worn.

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

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

5.3 Barricading Procedures: The following shall apply:

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

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

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

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

6.1 Composition

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

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

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

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

6.2 Duties and responsibilities

- a. The Project Manager or his representative shall act as the Chairperson of the committee.
- b. The committee shall conduct safety meetings at least once a month.
- c. The persons constituting the Safety and Health Committee shall, as far as practicable, be at the construction site whenever construction work is being undertaken.
- d. The committee shall continually plan and develop accident prevention programs.

- e. The committee shall review reports of inspection, accident investigation and monitor implementation of the safety program.
- f. The committee shall provide necessary assistance to government authorities authorized to conduct inspection in the proper conduct of their activities
- g. The committee shall initiate and supervise safety trainings for its employees
- h. The committee shall conduct safety inspection at least once a month, and shall conduct investigation of work accidents and shall submit a regular report to DOLE.
- i. The committee shall initiate and supervise the conduct of daily brief safety meetings or toolbox meetings.
- j. The committee shall prepare and submit to DOLE, reports on said committee meetings.
- k. The committee shall develop a disaster contingency plan and organize such emergency service units as may be necessary to handle disaster situations.

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

7.1 The Construction Safety and Health Report shall include:

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

7.2 Submission of Reports. The following shall apply:

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

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

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

8.2 The cost of the following PPEs: helmet, eye goggles, safety shoes, working gloves, rain coats, dust mask, ear muffs, rubber boots, and other similar PPE's shall be indicated/enumerated per cost, per worker, foreman, leadman, jackhammer operator, carpenter, electrician, mason,

steelman, painter, mechanic, welder, plumber, heavy equipment operator, physician/inspector, and other such personnel.

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

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

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

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

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

9.1 Workers shall be adequately and suitably:

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

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

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

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

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

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

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

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

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

10. Welfare Facilities. The following shall apply:

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

10.1 Adequate supply of safe drinking water:

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

10.2 Adequate sanitary and washing facilities:

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

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

- a. Where the number of female workers exceeds 100, one (1) and bath facilities for every 20 female workers up to the first 100 and one (1) toilet and bath facilities for every 30 additional female workers.

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

Mode of Measurement

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

Basis of Payment

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

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
B.7	Construction Safety &Health program	Lump Sum

ATTACHMENT C

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

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

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

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

B.9 MOBILIZATION AND DEMOBILIZATION

General

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

Scope of Work

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

Mobilization

- a) The Contractor shall mobilize and put into operation all equipment required to undertake the Bid Documents, which is the Bill of Quantities and all associated work items.
- b) Mobilization shall include the transferring to the job-sites of all equipment necessary for the execution and completion of the work subject to the confirmation of the LGU.
- c) Equipment encountering breakdowns must be repaired at the most expeditious method possible at no cost to the LGU. In the event that the equipment call for major repair works that cannot be undertaken at the site, the Contractor shall replace such equipment with equal or better performance capacity at no additional mobilization costs to the LGU, and the Contractor shall not be entitled to any time extension.
- d) The Contractor will be held responsible for any damage to existing structures, works, materials, or equipment because of his operations. The Contractor shall repair or

replace any damaged structures, works, materials, or equipment to the satisfaction of the LGU, and at no additional cost to the Procuring Entity.

- e) The Contractor shall be responsible for all damage to streets, roads, railroads, curbs, sidewalks, highways, shoulders, ditches, embankment, culverts, bridges, or other public or private property, which may be caused by the transport of equipment to or from the Works.
- f) All construction equipment provided by the Contractor shall, when brought on to the Site, be deemed to be exclusively intended for the construction and completion of the Works and the Contractor shall not remove the same or any part thereof without the approval of the LGU.
- g) The LGU shall not at any time be liable for the loss or damage to any of the said construction plant and equipment provided by the Contractor.

Demobilization

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

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

Method of Measurement

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

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

Basis of Payment

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

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

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

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

<u>Pay Item</u>	<u>Description</u>	<u>Unit</u>
B.9	Mobilization and Demobilization	lump sum

ITEM 803 - STRUCTURE EXCAVATION

803.1 Description

This Item shall consist of the necessary excavation for foundation of bridges, culverts, underdrains, and other structures not otherwise provided for in the Specifications. Except as otherwise provided for pipe culverts, the backfilling of completed structures and the disposal of all excavated surplus materials, shall be in accordance with these Specifications and in reasonably close conformity with the Plans or as established by the Engineer.

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

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

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

803.2 Construction Requirements

803.2.1 Clearing and Grubbing

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

803.2.2 Excavation

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.

803.2.3 Utilization of Excavated Materials

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

803.2.4 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.

803.2.5 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.

803.2.6 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.

803.2.7 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.

803.3 Method of Measurement

803.3.1 Structure Excavation

The volume of excavation to be paid for will be the number of cubic metres measured in original position of material acceptably excavated in conformity with the Plans or as directed by the Engineer, but in no case, except as noted, will any of the following volumes be included in the measurement for payment:

- (1) The volume outside of vertical planes 450 mm (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 underdrains as shown on the Plans, and outside the limits of foundation fill as ordered by the Engineer.
- (4) The volume included within the staked limits of the roadway excavation, contiguous channel changes, ditches, etc., for which payment is otherwise provided in the Specification.

- (5) Volume of water or other liquid resulting from construction operations and which can be pumped or drained away.
- (6) The volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed ground.
- (7) the volume of any material rehandled, except that where the Plans indicate or the Engineer directs the excavation after embankment has been placed and except that when installation of pipe culverts by the imperfect trench method specified in Item 500 is required, the volume of material re-excavated as directed will be included.
- (8) The volume of excavation for footings ordered at a depth more than 1.5 m (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.

803.3.2 Bridge Excavation

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

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.

803.3.3 Foundation Fill

The volume of foundation fill to be paid for will be the number of cubic metres measures 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.

803.3.4 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.

803.3.5 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:

Pay Item Number	Description	Unit of Measurement
803	Structural Excavation	Cubic meter

ITEM 804 - EMBANKMENT

804.1 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.

804.2 Material Requirements

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

1. Suitable Material – Material which is acceptable in accordance with the Contract and which can be compacted in the manner specified in this Item. It can be common material or rock.

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

ASSHTO T 90 and a liquid limit of not more than 30 as determined by AASHTO T 89.

2. Unsuitable Material – Material other than suitable materials such as:
 - (a) Materials containing detrimental quantities of organic materials, such as grass, roots and sewerage.
 - (b) Organic soils such as peat and muck.
 - (c) Soils with liquid limit exceeding 80 and/or plasticity index exceeding 55.
 - (d) Soils with a natural water content exceeding 100%.
 - (e) Soils with very low natural density, 800 kg/m³ or lower.
 - (f) Soils that cannot be properly compacted as determined by the Engineer.

804.3 Construction Requirements

804.3.1 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.

804.3.2 Methods of Construction

Where there is evidence of discrepancies on the actual elevations and that shown on the Plans, a preconstruction survey referred to the datum plane used in the approved Plan shall

be undertaken by the Contractor under the control of the Engineer to serve as basis for the computation of the actual volume of the embankment materials.

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

Unless shown otherwise on the Plans or special Provisions, where an embankment of less than 1.2 m (4 feet) below subgrade is to be made, all sod and vegetable matter shall be removed from the surface upon which the embankment is to be placed, and the cleared surfaced shall be completely broken up by plowing, scarifying, or steeping to a minimum depth of 150 mm except as provided in Subsection 102.2.2. This area shall then be compacted as provided in Subsection 104.3.3. Sod not required to be removed shall be thoroughly disc harrowed or scarified before construction of embankment. Wherever a compacted road surface containing granular materials lies within 900 mm (36 inches) of the subgrade, such old road surface shall be scarified to a depth of at least 150 mm (6 inches) whenever directed by the Engineer. This scarified materials shall then be compacted as provided in Subsection 104.3.3.

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

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

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

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

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

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

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

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

804.3.3 Compaction

Compaction Trials

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

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

Earth

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

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

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

Rock

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

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

804.3.4 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.

804.3.5 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.

804.3.6 Rounding and Warping Slopes

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

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

804.3.7 Finishing Roadbed and Slopes

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

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

804.3.8 Serrated Slopes

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

804.3.9 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

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. 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

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. Contractor shall take precautions to prevent material from escaping over the embankment slope.

804.4 Method of Measurement

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

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

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

804.5 Basis of Payment

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

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
804(1)a	Embankment from Structure Excavation	Cubic Meter
804(1)b	Embankment from Borrow by Equipment	Cubic Meter
804 (4)	Gravel Bedding	Cubic Meter

ITEM 900 - REINFORCED CONCRETE

900.1 Description

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

900.2 Materials Requirements

900.2.1 Portland Cement

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

900.2.2 Concrete Aggregates

Concrete aggregate shall conform to the requirements of subsection 311.2.2 and 311.2.3 under Item 311 of Volume II, (Blue Book) and ASTM C 33 for lightweight aggregates, except that aggregates failing to meet these specifications but which have been shown by special that or actual service to produce concrete of adequate strength and durability may be used under method (2) of determining the proportion of concrete, where authorized by the Engineer.

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

900.2.2.1 Aggregate Tests

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

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

900.2.3 Water

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

900.2.4 Metal Reinforcement

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

Deformed & Plain Billet Steel Bars for concrete Reinforcement (ASTM A 615)

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

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

Bar and rod mats for concrete reinforcement	ASTM A 187
Cold-Drawn Steel Wire for	(ASTM A 82)
concrete reinforcement	AASHTO M 32
Welded steel wire fabric	(ASTM A 185)
for concrete reinforcement	AASHTO M55
except that the weld shear strength requirement of those specification shall be extended to include a wire size differential up to and including six gages.	
Wire and Strands for prestressed	ASTMA416
Concrete	ASTM A 421

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

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

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

pipe columns

Cast-Iron Pipe for composite

ASTM A 377

columns

900.2.5 Admixtures

Air-entraining admixtures, if used, shall conform to ASTM C 260.

Water-reducing admixtures, retarding admixtures, water-reducing and retarding admixtures and water reducing and accelerating admixtures, if used, shall conform to the requirements of ASTM C 494.

900.2.6 Storage of Materials

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

900.3 Construction Requirements

Notations: The notations used in these regulations are defined as follows:

f'_c = compressive strength of concrete

F_{sp} = ratio of splitting tensile strength to square root of compressive strength.

900.3.1 Concrete Quality

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

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

900.3.2 Methods of Determining the Proportions of Concrete

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

Method 1, Without preliminary test

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

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

Water-cement ratios for strengths greater than that shown in Table I 900.1 may be used provided that the relationship between strength and I water-cement ratio for the materials to be used has been previously established by reliable test data and the resulting concrete satisfies the requirements of concrete quality.

Where previous data are not available. Concrete trial mixtures having proportions and consistency suitable for the work shall be made using at least three different water-cement ratios (or cement content in I the case of lightweight aggregates) which will produce a range of strengths encompassing those required for the work. For each water-cement ratio (or cement content) at least three specimens for each age to be tested shall be made, cured and tested for strength in accordance with ASTM C 39 and C 192.

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

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

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

Specified compressive strength at 28 days, psi fc	Maximum permissible water-cement ratio			
	Non air-entrained concrete		Air-entrained concrete	
	U.S. gal. per 42.6 kg. bag of cement	Absolute ratio by weight	U.S. gal per 42.6 kg. bag of cement	Absolute ratio by weight

2500	7 ¼	0.642	6 ¼	0.554
3000	6 ½	0.576	5 ¼	0.465
3500	5 ¾	0.510	4 ½	0.399
4000	5	0.443	4	0.354

900.3.3 Concrete Proportions and Consistency

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

900.3.4 Sampling and Testing of Structural Concrete

As work progress, at least one (1) set of sample consisting of three (3) concrete cylinder test specimens, 150 x 300 mm shall be taken from each class of concrete placed each day, and each set to represent not more than 75 cu m of concrete.

900.3.5 Consistency

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

900.3.6 Strength Test of Concrete

When strength is a basis for acceptance, each class of concrete shall be represented by at least five test (10 specimens). Two specimens shall be made for each test at a given age, and

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

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

To conform to the requirements of this Item:

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

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

When it appears that the laboratory-cured specimens will fail to conform to the requirements for strength, the Engineer shall have the right to order changes in the concrete sufficient to increase the strength to meet these requirements. The strengths of the specimens cured on the job are intended to indicate the adequacy of protection and curing of the concrete and may be used to determine when the forms may be stripped, shoring removed, or the structure placed in service. When, in the opinion of the Building Official, the strengths of the job-cured specimens, the contractor may be required to improve the procedures for protecting and curing the concrete, or when test of field-cured cylinders indicate deficiencies in protection and curing, the Engineer may require test in accordance with ASTM Specification C 42 or order load tests as outlined in the load tests of structures for that portion of the structure where the questionable concrete has been placed.

900.3.7 Splitting Tensile Test of Concrete

To determine the splitting ratio, F_{sp} , for a particular aggregate, test of concrete shall be made as follows:

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

2. The splitting tensile strength shall be determine in accordance with ASTM C 496, and compressive strength in accordance with ASTM C 39.

The ratio, F_{sp} , of splitting tensile strength to the square root of compressive strength shall be obtained by using the average of all 16 splitting tensile test and all 8 compressive tests.

Minimum Strength, Concrete other than fill, shall have a minimum compressive strength at 28 days of 140 kilograms per square centimeter (2000 psi).

900.3.8 Batching

Batching shall conform to the requirements of Item 405, Structural Concrete.

900.3.9 Mixing and Delivery

Mixing and delivery shall conform to the requirements of Item 405, Structural Concrete.

900.4 Concrete Surface Finishing: General

This shall be in accordance with Item 407, Concrete Structures.

900.5 Curing Concrete (See subsection 407)

900.6 Acceptance of Concrete

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

Concrete deemed to be not acceptable using the above criteria may be rejected unless contractor can provide evidence, by means of core tests, that the quality of concrete represented by the failed test result is acceptable in place. Three (3) cores shall be obtained from the affected area and cured and tested in accordance with AASHTO T24.

Concrete in the area represented by the cores will be deemed acceptable if the average of cores is equal to or at least 85 % and no sample core is less than 75 % of the specified strength otherwise it shall be rejected.

900.7 Method of Measurement

The quantity of concrete to be paid shall be the quantity shown in the Bid Schedule, unless changes in design are made in which case the quantity shown in the Bid Schedule will

be adjusted by the amount of the change for the purpose of payment. No deduction will be made for the volume occupied by the pipe less than 101 mm (4") in diameter nor for reinforcing steel anchors, weepholes or expansion materials.

900.8 Basis of Payment

The accepted quantities of structural concrete completed in place will be paid for at the contract unit price for cubic meter as indicated on the Bid Schedule.

Pay Item Number	Description	Unit of Measurement
900(1)	Structural Concrete for Footing Tie Beam, Column, Suspended Slab, Girder/Beam (Class A 28 days)	Cu.m.
900(1)c2	Structural Concrete for Footing, Slab on Fill (Class A 28 days)	Cu.m.

Such prices and payment shall be full compensation for furnishing all materials, including metal water stops, joints, joint fillers, weep holes, and rock backing and timber bumpers; for all form and false work; for mixing, placing, furnishing, and curing the concrete; and for all labor, materials, equipment, tools and incidentals necessary to complete the item, except that reinforcing steel shall be paid for at the contract unit price per kilogram for reinforcing steel metal pipes and drains, metal conduits and ducts, and metal expansion angles shall be paid for as structural steel that when the proposal does not include an item for structural steel these miscellaneous metal parts shall be paid for as reinforcing steel.

ITEM 902 – REINFORCING STEEL BARS

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 directions, in which case, alternate intersections shall be tied. Ties shall be fastened on the inside.

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

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:

Pay Item Number	Description	Unit of Measurement
902(1)	Reinforcing Steel Bars	Kilogram

ITEM 903(2) - FORMS AND FALSEWORKS

903.01 Description

This Item shall consist of furnishing, assembling and placing of forms and scaffoldings 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.

9033.02 Material Requirements

Marine Plywood (1/4" or 1/2") for forms or equivalent or as approved by the engineer and Lumber or steel scaffoldings or a combination hereof were the materials required under this section.

9033.03 Basis of Payment

The accepted quantity, measured as prescribed in this Section , shall be paid for at the contract unit price for Forms and Scaffoldings 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
903(2)	Forms and Falseworks	Sq.m.

ITEM 704/1046 – CONCRETE MASONRY BLOCKS/MASONRY WORKS

704.1 Clay or Shale Brick

Brick shall conform to the requirements of one of the following specifications:

- Sewer Brick - AASHTO M 91, Grade SM
- Sewer Brick - ASTM C 32, Grade SM
- Building Brick - AASHTO M 114, Grade SW, or ASTM C 62, Grade SW

The grade will be shown on the Plans or in the Special Provisions.

704.2 Concrete Brick

Concrete brick shall conform to the requirements of ASTM C 55, Grade A.

704.3 Concrete Masonry Blocks

Concrete masonry blocks may be rectangular or segmented and, when specified, shall have ends shaped to provide interlock at vertical joints.

Solid blocks shall conform with the requirements of ASTM C 139 or ASTM C 145, grade as specified. Hollow blocks shall conform to the requirements of ASTM C 90, grade as specified.

Dimensions and tolerances shall be as individually specified on the Plans.

704.4 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.

Pay Item Number	Description	Unit of Measurement
1046	150mm CHB Non Load Bearing (Including Reinforcement)	Sq.m.

ITEM 403/1047 - METAL STRUCTURES

403.1 Description

This work shall consist of steel structures and the steel structure portions of composite structures, constructed in reasonably close conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer.

The work will include the furnishing, fabricating, hauling, erecting, welding and painting of structural metals called for in the Special Provision or shown on the Plans. Structural metals will include structural steel, rivet, welding, special and alloy steels, steel forgings and castings and iron castings. This work will also include any incidental metal construction not otherwise provided for, all in accordance with these Specifications, Plans and Special Provisions.

403.2 Material Requirements

Materials shall meet the requirements of Item 712, Structural Metal; Item 409, Welded Structural Steel, and Item 409, Welded Structural Steel; and Item 709, Paints.

403.3 Construction Requirements

403.3.1 Inspection

The Contractor shall give the Engineer at least fifteen (15) days notice prior to the beginning of work at the mill or shop, so that the required inspection may be made. The term "mill" means any rolling mill, shop or foundry where material for the work is to be manufactured or fabricated. No material shall be rolled or fabricated until said inspection has been provided.

The Contractor shall furnish the Engineer with copies of the certified mill reports of the structural steel, preferably before but not later than the delivery of the steel to the job site.

The Contractor shall furnish all facilities for inspection and the Engineer shall be allowed free access to the mill or shop and premises at all times. The Contractor

shall furnish, without charge, all labor, machinery, material and tools necessary to prepare test specimens.

Inspection at the mill or shop is intended as a means of facilitating the work and avoiding errors and it is expressly understood that it will not relieve the Contractor from any responsibility for imperfect material or workmanship and the necessity for replacing same. The acceptance of any material or finished member at the mill or shop by the Engineer shall not preclude their subsequent rejection if found defective before final acceptance of the work. Inspection of welding will be in accordance with the provision of Section 5 of the "Standard Code for Arc and Gas Welding in Building Construction" of the American Welding Society.

403.3.2 Stock Material Control

When so specified in the Contract, stock material shall be segregated into classes designated as "identified" or "unidentified". Identified material is material which can be positively identified as having been rolled from a given heat for which certified mill test can be produced. Unidentified material shall include all other general stock materials. When it is proposed to use unidentified material, the Engineer shall be notified of such intention at least fifteen (15) days in advance of commencing fabrication to permit sampling and testing. When so indicated or directed, the Contractor shall select such material as he wishes to use from stock, and place it in such position that it will be accessible for inspection and sampling. The Contractor shall select identified material from as few heat numbers as possible, and furnish the certified mill test reports on each of such heat numbers. Two samples shall be taken from each heat number as directed, one for a tension test and one for a bend test.

In the case of unidentified stock, the Engineer may, at his discretion, select any number of random test specimens.

Each bin from which rivets or bolts are taken shall subject to random test. Five rivets or bolts may be selected by the Engineer from each bin for test purposes.

Structural material, either plain or fabricated, shall be stored above the ground upon platforms, skids, or other supports. It shall be kept free from dirt, grease, or other foreign matter, and shall be protected as far as practicable from corrosion.

403.3.3 Fabrication

These Specifications apply to riveted, bolted and welded construction. The Contractor may, however, with approval of the Engineer, substitute high tensile strength steel bolts equivalent to the rivets in any connection.

Workmanship and finish shall be in accordance with the best general practice in modern bridge shops. Portions of the work exposed to view shall be finished neatly. Shearing, flame cutting, and chipping shall be done carefully and accurately.

Structural material, either plain or fabricated, shall be stored above the ground upon platforms, skids or other supports. It shall be kept free from dirt, grease or other foreign matter, and shall be protected as far as practicable from corrosion.

Rolled material before being laid off or worked must be straight. If straightening is necessary, it shall be done by methods that will not injure the metal. Sharp kinks and bends will be cause for rejection of the material.

Preparation of material shall be in accordance with AWS (American Welding Society) D 1.1, paragraph 3.2 as modified by AASHTO Standard Specification for Welding of Structural Steel Highway Bridges.

403.3.4 Finishing and Shaping

Finished members shall be true to line and free from twists, bends and open joints.

1. Edge Planing

Sheared edges of plates more than 15.9 mm in thickness and carrying calculated stresses shall be planed to a depth of 6.3 mm. Re-entrant cuts shall be filleted before cutting.

2. Facing of Bearing Surfaces

The surface finish of bearing and based plates and other bearing surfaces that are to come in contact with each other or with concrete shall meet the American National Standards Institute surface roughness requirements as defined in ANSI B-46.1-47, Surface Roughness Waviness and Lay, Part I:

Steel slabs	ANSI 2,000
Heavy plates in contact in shoes to Be welded	ANSI 1,000
Milled ends of compression members, stiffeners and fillers	ANSI 500
Bridge rollers and rockers	ANSI 250
Pins and pin holes	ANSI 125
Sliding bearings	ANSI 125

3. Abutting Joints

Abutting joints in compression members and girders flanges, and in tension members where so specified on the drawings, shall be faced and brought to an even bearing. Where joints are not faced, the opening shall not exceed 6.3 mm.

4. End Connection Angles

Floor beams, stringers and girders having end connection angles shall be built to plan length back to back of connection angles with a permissible tolerance of 0 mm to minus 1.6 mm. If end connections are faced, the finished thickness of the angles shall not be less than that shown on the detail drawings, but in no case less than 9.5 mm.

5. Lacing Bars

The ends of lacing bars shall be neatly rounded unless another form is required.

6. Fabrication of Members

Unless otherwise shown on the Plans, steel plates for main members and splice plates for flanges and main tension members, not secondary members, shall be cut and fabricated so that the primary direction of rolling is parallel to the direction of the main tensile and/or compressive stresses.

Fabricated members shall be true to line and free from twists, bends and open joints.

7. Web Plates (Riveted or Bolted)

In girders having no cover plates and not to be encased in concrete, the top edges of the web shall not extend above the backs of the flange angles and shall not be more than 3.2 mm below at any point. Any portion of the plate projection beyond the angles shall be chipped flush with the backs of the angles. Web plates of girders having cover plates may not be more than 12.7 mm less in width than the distance back to back of flange angles.

Splices in webs of girders without cover plates shall be sealed on top with red lead paste prior to painting.

At web splices, the clearance between the ends of the plates shall not exceed 9.5 mm. The clearance at the top and bottom ends of the web splice plates shall not exceed 6.3 mm.

8. Bent Plates

Cold-bent load-carrying rolled-steel plates shall conform to the following:

- a. They shall be so taken from the stock plates that the bendline will be at right angles to the direction of rolling, except that cold-bent ribs for orthotropic deck bridges may be bent in the direction of rolling if permitted by the Engineer.
- b. The radius of bends shall be such that no cracking of the plate occurs. Minimum bend radii, measured to the concave face of the metal, are shown in the following table:

ASTM DESIGNATION		THICKNESS, t in mm				
		Up to 6.3	Over 6.3 to 12.7	Over 12.7 to 25.4	Over 25.4 to 38.1	Over 38.1 to 50.08
A36		1.5t	1.5t	2t	3t	4t
A242		2t	3t	5t	a---	a---
A440		2.5t	3.5t	6t	a---	a---
A441		2t	3t	5t	a---	a---
A529		2t	2t	----	----	----
A572	Gr.42	2t	2t	3t	4t	5t
	Gr.45	2t	2t	3t	4t	----
	Gr.50	2.5t	2.5t	4t	a---	----
	Gr.55	3t	3t	5t	a---	----
	Gr.60	3.5t	3.5t	6t	----	----
	Gr.65	4t	4t	----	----	----
A588		2t	3t	5t	a---	a---
A514 ^b		2t	2t	2t	3t	3t

^a It is recommended that steel in this thickness range be bent hot. Hot bending however, may result in a slight decrease in the as-rolled mechanical properties.

^b The mechanical properties of ASTM A 514 steel results from a quench-and-temper-operation. Hot bending may adversely affect these mechanical

properties. If necessary to hotbend, fabricator should discuss procedure with steel supplier.

- c. Before bending, the corners of the plate be rounded to a radius of 1.6 mm throughout that portion of the plate where the bending is to occur.

9. Fit of Stiffeners

End stiffeners of girders and stiffeners intended as supports for concentrated loads shall have full bearing (either milled, ground or on weldable steel in compression areas of flanges, welded as shown on the Plans or specified) on the flanges to which they transmit load or from which they receive load. Stiffeners not intended to support concentrated loads shall, unless shown or specified otherwise, fit sufficiently tight to exclude water after being painted, except that for welded flexural members, the ends of stiffeners adjacent to the tension flanges shall be cut back as shown on the Plans. Fillers under stiffeners shall fit within 6.3 mm at each end.

Welding will be permitted in lieu of milling or grinding if noted on the Plans or in the Special Provisions. Brackets, clips, gussets, stiffeners, and other detail material shall not be welded to members or parts subjected to tensile stress unless approved by the Engineer.

10. Eyebars

Pin holes may be flame cut at least 50.8 mm smaller in diameter than the finished pin diameter. All eyebars that are to be placed side by side in the structure shall be securely fastened together in the order that they will be placed on the pin and bored at both ends while so clamped. Eyebars shall be packed and matchmarked for shipment and erection. All identifying marks shall be stamped with steel stencils on the edge of one head of each member after fabrication is completed so as to be visible when the bars are nested in place on the structure. The eyebars shall be straight and free from twists and the pin holes shall be accurately located on the centerline of the bar. The inclination of any bar to the plane of the truss shall not exceed 1.6 mm to 305 mm.

The edges of eyebars that lie between the transverse centerline of their pin holes shall be cut simultaneously with two mechanically operated torches abreast of each other, guided by a substantial template, in such a manner as to prevent distortion of the plates.

11. Annealing and Stress Relieving

Structural members which are indicated in the Contract to be annealed or normalized shall have finished machining, boring and straightening done subsequent to heat treatment. Normalizing and annealing (full

annealing) shall be in accordance with ASTM E 44. The temperatures shall be maintained uniformly throughout the furnace during heating and cooling so that the temperature at no two points on the member will differ by more than 37.8°C at any one time.

Members of A514/A517 steels shall not be annealed or normalized and shall be stress relieved only with the approval of the Engineer.

A record of each furnace charge shall identify the pieces in the charge and show the temperatures and schedule actually used. Proper instruments including recording pyrometers, shall be provided for determining at any time the temperatures of members in the furnace. The records of the treatment operation shall be available to and meet the approval of the Engineer.

Members, such as bridge shoes, pedestals, or others which are built up by welding sections of plate together shall be stress relieved in accordance with the provisions of Subsection 403.3.11 when required by the Plans, Specifications or Special Provisions governing the Contract.

12. Tests

When full size tests of fabricated structural members or eyebars are required by the Contract, the Plans or Specifications will state the number and nature of the tests, the results to be attained and the measurements of strength, deformation or other performances that are to be made. The Contractor will provide suitable facilities, material, supervision and labor necessary for making and recording the tests. The members tested in accordance with the Contract will be paid for in accordance with Subsection 403.3.5.1. The cost of testing, including equipment handling, supervision labor and incidentals for making the test shall be included in the contract price for the fabrication or fabrication and erection of structural steel, whichever is the applicable item in the Contract, unless otherwise specified.

403.3.5 Pins and Rollers

Pins and rollers shall be accurately turned to the dimensions shown on the Plans and shall be straight, smooth, and free from flaws. Pins and rollers more 228.6 mm or less in diameter may either be forged and annealed. Pins and rollers 228.6 mm or less in diameter may either be forged and annealed or cold-finished carbon-steel shafting.

In pins larger than 228.6 mm in diameter, a hole not less than 50.8 mm in diameter shall be bored full length along the axis after the forging has been allowed to cool to a temperature below the critical range under suitable conditions to prevent injury by too rapid cooling and before being annealed.

Pin holes shall be bored true to the specified diameter, smooth and straight, at right angles with the axis of the member and parallel with each other unless otherwise specified. The final surface shall be produced by a finishing cut.

The distance outside to outside of holes in tension members and inside to inside of holes in compression members shall not vary from that specified more than 0.8 mm. Boring of holes in built-up members shall be done after the riveting is completed.

The diameter of the pin hole shall not exceed that of the pin by more than 0.51 mm for pins 127 mm or less in diameter, or 0.8 mm for larger pins.

The pilot and two driving nuts for each size of pin shall be furnished, unless otherwise specified.

403.3.6 Fastener Holes (Rivets and Bolts)

All holes for rivets or bolts shall be either punched or drilled. Material forming parts or a member composed of not more than five thickness of metal may be punched 1.6 mm larger than the nominal diameter of the rivets or bolts whenever the thickness of the material is not greater than 19 mm for structural steel, 15.9 mm for high-strength steel or 12.7 mm for quenched and tempered alloy steel, unless subpunching and reaming is required for field connections.

When there are more than five thicknesses or when any of the main material is thicker than 19 mm for structural steel, 15.9 mm for high-strength steel, or 12.7 mm for quenched and tempered alloy steel, all holes shall either be subdrilled or drilled full size.

When required for field connections, all holes shall either be subpunched or subdrilled (subdrilled if thickness limitation governs) 4.8 mm smaller and, after assembling, reamed 1.6 mm larger or drilled full size 1.6 mm larger than the nominal diameter of the rivets or bolts.

When permitted by design criteria, enlarged or slotted holes are allowed with high-strength bolts. For punched holes, the diameter of the die shall not exceed the diameter of the punch by more than 1.6 mm. If any holes must be enlarged to admit the fasteners, they shall be reamed. Holes shall be clean cut, without torn or ragged edges. Poor matching of holes will be cause for rejection.

Reamed holes shall be cylindrical, perpendicular to the member, and not more than 1.6 mm larger than the nominal diameter of the fasteners. Where practicable, reamers shall be directed by mechanical means. Drilled holes shall be 1.6 mm larger than the nominal diameter of the fasteners. Burrs on the outside surfaces shall be removed. Poor matching of holes will be cause for rejection. Reaming and drilling shall be done with twist drills. If required by the Engineer, assembled parts shall be taken apart for removal of burrs caused by drilling. Connecting parts

requiring reamed or drilled holes shall be assembled and securely held while being reamed or drilled and shall be matchmarked before disassembling.

Unless otherwise specified, holes for all field connections and field splices of main truss or arch members, continuous beams, towers (each face), bents, plate girders and rigid frames shall be subpunched (or subdrilled if subdrilling is required) and subsequently reamed while assembled in the shop in accordance with Subsection 403.3.7.

All holes for floor-beam and stringer field end connections shall be subpunched and reamed to a steel template reamed while being assembled.

Reaming or drilling full size of field connection through templates shall be done after templates have been located with the utmost care as to position and angle and firmly bolted in place. Templates used for the reaming of matching members, or of the opposite faces of one member, shall be exact duplicated. Templates for connections which duplicate shall be so accurately located that like members are duplicates and require no matchmarking.

If additional subpunching and reaming is required, it will be specified in the Special Provisions or on the Plans.

Alternately, for any field connection or splice designated above in lieu of sub-sized holes and reaming while assembled, or drilling holes full-size while assembled, the Contractor shall have the option to drill bolt holes full-size in unassembled pieces and/or connections including templates for use with matching sub-sized and reamed holes means of suitable numerically-controlled (N/C) drilling equipment subject to the specific provisions contained in this Subsection.

If N/C drilling equipment is used, the Engineer, unless otherwise stated in the Special Provisions or on the Plans, may require the Contractor, by means of check assemblies to demonstrate that this drilling procedure consistently produces holes and connections meeting the requirements of conventional procedures.

The Contractor shall submit to the Engineer for approval a detailed outline of the procedures that he proposes to follow in accomplishing the work from initial drilling through check assembly, if required, to include the specific members of the structure that may be N/C drilled, the sizes of the holes, the location of common index and other reference points, composition of check assemblies and all other pertinent information.

Holes drilled by N/C drilling equipment shall be drilled to appropriate size either through individual pieces, or any combination of pieces held tightly together.

All holes punched full size, subpunched or subdrilled shall be so accurately punched that after assembling (before any reaming is done), a cylindrical pin 3.2 mm smaller in diameter than the nominal size of the punched hole may be entered perpendicular to the face of the member, without drifting, in at least 75 percent of

the contiguous holes in the same plane. If the requirement is not fulfilled, the badly punched pieces will be rejected. If any hole will not pass a pin 4.8 mm smaller in diameter than the nominal size of the punched holes, this will cause for rejection.

When holes are reamed or drilled, 85 percent of the holes in any continuous group shall, after reaming or drilling, show no offset greater than 0.8 mm between adjacent thickness of metal.

All steel templates shall have hardened steel bushings in holes accurately dimensioned from the center lines if the connections as inscribed on the template. The center lines shall be used in locating accurately the template from the milled or scribed ends of the members.

403.3.7 Shop Assembly

1. Fitting for Riveting and Bolting

Surfaces of metal in contact shall be cleaned before assembling. The parts of a member shall be assembled, well pinned and firmly drawn together with bolts before reaming or riveting is commenced. Assembled pieces shall be taken apart, if necessary, for the removal of burrs and shavings produced by the reaming operation. The member shall be free from twists, bends and other deformation. Preparatory to the shop riveting of full-sized punched material, the rivet holes, if necessary, shall be spear-reamed for the admission of the rivets. The reamed holes shall not be more than 1.6 mm larger than the nominal diameter of the rivets.

End connection angles, and similar parts shall be carefully adjusted to correct positions and bolted, clamped, or otherwise firmly in place until riveted.

Parts not completely riveted in the shop shall be secured by bolts, in so far as practicable, to prevent damage in shipment and handling.

2. Shop Assembling

The field connections of main members of trusses, arches, continuous beam spans, bents, towers (each face), plate girders and rigid frames shall be assembled in the shop with milled ends of compression members in full bearing, and then shall have their sub-size holes reamed to specified size while the connections are assembled. Assembly shall be "Full Truss or Girders Assembly" unless "Progressive Chord Assembly" or "Special Complete Structure Assembly" is specified in the Special Provisions or on the Plans.

Check assemblies with Numerically-Controlled Drilled Fields Connections shall be in accordance with the provision of 2 (f) of this Subsection.

Each assembly, including camber, alignment, accuracy of holes and fit of milled joints, shall be approved by the Engineer before reaming is commenced or before an N/C drilled check assembly is dismantled.

The fabricator shall furnish the Engineer a camber diagram showing the camber at each panel point in the cases of trusses or arch ribs and at the location of field splices and fractions of span length (0.25 points minimum, 0.10 points maximum) in case of continuous beam and girders or rigid frames. When the shop assembly is Full Truss or Girder Assembly or Special Complete Structure Assembly, the camber diagram shall show the camber measured in assembly. When any of the other methods of shop assembly is used, the camber diagram shall show calculated camber.

Methods of assembly shall be described below:

- a. Full of Truss or Girders Assembly shall consist of assembling all members of each truss, arch rib, bent, tower face, continuous beam line, plate girder or rigid frame at one time.
- b. Progressive Truss or Girder Assembly shall consist of assembling initially for each truss, arch rib, bent, tower face, continuous beam line, plate girder, or rigid frame all members in at least three continuous shop sections or panels but not less than the number of panels associated with three continuous chord lengths (i.e., length between field splices) and not less than 45.72 m in case of structures longer than 45.72 m. At least one shop section or panel or as many panels as are associated with a chord length shall be added at the advancing end of the assembly before any member is removed from the rearward end so that the assembled portion of the structure is never less than that specified above.
- c. Full Chord Assembly shall consist of assembling with geometric angles at the joints, the full length of each chord or each truss or open spandrel arch, or each leg of each bent or tower, then reaming their field connection holes while the members are assembled; and reaming the web member connections to steel templates set at geometric (not cambered) angular relation to the chord lines. Field connection holes in web members shall be reamed to steel templates. At least one end of each web member shall be milled or shall be scribed normal to the longitudinal axis of the member and the templates of both ends of the member shall be accurately located from one of the milled ends or scribed line.

- d. Progressive Chord Assembly shall consist of assembling contiguous chord members in the manner specified for Full Chord Assembly, and in the number and length specified for Progressive Truss or Girder Assembly.
- e. Special Complete Structure Assembly shall consist of assembling the entire structure, including the floor system. (This procedure is ordinarily needed only for complicated structures such as those having curved girders, or extreme skew in combination with severe grade or camber). The assembly including camber, alignment, accuracy of holes and fit of milled joints shall be approved by the Engineer before reaming is commenced.

A Contractor shall furnish the Engineer a camber diagram showing the camber at each panel point of each truss, arch rib, continuous beam line, plate girder or rigid frame. When shop assembly is Full Truss or Girder Assembly or Special Complete Structure Assembly, the camber diagram shall show the camber measured in assembly. When any of the other methods of shop assembly is used, the camber diagram shall show calculated camber.

- f. Check Assemblies with Numerically-Controlled Drilled Field Connections. A check assembly shall be required for each major structural type of each project, unless otherwise designated on the Plans or in the Special Provisions, and shall consist of at least three contiguous shop sections or, in a truss, all members in at least three contiguous panels but not less than the number of panels associated with three contiguous chord lengths (i.e., length between field splices). Check assemblies should be based on the proposed order erection, joints in bearings, special complex points, and similar considerations. Such special points could be the portals of skewed trusses, etc.

Use of either geometric angles (giving theoretically zero secondary stresses under deadload conditions after erection) or cambered angles (giving theoretically zero secondary stresses under no-load conditions) should be designated on the Plans or in the Special Provisions.

The check assemblies shall preferably be the first such sections of each major structural type to be fabricated.

No matchmaking and no shop assemblies other than the check assemblies shall be required.

If the check assembly fails in some specific manner to demonstrate that the required accuracy is being obtained, further check assemblies may be

required by the Engineer for which there shall be no additional cost to the contracting authority.

403.3.8 Rivets and Riveting

The size of rivets called for on the Plans shall be the size before heating. Rivet heads shall be of standard shape, unless otherwise specified, and of uniform size for the same diameter of rivet. They shall be full, neatly made, concentric with the rivets holes, and in full contact with the surface of the member. Sufficient rivets for field connections shall be furnished to rivet the entire structure with an ample surplus to replace all rivets burned, lost or cut out.

Rivets shall be heated uniformly to a "light cherry red color" and shall be driven while hot. Any rivet whose point is heated more than the remainder shall not be driven. When a rivet is ready for driving, it shall be free from slag, scale and other adhering matter. Any rivet which is sealed excessively, will be rejected.

All rivets that are loose, burned, badly formed, or otherwise defective shall be removed and replaced with satisfactory rivets. Any rivet whose head is defective in size or whose head is driven off center will be considered defective and shall be removed. Stitch rivets that are loosened by driving of adjacent rivets shall be removed and replaced with satisfactory rivets. Caulking, recapping, or double gunning of rivets heads will not be permitted.

Shop rivets shall be driven by direct-acting rivet machines when practicable. Approved bevelled rivet sets shall be used for forming rivet heads on sloping surfaces. When the use of a direct-acting rivet machine is not practicable, pneumatic hammers of approved size shall be used. Pneumatic bucking tools will be required when the size and length of the rivets warrant their use.

Rivets may be driven cold provided their diameter is not over 9.5 mm.

403.3.9 Bolted Connections, Unfurnished, Turned and Ribbed Bolts

1. General

Bolts under this Subsection shall conform to "Specifications for Carbon Steel Externally and Internally Threaded Standard Fasteners", ASTM A 307. Specifications for high strength bolts are covered under Subsection 403.3.10.

Bolts shall be unfinished, turned or an approved form of ribbed bolts with hexagonal nuts and heads except that ribbed bolts shall have button heads. Bolted connections shall be used only as indicated by the Plans or Special Provisions. Bolts not tightened to the proof loads shall have single self locking nuts or double nuts. Bevel washers shall be used where bearing faces have a slope or more than 1:20 with respect to a plane normal to the bolt axis. Bolts shall be of such length that will

extend entirely through their nuts but not more than 6.3 mm beyond them.

Bolts shall be driven accurately into the holes without damage to the threads. A snap shall be used to prevent damage to the heads. The heads and nuts shall be drawn tight against the work with the full effort of a man using a suitable wrench, not less than 381 mm long for bolts of nominal diameter 19 mm and over. Heads of bolts shall be tapped with a hammer while the nuts are being tightened.

2. Unfinished Bolts

Unfinished bolts shall be furnished unless other types are specified. The number of bolts furnished shall be 5 percent more than the actual number shown on the Plans for each size and length.

3. Turned Bolts

The surface of the body of turned bolts shall meet the ANSI roughness rating value of 125. Heads and nuts shall be hexagonal with standard dimensions for bolts of the nominal size specified or the next larger nominal size. Diameter of threads shall be equal to the body of the bolt or the nominal diameter of the bolt specified. Holes for turned bolts shall be carefully reamed with bolts furnished to provide for a light driving fit. Threads shall be entirely outside of the holes. A washer shall be provided under the nut.

4. Ribbed Bolts

The body of ribbed shall be of an approved form with continuous longitudinal ribs. The diameter of the body measured on a circle through the points of the ribs shall be 1.98 mm greater than the nominal diameter specified for the bolts.

Ribbed bolts shall be furnished with round heads conforming to ANSI B 18.5 unless otherwise specified. Nuts shall be hexagonal, either recessed or with a washer of suitable thickness. Ribbed bolts shall make a driving fit with the holes. The hardness of the ribs shall be such that the ribs do not mash down enough to permit the bolts to turn in the holes during tightening. If for any reason the bolt twists before drawing tight, the holes shall be carefully reamed and an oversized bolt used as a replacement. The Contractor shall provide and supply himself with oversize bolts and nuts for this replacement in an amount not less than ten percent (10%) of the number of ribbed bolts specified.

403.3.10 Bolted Connections (High Tensile-Strength Bolts)

1. Bolts

Bolts shall be AASHTO M 164 (ASTM A 325 or AASHTO M 253) tensioned to a high tension. Other fasteners which meet the chemical requirements of AASHTO M 164 or M 253 and which meet the mechanical requirements of the same specification in full size tests and which have body diameter and bearing areas under the head and nut, or their equivalents, not less than those provided by a bolt and nut of the same nominal dimensions prescribed above, may be used subject to the approval of the Engineer.

Bolts lengths shall be determined by adding the grip-length values given in Table 403.1 to the total thickness of connected material. The values of Table 403.1 compensate for manufacturer's tolerance, the use of heavy semi-finished hexagon nut and a positive "stick-through" at the end of the bolt. For each hardened flat washer that is used add 4 mm to the tabular value and for each bevelled washer add 7.9 mm. The length determined shall be adjusted to the next longer 6.3 mm.

Table 403.1 – Grip-Length Values

Bolts Size (mm)	To determine required bolt length, add grip (mm) *
9.5	17.5
12.7	22.2
19.0	25.4
22.2	28.6
25.4	31.7
28.6	38.1
31.7	41.3
34.9	44.4
38.1	47.6

* Does not include allowance for washer thickness

2. Bolted Parts

The slope of surface of bolted parts in contact with the bolt head and nut shall not exceed 1:20 with respect to a plane normal to the bolt axis. Bolted parts shall fit solidly together when assembled and shall not be

separated by gaskets or any other interposed compressible material. When assembled, all joint surfaces, including those adjacent to the bolt head, nuts or washers, shall be free of scale, except tight mill scale, and shall also be free of burrs, dirt and other foreign material that would prevent solid seating of the parts. Paint is permitted unconditionally in bearing-type connections.

In friction-type connections, the Class, as defined below, indicating the condition of the contact surfaces shall be specified on the Plans. Where no Class is specified, all joint surfaces shall be free of scale, except tight mill scale and shall not have a vinyl wash.

- a. Classes A, B and C (uncoated). Contact surfaces shall be free of oil, paint, lacquer or other coatings.
- b. Class D (hot-dip galvanized and roughened). Contact surfaces shall be tightly scored by wire brushing or blasting after galvanizing and prior to assembly. The wire brushing treatment shall be a light application of manual or power brushing that marks or scores the surface but remove relatively little of the zinc coating. The blasting treatment shall be a light "brush-off" treatment which will produce a dull gray appearance. However, neither treatment should be severed enough to produce any break or discontinuity in the zinc surface.
- c. Classes E and F (blast-cleaned, zinc rich paint). Contact surfaces shall be coated with organic or inorganic zinc rich paint as defined in the Steel Structures Painting Council Specification SSPC 12.00.
- d. Classes G and H (blast-cleaned, metallized zinc or aluminum). Contact surfaces shall be coated in accordance with AWS C2.2, Recommended Practice for Metallizing with Aluminum and Zinc for Protection of Iron and Steel, except that subsequent sealing treatments, described in Section IV therein shall not be used.
- e. Class I (vinyl wash). Contact surfaces shall be coated in accordance with the provisions of the Steel Structure Painting Council Pretreatment Specifications SSPC PT3.

AASHTO M 164 (ASTM A 325) Type 2 and AASHTO M 253 bolts shall not be galvanized nor shall they be used to connect galvanized material.

3. Installation

- a. Bolt Tension. Each fastener shall be tightened to provide, when all fasteners in the joints are tight at least the minimum bolt tension shown in Table 403.2 for the size of fastener used.

Threaded bolts shall be tightened with properly calibrated wrenches or by the turn-of-nut method. If required, because of bolt entering and wrench operation clearances, tightening by either procedure may be done by turning the bolt while the nut is prevented from rotating. Impact wrenches, if used, shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt in approximately ten seconds.

AASHTO M 253 and galvanized AASHTO M 164 (ASTM A 325) bolts shall not be reused. Other AASHTO M 164 (ASTM A 325) bolts may be reused, but not more than once, if approved by the Engineer. Retightening previously tightened bolts which may have been loosened by the tightening of adjacent bolts shall not be considered as a reuse.

- b. Washers. All fasteners shall have a hardened washer under the element (nut or bolt head) turned in tightening except that AASHTO M 164 (ASTM A 325) bolts installed by the turn of the nut method in holes which are not oversized or slotted may have the washer omitted. Hardened washers shall be used under both the head and nut regardless of the element turned in the case of AASHTO M 253 bolts if the material against which it bears has a specified yield strength less than 275.76 MPa.

Table 403.2 - Bolt Tension

Bolt Size, mm	Minimum Bolt Tension ¹ , kg.	
	AASHTO M 164 (ASTM A 325) Bolts	AASHTO M 253 (ASTM A 420) Bolts
12.7	5 466	6 758
15.9	8 709	10 569
19.0	12 882	15 821
22.2	13 268	21 999
25.4	23 360	24 312
28.6	25 605	36 786

31.7	32 522	45 858
34.9	38 760	55 111
38.1	47 174	66 905

¹ Equals to 70 percent of specified minimum tensile strength bolts. Where an outer face of the bolted parts has a slope of more than 1:20 with respect to a Plane normal to the bolt axis, a smooth bevelled washer shall be used to compensate for the lack of parallel line.

c. Calibrated Wrench Tightening. When Calibrated wrenches are used to provide the bolt tension as specified above, their setting shall be such as to induce a bolt tension 5 to 10 percent in excess of this value. These wrenches shall be calibrated at least once each working day by tightening, in a device capable of indicating actual bolt tension, not less than three typical bolts of each diameter from the bolts to be installed. Power wrenches shall be adjusted to installed or cut-out at the selected tension. If manual torque wrenches are used, the torque indication corresponding to the calibrating tension shall be noted and used in the installation of all the tested lot. Nuts shall be turned in the tightening direction when torque is measured. When using calibrated wrenches to install several bolts in a single joint, the wrench shall be returned to "touch-up" bolts previously tightened which may have been loosened by the tightening of adjacent bolts, until all are tightened to the prescribed amount.

d. Turn-of-Nut Tightening. When the turn-of-nut method is used to provide the bolt tension specified in (a) above, there shall first be enough bolts brought to a "snug tight" condition to insure that the parts of the joint are brought into full contact with each other. Snug tight is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Following this initial operation, bolts shall be placed in any remaining holes in the connection and brought to snug tightness.

All bolts in the joints shall then be tightened additionally, by the applicable amount of nut rotation specified in Table 403.3 with tightening progressing systematically from the most rigid part of the joint to its free edges. During this operation, there shall be no rotation of the part not turned by the wrench.

e. Lock Pin and Collar Fasteners. The installation of lock pin and collar fasteners shall be by methods approved by the Engineer.

Table 403.3 – Nut Rotation From Snug Tight Condition¹

Bolt Length measured from underside of head to extreme end of point	Disposition of Outer Faces of Bolted Parts		
	Both faces normal to faces normal to bolt axis	One face normal to bolt axis and other face sloped not more than 1:20 (bevel washer not used)	Both faces sloped not more than 1:20 from normal to bolt axis (bevel washers not used)
Up to and including 4 diameters	0.33 turn	0.5 turn	0.66 turn
Over 4 diameters but not exceeding 8 diameters	0.5 turn	0.66 turn	0.625 turn
Over 8 diameters but not exceeding 12 diameters ²	0.66 turn	0.83 turn	1 turn

¹ Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by ½ turn and less the tolerance should be plus or minus 30°, for bolts installed by 2/3 turn and more, the tolerance should be plus or minus 45°.

² No research work has been performed by the Research Council on Riveted and Bolted Structural joints to establish the turn-of-nut procedure when bolt lengths exceed 12 diameters. Therefore, the required rotation must be determined by actual tests in a suitable tension device simulating the actual conditions.

4. Inspection

The Engineer will determine that the requirements of these Specifications are not in the work. When the calibrated wrench method of tightening is used, the Engineer shall have full opportunity to witness the calibration tests.

The Engineer will observe the installation and tightening of the bolts to determine that the selected tightening procedure is properly used and will determine that all bolts are tightened.

The following inspection shall be used unless a more extensive or different procedure is specified:

- a. The Contractor shall use an inspecting wrench which may either be a torque wrench or a power wrench that can be accurately adjusted in accordance with the requirements of Subsection 403.3.10(3) (c) above, in the presence of the Engineer.
- b. Three bolts of the same grade, size and condition as those under inspection shall be placed individually in a calibration device capable of indicating bolt tension. Length may be any length representative of bolts used in the structure. There shall be a washer under the part turned in tightening each bolt.
- c. When the inspecting wrench is a torque wrench, each of the three bolts specified above shall be tightened in the calibration device by any convenient means to the minimum tension specified for its size in Table 403.2. The inspecting wrench shall then be applied to the tightened bolt and the torque necessary to run the nut or head 5 degrees (approximately 25.4 mm at 304.8 mm radius) in the tightening direction shall be determined. The average torque measured in the tests of three bolts shall be taken as the job inspection torque to be used in the manner specified below.
- d. When the inspecting wrench is a power wrench, it shall be adjusted so that it will tighten each of the three bolts specified to a tension at least 5 but not more than 10 percent greater than the minimum tension specified for its size in Table 403.2. This setting of wrench shall be taken as the job inspecting torque to be used in the manner specified below.
- e. Bolts, represented by the three samples bolts prescribed above, which have been tightening in the structure shall be inspected by applying, in the tightening direction, the inspecting wrench and its job inspecting torque to 10 percent of the bolts, but not less than two bolts selected at random in each connection. If no nut or bolt head is turned by this application of the job inspecting torque, the connection shall be accepted as properly tightened. If any nut or bolt head is turned by the application of the job inspecting torque, this torque shall be applied to all bolts in the connection, and all bolts whose nut or head is turned by the job inspecting torque shall be tightened and

re-inspected, or alternatively, the fabricator or erector, at his option may re-tighten all the bolts in the connection and then resubmit the connection for the specified inspection.

403.3.11 Welding

Welding shall be done in accordance with the best modern practice and the applicable requirements at AWS D1.1 except as modified by AASHTO "Standard Specifications for Welding of Structural Steel Highway Bridges".

403.3.12 Erection

1. General

The Contractor shall provide the falsework and all tools, machinery and appliances, including driftpins and fitting-up bolts, necessary for the expeditious handling of the work and shall erect the metal work, remove the temporary construction, and do all work necessary to complete the structure as required by the Contract and in accordance with the Plans and these Specifications.

If shown on the Plans or in the Special Provisions, the Contractor shall dismantle the old structure on the bridge site in accordance with Item 101, Removal of Structures and Obstructions.

403.3.13 Handling and Storing Materials

Materials to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained. Girders and beams shall be placed upright and shored. Long members, such as columns and chords, shall be supported on skids placed near enough together to prevent injury from deflection. If the Contract is for erection only, the Contractor shall check the material turned over to him against the shipping lists and report promptly in writing any shortage or damage discovered. He shall be responsible for the loss of any material while in his care, or for any damage caused to it after being received by him.

403.3.14 Falsework

The false work shall be properly designed and substantially constructed and maintained for the loads which will come upon it. The Contractor shall prepare and submit to the Engineer working drawings for falsework and working drawings for changes in any existing structure for maintaining traffic, in accordance with Clause 45 of Part G, Div. II, Vol. I.

403.3.15 Method and Equipment

Before starting the work of erection, the Contractor shall inform the Engineer fully as to the method of erection he proposes to follow, and the amount and character of equipment he proposes to use, which shall be subject to the approval of the

Engineer. The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety of his method or equipment or from carrying out the work in full accordance with the Plans and Specifications. No work shall be done until such approval by the Engineer has been obtained.

403.3.16 Straightening Bent Materials

The strengthening of plates, angles, other shapes and built-up members, when permitted by the Engineer, shall be done by methods that will not produce fracture or other injury. Distorted members shall be straightened by mechanical means or, if approved by the Engineer, by the carefully planned and supervised application of a limited amount of localized heat, except that heat straightening of AASHTO M 244 (ASTM A 514) or ASTM A 517 steel members shall be done only under rigidly controlled procedures, each application subject to the approval of the Engineer. In no case shall the maximum temperature of the AASHTO M 244 (ASTM A 514) or ASTM A 517 steels exceed 607.2°C, nor shall the temperature exceed 510°C at the weld metal or within 152.4 mm of weld metal. Heat shall not be applied directly on weld metal. In all other steels, the temperature of the heated area shall not exceed 648.9°C (a dull red) as controlled by temperature indicating crayons, liquids or bimetal thermometers.

Parts to be heat-straightened shall be substantially free of stress and from external forces, except stresses resulting from mechanical means used in conjunction with the application of heat.

Following the straightening of a bend or buckle, the surface of the metal shall be carefully inspected for evidence of fracture.

403.3.17 Assembling Steel

The parts shall be accurately assembled as shown on the working drawings and any matchmarks shall be followed. The material shall be carefully handled so that no parts will be bent, broken or otherwise damaged. Hammering which will injure or distort the members shall not be done. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled. Unless erected by the cantilever methods, truss spans shall be erected on blocking so placed as to give the trusses proper camber. The blocking shall be left in place until the tension chord splices are fully connected with permanent fasteners and all other truss connections pinned and erection bolted. Splices of butt joints of compression members, that are milled to bear and of railing shall not be permanently fastened until the spans have been swung, except that such permanent fastening may be accomplished for the truss members at any time that joint holes are fair. Splices and field connections shall

have one-half of the holes filled with erection bolts and cylindrical erection pins (half bolts and half pins) before placing permanent fasteners. Splices and connections carrying traffic during erection shall have three-fourths of the holes so filled, unless otherwise permitted by the Engineer.

Fitting-up bolts shall be of the same nominal diameter as the permanent fasteners and cylindrical erection pins will be 1.6 mm larger.

403.3.18 Riveting

Pneumatic hammers shall be used for field riveting except when the use of hand tools is permitted by the Engineer. Rivets larger than 15.9 mm in diameter shall not be driven by hand. Cup-faced dollies, fitting the head closely to insure good bearing, shall be used. Connections shall be accurately and securely fitted up before the rivets are driven.

Drifting shall be only such as to draw the parts into position and not sufficient to enlarge the holes or distort the metal. Unfair holes shall be reamed or drilled. Rivets shall be heated uniformly to a "light cherry red" color and shall be driven while hot. They shall not be overheated or burned. Rivet heads shall be full and symmetrical, concentric with the shank, and shall have full bearing all around. They shall not be smaller than the heads of the shop rivets. Rivets shall be tight and shall grip the connected parts securely together. Caulking or recupping will not be permitted. In removing rivets, the surrounding metal shall not be injured. If necessary, they shall be drilled out.

403.3.19 Pin Connections

Pilot and driving nuts shall be used in driving pins. They shall be furnished by the Contractor without charge. Pins shall be so driven that the members will take full bearing on them. Pin nuts shall be screwed up tight and the threads burred at the face of the nut with a pointed tool.

403.3.20 Setting Shoes and Bearings

Shoes and bearing shall not be placed on bridge seat bearing areas that are improperly finished, deformed, or irregular. They shall be set level in exact position and shall have full and even bearing. The shoes and bearing plates may be set by either of the following methods:

1. Method 1

The bridge seat bearing area shall be heavily coated with red lead paint and then covered with three layers of 405 to 472 g/m² duck, each layer being coated thoroughly on its top surface with red lead paint. The shoes and bearing plates shall be placed in position while the paint is plastic.

As alternatives to canvas and red lead, and when so noted on the Plans or upon written permission by the Engineer, the following may be used:

- a. Sheet lead of the designated thickness
 - b. Preformed fabric pad composed of multiple layers of 270 g/m² duck impregnated and bound with high quality natural rubber or of equivalent and equally suitable materials compressed into resilient pads of uniform thickness. The number of plies shall be such as to produce the specified thickness, after compression and vulcanizing. The finished pads shall withstand compression loads perpendicular to the plane of the laminations of not less than 7 kg/mm² without detrimental reduction in thickness or extension.
 - c. Elastomeric bearing pads
2. Method 2

The shoes and bearing plates shall be properly supported and fixed with grout. No load shall be placed on them until the grout has set for at least 96 hours, adequate provision being made to keep the grout well moistened during this period. The grout shall consist of one part Portland Cement to one part of fine-grained sand.

The location of the anchor bolts in relation to the slotted holes in expansion shoes shall correspond with the temperature at the time of erection. The nuts on anchor bolts at the expansion ends shall be adjusted to permit the free movement of the span.

403.3.21 Preparing Metal Surfaces for Painting

All surfaces of new structural steel which are to be painted shall be blast cleaned unless otherwise specified in the Special Provisions or approved in writing by the Engineer.

In repainting existing structures where partial cleaning is required, the method of cleaning will be specified in the Special Provision.

The steel surfaces to be painted shall be prepared as outlined in the "Steel Structures Painting Council Specifications" (SSPC) meeting one of the following classes of surface preparation.

- a. SSPC – SP – 5 White Metal Blast Cleaning
- b. SSPC – SP – 6 Commercial Blast Cleaning
- c. SSPC – SP – 8 Pickling
- d. SSPC – SP – 10 Near White Blast Cleaning

Blast cleaning shall leave all surfaces with a dense and uniform anchor pattern of not less than one and one-half mills as measured with an approved surface profile comparator.

Blast cleaned surfaces shall be primed or treated the same day blast cleaning is done. If cleaned surface rust or are contaminated with foreign material before painting is accomplished, they shall be recleaned by the Contractor at his expense.

When paint systems No. 1 or 3 are specified, the steel surfaces shall be blast cleaned in accordance with SSPC – SP – 10. When paint systems No. 2, 4 or 5 are specified, the steel surface shall be blast cleaned in accordance with SSPC – SP – 6.

403.3.22 System of Paint

The paint system to be applied shall consist of one as set forth in Table 403.4 and as modified in the Special Provisions.

403.3.23 Painting Metal Surfaces

1. Time of Application

The prime coat of paint or pretreatment when specified, shall be applied as soon as possible after the surface has been cleaned and before deterioration of the surface occurs. Any oil, grease, soil, dust or foreign matter deposited on the surface after the surface preparation is completed shall be removed prior to painting. In the event the rusting occurs after completion of the surface preparation, the surfaces shall be again cleaned.

Particular care shall be taken to prevent the contamination of cleaned surfaces with salts, acids, alkali, or other corrosive chemicals before the prime coat is applied and between applications of the remaining coats of paint. Such contaminants shall be removed from the surface. Under these circumstances, the pretreatments or, in the absence of a pretreatment, the prime coat of paint shall be applied immediately after the surface has been cleaned.

2. Storage of Paint and Thinner

All paint and thinner should preferably be stored in a separate building or room that is well ventilated and free from excessive heat, sparks, flame or the direct ray of the sun.

All containers of paint should remain unopened until required for use. Containers which have been opened shall be used first.

Paint which has livered, gelled, or otherwise deteriorated during storage shall not be used. Thixotropic materials which may be stirred to attain normal consistency are satisfactory.

3. Mixing and Thinning

All ingredients in any container of paint shall be thoroughly mixed before use and shall be agitated often enough during application to keep the pigment in suspension.

Paint mixed in the original container shall not be transferred until all settled pigment is incorporated into the vehicle. This does not imply that part of the vehicle cannot be poured off temporarily to simplify the mixing.

Mixing shall be by mechanical methods, except that hand mixing will be permitted for container up to 19 litres in size.

Mixing in open containers shall be done in a well ventilated area away from sparks or flames.

Paint shall not be mixed or kept in suspension by means of an air stream bubbling under the paint surface.

When a skin has formed in the container, the skin shall be cut loose from the sides of the container, removed, and discarded. If such skins are thick enough to have a practical effect on the composition and quality of the paint, the paint shall not be used.

The paint shall be mixed in manner which will insure breaking up of all lumps, complete dispersion of settled pigment, and a uniform composition. If mixing is done by hand, most of the vehicle shall be poured off into a clean container. The pigment in the paint shall be lifted from the bottom of the container with a broad, flat paddle, lumps shall be broken up, and the pigment thoroughly mixed with the vehicle. The poured off vehicle shall be returned to the paint with simultaneous stirring, or pouring repeatedly from one container to another until the composition is uniform. The bottom of the container shall be inspected for unmixed pigment. Tinting pastes or colors shall be wetted with a small amount of thinner, vehicle, or paint and thoroughly mixed. The thinned mixture shall be added to the large container of paint and mixed until the color is uniform.

Paint which does not have a limited pot life, or does not deteriorate on standing, may be mixed at any time before using, but if settling has occurred, it must be remixed immediately before using. Paint shall not remain in spray pots, painter's buckets, etc., overnight, but shall be gathered into a container and remixed before use.

No thinner shall be added to the paint unless necessary for proper application. In no case shall more than 0.5 litres of thinner be added per 3.8 litres unless the paint is intentionally formulated for greater thinning.

The type of thinner shall comply with the paint specification.

When the use of thinner is permissible, thinner shall be added to paint during the mixing process. Painters shall not add thinner to paint after it has been thinned to the correct consistency.

All thinning shall be done under supervision of one acquainted with the correct amount and type of thinner to be added to the paint.

Table 403.4 - Paint System

	Paint System				
	1	2	3	4	5
High Pollution or Coastal	x	x	x		
Mild Climate				x	X

Note:

1. Paint system shown for severe areas are satisfactorily in less severe areas.
2. Coastal - within 304.8 m of ocean or tidal water.

High pollution-air pollution environment such as industrial areas.

Mild-other than coastal areas not in air pollution environment.

All structural steel shall be painted by one of the following systems. The required system or choice of systems will be shown in the Contract.

System 4 is intended for use in mild climates or to repaint existing structures where the other systems are not compatible.

Coating Thickness	Specifications	Min. Dry Film
System 1 - Vinyl Paint System		
Wash Prime	708.03 (b)	12.7
Intermediate Coat	708.03 (b)	38.10 - 50.80
3 rd Coat	708.03 (b)	38.10 - 50.80
4 th Coat	708.03 (b)	38.10 - 50.80
Finish Coat	708.03 (b)	38.10 - 50.80

Total thickness		165.10 203.20	-
System 2 – Epoxy-Polyimide System			
Prime Coat	708.03 (c)	50.80 – 76.20	
Intermediate Coat	708.03 (c)	50.80 – 76.20	
3 rd Coat	708.03 (c)	50.80 – 76.20	
Finish Coat	708.03 (c)	38.10 – 50.80	
Total thickness		190.50 279.40	-
* The third coat may be eliminated in mild climates			
Coating Thickness Specifications Min. Dry Film			
System 3 – Inorganic Zinc-Rich Coating System			
Prime Coat	708.03(d)	88.90 – 127	
Epoxy Intermediate Coat	708.03 (d)	40.80 – 76.20	
Finish Coat	708.03 (d)	38.10 – 50.80	
Total thickness		177.80 – 254	
Alternate System			
Prime Coat	708.03 (d)	88.90 – 127	
Wash Primer Tie Coat	708.03 (d)	2.70	
Finish Coat	708.03 (d)	38.10 – 50.80	
Total thickness		139.70 – 190.50	
System 4 – Alkyd-Oil-Basic Lead-Chromate System			
Prime Coat	708.03 (e)	38.10 – 50.80	

Intermediate Coat	708.03 (e)	38.10 – 50.80
Finish Coat	708.03 (e)	38.10 – 50.80
Total thickness		114.30 – 152.40
* The paint system may be specified as four coats for new structure steel in mild climate, with a minimum thickness of 152.40 mm.		
System 5 – Organic Zinc-Rich Paint System		
Prime Coat	708.03 (f)	38.10 – 50.80
Intermediate Coat	708.03 (f)	50.80 – 63.50
Wash Primer Tie Coat	708.03 (f)	12.70
Finish Coat	708.03 (f)	38.10 – 50.80
Total thickness		139.70 – 177.80

4. Application of Paint

a. General

The oldest of each kind of paint shall be used first. Paint shall be applied by brushing or spraying or a combination of these methods. Daubers or sheepskins may be used when no other method is practicable for proper application in places of difficult access. Dipping, roller coating, or flow coating shall be used only when specifically authorized. All paints shall be applied in accordance with the manufacturer's instructions.

Open seams at contact surfaces of built up members which would retain moisture shall be caulked with red lead paste, or other approved material, before the second undercoat of paint is applied.

Paint shall not be applied when the surrounding air temperature is below 4.4°C. Paint shall not be applied when the temperature is expected to drop to 0°C before the paint has dried. Paint shall not be applied to steel at a temperature over 51.7°C unless the paint is specifically formulated for application at the proposed temperature, nor shall paint be applied to steel which is at a temperature that will cause

blistering or porosity or otherwise will be detrimental to the life of the paint.

Paint shall not be applied in fog or mist, or when it is raining or when the relative humidity exceeds 85 percent. Paint shall not be applied to wet or damp surfaces.

When paint must be applied in damp or cold weather, the steel shall be painted under cover, or protected, or sheltered or the surrounding air and the steel heated to a satisfactory temperature. In such cases, the above temperature and humidity conditions shall be met. Such steel shall remain under cover or be protected until dry or until weather conditions permit its exposure.

Any applied paint exposed to excess humidity, rain or condensation shall first be permitted to dry. Then damaged areas of paint shall be removed, the surface again prepared and then repainted with the same number of coats of paint of the same kind as the undamaged areas.

If stripe painting is stipulated in the Special Provisions or if the Contractor chooses to do so at his option, all edges, corners, crevices, rivets, bolts, weld and sharp edges shall be painted with the priming paint by brush before the steel receives first full prime coat of paint. Such striping shall extend for at least 25.4 mm from the edge. When practicable, this stripe coat shall be permitted to dry before the prime coat is applied, otherwise the stripe coat shall set to touch before the full prime coat is applied. However, the stripe coat shall not be permitted to dry for a period of long enough to allow rusting of the unprimed steel. When desired, the stripe coat may be applied after a complete prime coat.

To the maximum extent practicable, each coat of paint shall be applied as continuous film of uniform thickness free of pores. Any thin spots or areas missed in the application shall be repainted and permitted to dry before the next coat of paint is applied. Film thickness is included in the description of paint systems. Each coat of paint shall be in a proper state of cure or dryness before application of the succeeding coat.

b. Brush Application

Paint shall be worked into all crevices and corners where possible and surfaces not accessible to brushes shall be painted by spray, doublers, or sheepskins. All runs or rags shall be brushed out. There shall be a minimum of brush marks left in the paint.

c. Spray Application of Paint

The equipment used for spray application of paint shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to

be applied and shall be equipped with suitable pressure regulators and gages. The air caps, nozzles, and needles shall be those recommended by the manufacturer of the equipment for the material being sprayed. The equipment shall be kept in satisfactory condition to permit proper paint application. In closed or recirculating paint spray system, where gas under pressure is used over the liquid, the gas shall be an inert, one such as nitrogen. Traps or separators shall be provided to remove oil and water from the compressed air. These traps or separators shall be adequate size and shall be drained periodically during operations. The air from the spray gun impinging against the surface shall show no water or oil.

Paint ingredients shall be kept properly mixed in the spray pots or containers during paint applications either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

The pressure on the material in the pot and of the air at the guns shall be adjusted for optimum spraying effectiveness. The pressure on the material in the pot shall be adjusted when necessary for changes in elevation of the gun above the pot. The atomizing air pressure at the gun shall be high enough to atomize the paint properly but not so high as to cause excessive fogging of paint, excessive evaporation of solvent or loss by overspray.

Spray equipment shall be kept sufficiently clean so that dirt, dried paint and other foreign material are not deposited in the paint film. Any solvents left in the equipment shall be completely removed before applying paint to the surface being painted.

Paint shall be applied in uniform layer, with overlapping at the edge of the spray pattern. The spray shall be adjusted so that the paint is deposited uniformly. During application, the gun shall be held perpendicular to the surface and at a distance which will insure that a wet layer of paint is deposited on the surface. The trigger of the gun should be released at the end of each stroke.

All runs and sags shall be brushed out immediately or the paint shall be removed and the surface repainted. Spray application of prime coats shall in all cases be immediately followed by brushing

Areas inaccessible to the spray gun shall be painted by brush, if not accessible by brush, daubers or sheepskins shall be used. Brushes shall be used to work paint into cracks, crevices and blind spots where are not adequately painted by spray.

d. Shop Painting

Shop painting shall be done after fabrication and before any damage to the surface occurs from weather or other exposure. Shop contact surfaces shall not be painted unless specified.

Surfaces not to be in contact but which will be inaccessible after assembly shall receive the full paint system specified or three shop coats of the specified before assembly.

The areas of steel surfaces to be in contact with concrete shall not be painted, unless otherwise shown on the Plans, the areas of steel surfaces to be in contact with wood shall receive either the full paint coats specified or three shop coats of the specified primer.

If paint would be harmful to a welding operator or would be detrimental to the welding operation or the finished welds, the steel shall not be painted within a suitable distance from the edges to be welded. Welding through inorganic zinc paint systems will not be permitted unless approved by the Engineer.

Antiweld spatter coatings shall be removed before painting. Weld slag and flux shall be removed by methods at least as effective as those specified for the cleaning.

Machine-finished or similar surfaces that are not to be painted, but do not require protections, shall be protected with a coating of rust inhibitive petroleum, other coating which may be more suitable, for special conditions.

Erection marks and weight marks shall be copied on area that have been previously painted with the shop coat.

e. Field Painting

Steel structures shall be painted as soon as practicable after erection.

Metal which has been shop coated shall be touched up with the same type of paints as the shop coat. This touch-up shall include cleaning and painting of field connections, welds, rivets and all damaged or defective paint and rusted areas. The Contractor may, at his option, apply an overall coat of primer in place of touch-up spot painting.

Surfaces (other than contact surfaces) which are accessible before erection but which will not be accessible after erection shall receive all field coats of paint before erection.

If possible the final coat of paint shall not be applied until all concrete work is finished. If concreting or other operations damage any paint, the

surfaces shall be cleaned and repainted. All cement or concrete spatter and dripping shall be removed before any paint is applied.

Wet paint shall be protected against damage from dust or other detrimental foreign matter to the extent practicable.

f. Drying of Painted Metal

The maximum practicable time shall be allowed for paint to dry before recoating or exposure. No drier shall be added to paint on the job unless specifically called for in the Specifications for the paint. No painted metal shall be subjected to immersion before the paint is dried through. Paint shall be protected from rain, condensation, contamination, and freezing until dry, to the fullest extent practicable.

g. Handling of Painted Steel

Painted steel shall not be handled until the paint has dried, except for necessary handling in turning for painting or stacking for drying.

Paint which is damaged in handling shall be scraped off and touched-up with the same number of the coats and kinds of paint as were previously applied to the steel.

Painted steel shall not be loaded for shipment or shipped until it is dry.

Precautions shall be taken to minimize damage to paint films resulting from stocking members.

5. Measurement of Dry Film Thickness of Paints

a. Instrumentation

Dry paint film thickness shall be measured using Pull-Off (Type 1) or Fixed Probe (Type 2) Magnetic Gages. Type 1 gages include Tinsley, Elcometer, Microtest and Inspector models. Type 2 gage include Elcometric, Minitector, General Electric, Verimeter and Accuderm models.

b. Calibration

1. Type 1 (Pull-Off) Magnetic Gages

Measure the coating thickness on a series of reliable standards covering the expected range of paint thickness. Record the calibration correction either plus (+) or minus (-) required at each standard thickness. To guard against gage drift during use, re-check occasionally with one or more of the standards.

When the gage adjustment has drifted so far that large corrections are needed, it is advisable to re-adjust closer to the standard values and re-calibrate.

For Type 1 gages, the preferred basic standards are small, chromeplated steel panels that may be available from the National Bureau of Standards in coating thickness from 12.70 mm to 203.20 mm.

Plastic shims of certified thickness in the appropriate ranges may also be used to calibrate the gages. The gage is held firmly enough to press the shim tightly against the steel surface. Record the calibration correction as above.

2. Type 2 (Fixed Probe) Magnetic Gages

Shims of plastic or non-magnetic metals laid on the appropriate steel base (at least 76.2 x 76.2 x 3.2 mm) are suitable working standards. These gages are held firmly enough to press the shim tightly against the steel surface. One should avoid excessive pressure that might indent the plastic or, on a blast cleaned surface, might impress the steel peaks into the undersurface of the plastic.

The National Bureau of Standards – standards panels shall not be used to calibrate Type 2 gages.

c. Measurement Procedures

To determine the effect of the substrate surface condition on the gage readings, access is required to some unpainted areas.

Repeated gage readings, even at points close together, may differ considerably due to small surface irregularities. Three gage readings should therefore be made for each spot measurement of either the substrate or the paint. Move the probe a short distance for each new gage reading. Discard any unusually high or low gage reading that cannot be repeated consistently. Take the average of the three gage readings as the spot measurement.

1. Measurement with Type 1 (Pull-Off) Gage

Measure (A), the bare substrate, at a number of spots to obtain a representative average value. Measure (B), the dry paint film, at the specified number of spots.

Correct the (A) and (B) gage readings or averages as determined by calibration of the gage. Subtract the corrected readings (A) from (B) to obtain the thickness of the paint above the peaks of the surface.

2. Measurement with Type 2 (Fixed Probe) Gage

Place a standard shim of the expected paint thickness on the bare substrate that is to be painted. Adjust the gage in place on the shim so that it indicates the known thickness of the shim.

Conform the gage setting by measuring the shim at several other area of the bare substrate. Re-adjust the gage as needed to obtain an average setting representative of the substrate.

With the gage adjustment as above, measure the dry paint film at three points. The gage readings indicate the paint film thickness at the three points. The gage readings indicate the paint thickness above the peaks of the surface profile.

Re-check the gage setting at frequent intervals during a long series of measurements. Make five separate spot measurements spaced evenly over each section of the structure 9.29 square metres in area, or of other area as may be specified. The average of five spot measurements for each such section shall not be less than the specified thickness. No single spot measurement (average of three readings) in any section shall be less than 80% of the specified thickness.

Since paint thickness is usually specified (or implied) as a minimum, greater thickness that does not cause defects of appearance or functions such as mud cracking, wrinkling, etc., is permitted unless otherwise specified.

d. Special Notes

All of the above magnetic, if properly adjusted and in good condition, are inherently accurate to within +15% of the true thickness of the coating.

Much larger, external errors may be caused by variations in method of use of the gages or by unevenness of the surface of the substrate or of the coating. Also, any other film present on the steel (rust or mill scale or even a blast cleaned profile zone) will add to the apparent thickness of the applied paint film.

The surface of the paint and the probe of the gage must be free from dust, grease and other foreign matter in order to obtain close contact of the probe with the paint and also to avoid adhesion of the magnet. The accuracy of the measurement will be affected if the coating is tacky or excessively soft.

The magnetic gages are sensitive to geometrical discontinuities of the steel, as at holes, corners or edges. The sensitivity to edge effects and discontinuities varies from gage to gage. Measurements closer than 25.4

mm from the discontinuity may not be valid unless the gage is calibrated specifically for that location.

Magnetic gage readings also may be affected by proximity to another mass of steel close to the body of the gage, by surface curvature and presence of other magnetic fields.

All of the magnets or probe must be held perpendicular to the painted surface to produce valid measurements.

403.3.24 Clean-up

Upon completion and before final acceptance, the Contractor shall remove all falsework, falsework piling down to at least 609.6 mm below the finished ground line, excavated or unused materials, rubbish and temporary buildings. He shall replace or renew any fences damaged and restored in an acceptable manner all property, both public and private, which may have been damaged during the prosecution of the work and shall leave the work site and adjacent highway in a neat and presentable condition, satisfactory to the Engineer. All excavated material or falsework placed in the stream channel during construction shall be removed by the Contractor before final acceptance.

403.4 Method of Measurement

403.4.1 Unit Basis

The quantity of structural steel to be paid for shall be the number of kilos complete in place and accepted. For the purpose of measurement for payment components fabricated from metals listed in (1) below, such as casting, alloy steels, steel plates, anchor bolts and nuts, shoes, rockers, rollers, pins and nuts, expansion dams, roadway drains and souppers, welds metal, bolts embedded in concrete, cradles and brackets, posts, conduits and ducts, and structural shapes for expansion joints and pier protection will be considered as structural steel.

Unless otherwise provided, the mass of metal paid for shall be computed and based upon the following mass:

1. Unit Density kg/m³

Aluminum, cast or rolled	2771.2
Bronze or copper alloy	8585.9
Copper sheet	8938.3
Iron, cast	7128.2
Iron, malleable	7528.7

Lead, sheet	11229
Steel, cast or rolled, including alloy copper bearing and stainless	7849
Zinc	7208.3

2. Shapes, Plates Railing and Flooring

The mass of steel shapes and plates shall be computed on the basis of their nominal mass and dimensions as shown on the approved shop drawings, deducting for copes, cuts and open holes, exclusive of rivets holes. The mass of all plates shall be computed on the basis of nominal dimensions with no additional for overrun.

The mass of railing shall be included as structural steel unless the Bill of Quantities contains as pay item for bridge railing under Item 401, Railings.

The mass of steel grid flooring shall be computed separately.

3. Casting

The mass of casting shall be computed from the dimensions shown on the approved drawings, deducting for open holes. To this mass will be added 5 percent allowable for fillets and overruns. Scale mass may be substituted for computed mass in the case of castings of small complex parts for which accurate computations of mass would be difficult.

4. Miscellaneous

The mass of erection bolts, shop and field paint, galvanizing the boxes, crates and other containers used for shipping, together with sills, struts, and rods used for supporting members during the transportation, bridge hardware as defined in Subsection 402.2.2 excluding steel plates and bearings, connectors used for joining timber members, nails, spikes and bolts, except anchor bolts will be excluded.

5. Rivets Heads

The mass of all rivet heads, both files and shop, will be assumed as follows:

Diameter of rivet (mm)		kg per 100 heads
12.7		1.80
15.9		3.20
19.0		5.44

22.2		8.16
25.4		11.80
28.6		16.33
31.7		21.8

6. High-Strength Bolts

High-strength steel bolts shall be considered for purpose of payment, the same as rivets of the same diameter, with the mass of the bolt heads and nuts the same as the corresponding rivet heads.

7. Welds

The mass of shop and field fillet welds shall be assumed as follows:

Size of Weld (mm)		kg per linear metre
6.3		0.984
7.9		1.213
9.5		1.771
12.7		2.690
5.9		3.936
19.0		5.379
22.2		7.314
25.4		9.774

The mass of other welds will be computed on the basis of the theoretical volume from dimensions of the welds, with an addition of 50 mass percent as an allowance for overrun.

8. Other Items

The quantities of other Contract Items which enter into the completed and accepted structure shall be measured for payment in the manner prescribed for the Items involved.

403.4.2 Lump Sum Basis

Lump sum will be the basis of payment unless noted otherwise in the bidding documents. No measurements of quantities will be made except as provided in Subsection 403.5.1 (4).

403.5 Basis of Payment

403.5.1 Structural Steel

1. Furnished, Fabricated and Erected

The quantity, determined as provided above, shall be paid for at the contract unit price per kilogram for “Structural Steel, furnished, fabricated and erected”, which price and payment shall constitute full compensation for furnishing, galvanizing, fabricating, radiographing, magnetic particle inspection, delivering, erecting ready for use, and painting all steel and other metal including all labor, equipment, tools and incidentals necessary to complete the work, except as provided in Subsections 403.5.2, 403.5.3 and 403.5.4.

2. Furnished and Fabricated

When a quantity and unit price for “Structural Steel, furnished and fabricated” are shown in the Bill of Quantities, the quantity, determined as provided above, will be paid for at the contract unit price per kilogram which price and payment shall be full compensation for furnishing, galvanizing, fabricating, radiographing, magnet particle inspection, shop painting and delivering the structural steel and other metal free of charges at the place designated in the Special Provisions and for all labor, equipment, tools and incidentals necessary to complete the work, save erection and except as provided in Subsection 403.5.2, 403.5.3 and 403.5.4.

3. Erected

When a quantity and unit price for “Structural Steel Erected” are shown in the Bill of Quantities, the quantity, determined as provided above, will be paid for at the said contract unit price per kilogram which price and payment shall be full compensation for unloading all the structural steel and other metal, payment of any demurrage charges, transporting to the bridge site, erecting, magnetic particle inspection and radiographing, complete ready for use including furnishing and applying the field paint including all labor, equipment, tools and incidentals necessary to complete the work, save furnishing and fabrication, and except as provided in Subsections 403.5.2, 403.5.3 and 403.5.4.

4. Lump Sum

When the Bill of Quantities calls for lump sum price for “Structural Steel, furnished, fabricated and erected”, the Item will be paid for at the contract lump sum price and payment shall be full compensation for furnishing, fabricating and erecting material and for all work herein before prescribed in connection therewith, including all labor, equipment, tools and incidentals necessary to complete the work, except as provided in Subsections 403.5.2, 403.5.3 and 403.5.4.

The estimate of the mass of structural steel shown on the Plans is approximate only and no guarantee is made that it is the correct mass to be furnished. No adjustment in the contract price will be made if the mass furnished is more or less than estimated mass.

If changes in the work are ordered by the Engineer, which vary the mass of steel to be furnished, the lump sum payment shall be adjusted as follows:

- a. The value per kilogram of the increase or decrease in mass of structural steel involved in the change shall be determined by dividing the contract lump sum amount by the estimate of mass shown on the Plans. The adjusted contract lump sum payment shall be the contract lump sum plus or minus the value of the steel involved in the change, and no additional compensation shall be made on account of said change.
- b. Full-size members which are tested in accordance with the Specifications when such tests are required by the Contract, shall be paid for at the same rate as for comparable members in the structure. Members which fail to meet the Contract requirements, and members rejected as a result of test shall not be paid for.

403.5.2 Material Considered as Structural Steel

For the purpose of Subsection 403.5.1 and unless otherwise shown on the Plans, castings, forgings, special alloy steels and steel plates, wrought iron, and structural shapes of expansion joints and pier protection shall be considered as structural steel except that when quantities and unit price for certain alloy steels, forgings, castings or other specific categories of metal are called for in the Bill of Quantities, the mass of such selected material, determined as provided above, shall be paid for at the respective contract unit price per kilogram for “Structural Steel (Alloy steel, forgings, castings, and/or other category), furnished and fabricated, and erected” or “Structural Steel (Subsection 403.4.1), furnished and fabricated” as named in the Bill of Quantities.

403.5.3 Other Items

The quantities of all other Contract Items which enter into the completed and accepted structure shall be paid for at the contract unit prices for the several Pay Items as prescribed for the Items involved.

403.5.4 Payment as Reinforcing Steel

When the Bill of Quantities does not contain a pay item for structural steel, the quantities of metal drains, scuppers, conduits, ducts and structural shapes for expansion joints and pier protection, measured as provided above will be paid for as Reinforcing Steel under Item 404.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1047(2)b	Structural Steel Roof Truss	kilogram
1047(2)c	Structural Steel Purlins	Kilogram
1047(3)a	Metal Structure Accessories (Anchor Bolt)	Pcs.
1047(3)b	Metal Structure Accessories (Sagrods)	Pcs.
1047(3)c	Metal Structure Accessories (Turnbuckle)	Pcs.
1047(3)d	Metal Structure Accessories (Cross Bracing)	Pcs.
1047(5)	Metal Structure Accessories (Steel Plates)	Kilogram

Where separate payment is to be made for certain metals or for certain particular components, other than under the general provision for structural steel, designation of those particular cases shall be inserted in the spaces provided in the pay names for Item 403 (2), 403 (4) or 403 (6), as the case may be.

ITEM 1014 - PREPAINTED METAL SHEETS

1014.1 Description

This Item shall consist of furnishing all pre-painted metal sheet materials, tools and equipment, plant including labor required in undertaking the proper installation complete as shown on the Plans and in accordance with this Specification.

1014.2 Material Requirements

All pre-painted metal sheet and roofing accessories shall be oven baked painted true to profiles indicated on the Plans.

1014.2.1 Pre-Painted Roofing Sheets

Pre-painted roofing sheets shall be fabricated from cold rolled galvanized iron sheets specially tempered steel for extra strength and durability. It shall conform to the material requirements defined in PNS 67: 1985. Profile section in identifying the architectural moulded rib to be used are as follows: Regular corrugated, Quad-rib, Tri-wave, Rib-wide, twin-rib, etc. Desired color shall be subject to the approval of the Architect/Engineer.

1014.2.2 Gutters, Valleys, Flashings Hip and Ridge roll shall be fabricated from gauge 24 (.600 mm thick) cold-rolled plain galvanized iron sheets specially tempered steel. Profile section shall be as indicated on the Plans.

1014.2.3 Fastening hardware shall be of galvanized iron straps and rivets. G.I. straps are of .500 mm thick x 16 mm wide x 267 mm long (gauge 26 x 5/8" x 10-1/2") and standard rivets.

1014.2.4 Base metal thickness shall correspond to the following gauge designation available locally as follows:

a) Base Metal Thickness	Designated Gauges
.400 mm thick	Gauge 28
.500 mm thick	Gauge 26
.600 mm thick	Gauge 24
.800 mm thick	Gauge 22
b) Protective Coatings	<u>Thickness</u>
1. Zinc	34.4 microns (244 gm/m ²)
2. Paint coatings	
Top coat	15.20 microns
Bottom coat	6.8 microns
a) Overall thickness with protective coats	
b) .400 mm	.428-451 mm
.500 mm	.532-551 mm
.600 mm	.638-651 mm

c) Length of roofing sheets - available in cut to length long span length up to 18.29 meters

d) Special length and thickness are available by arrangements.

1014.3 Construction Requirements

Before any installation work is commenced, the Contractor shall ascertain that the top faces of the purlins are in proper alignment. Correct the alignment as necessary in order to have the top faces of the purlins on an even plane.

1014.3.1 Handling/Lifting/Positioning of Sheets

Sheets shall be handled carefully to prevent damage to the paint coating. Lift all sheets or sheet packs on to the roof frame with the overlapping down-turned edge facing towards the side of the roof where installation will commence, otherwise sheets will have to be turned end-to-end during installation.

1014.3.2 Installation Procedure

1014.3.2.1 Start roofing installation by placing the first sheet in position with the downturned edge in line with other building elements and fastened to supports as recommended.

1014.3.2.2 Place the downturned edge of the next sheet over the edge of the first sheet, to provide side lap and hold the side lap firmly in place. Continue the same procedure for subsequent sheets until the whole roofing area is covered and/or (Adopt installation procedure provided in the instruction manual for each type of Architectural molded rib profile section).

1014.3.2.3 For walling applications follow the procedure for roofing. Allow a minimum end lap of 100 mm (4") for vertical walling.

1014.3.3 Gutters, Valleys, Flashing ridge and Hip rolls

Gutters, valleys, flashing ridge and hip rolls shall be fastened where indicated on the Plans by self-tapping screws or galvanized iron straps and rivets.

1014.3.4 End Laps

In case handling or transport consideration requires to use two or more end lapped sheets to provide full length coverage for the roof run, install each line of sheets from bottom to top or from eave line to apex of roof framing. Provide 150 mm minimum end lap.

1014.3.5 Anchorage/Fastening

1014.3.5.1 Pre-painted steel roofing sheets shall be fastened to the wood purlins with standard length G.I. straps and rivets.

1014.3.5.2 For steel frame up to 4.5 mm thick use self-drilling screw No. 12 by 35 mm long hexagonal head with neoprene washer.

1014.3.5.3 For steel support up to 5 mm thick or more use thread cutting screw No. 12 by 40 mm long hexagonal head with neoprene washer.

1014.3.5.4 Side lap fastener use self-drilling screw NO.10 by 16 mm long hexagonal head with neoprene washer.

1014.3.5.5 Valley fastened to lumber and for walling use self-drilling wood screw No. 12 by 25 mm long hexagonal head with neoprene washer.

1014.3.5.6 Valleys fastened to steel supports use self-drilling screws, hexagonal head with neoprene washer. Drill size is 5 mm diameter.

1014.3.6 Cutting of Sheets

1014.3.6.1 In cutting pre painted steel roofing sheets and accessories to place the exposed color side down. Cutting shall be carried out on the ground and not over the top of other painted roofing product.

1014.3.6.2 Power cutting or drilling to be done or carried out on pre-painted products already installed or laid in position, the area around holes or cuts shall be masked to shield the paint from hot fillings.

1014.3.7 Storage and Protection

Pre-painted steel roofing, walling products and accessories should be delivered to the jobsite in strapped bundles. Sheets and/or bundles shall be neatly stacked in the ground and if left in the open it shall be protected by covering the stack materials with loose tarpauline.

1014.4 Method of Measurement

The work done under this Item shall be measured by actual area covered or installed with pre-painted steel roofing and/or walling in square meters and accepted to the satisfaction of the Engineer/Architect.

1014.5 Basis of Payment

The area of pre-painted steel roofing and/or walling in square meters as provided in Section 1014 shall be paid for at the unit bid or contract unit price which payment shall constitute full compensation including labor, materials, tools and incidents necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1014(a)	Pre-painted Metal Sheets (Rib-Type Long Span)	Square Meters

ITEM 1013 – CORRUGATED METAL ROOFING ACCESSORIES

1013.1 Description

This Item shall consist of furnishing all plant equipment, tools, materials and labor required to properly perform and complete the corrugated metal roofing, together with related accessories such as ridge/hip rolls, valleys, gutters and flashing, when called for on Plans all in conformity with his Specifications.

1013.2 Material Requirements

1013.2.1 Corrugated and Plain Galvanized Iron Sheets

Corrugated galvanized iron (G.I.) sheets, including plain G.I. sheets for roofing accessories, shall be cold-rolled meeting ASTM A 153 and with spelter coating of zinc of not less than 0.381 kg/m² (1.25 ounces/square foot), conforming to ASTM A 525 OR pns 67:1985. Unless otherwise specified or shown on Plans roofing sheets shall be gauge 26 (0.48 mm thick) and provided in long span sizes to minimize end laps. Sheets shall weigh not less than 3.74 kg/m² and shall be marked or stamped showing the gauge, size, amount of zinc coating, brand and name of manufacturer. Test specimens shall stand being bent through 180° flat on itself without fracture of the base metal and without flaking of the zinc coating.

1013.2.2 Strap Fasteners

Strap fasteners shall be gauge 26 G.I. 25 mm wide and sufficiently long to bend around up to the opposite face of purlin, with corners chipped off at the riveting ends.

1013.2.3 Rivets, Washers and Burrs

Rivets and washers shall be galvanized mild iron. Rivets shall not be less than 5 mm in diameter and 10 mm in length. Washers shall not be less than 1.5 mm thick and 20 mm in outside diameter. Washer's inside diameter shall provide snug fit to the rivet.

1013.2.4 Soldering Lead

Soldering lead shall have a composition of 50 percent tin and 50 percent lead, conforming to ASTM B 32.

Rivets and burrs for lap joints of gutters, downspouts and flashing shall be copper not less than 3.175 mm in diameter (No. 8).

1013.2.5 Fabricated Metal Roofing Accessories

Ridge/hip rolls, valleys, flashing and counter flashings, gutters and downspouts, whenever required, shall be fabricated from plain G.I. sheets. Ridge/hip rolls, flashings and counter flashings shall be gauge 26. Valleys, gutters and downspouts shall be gauge 24 unless otherwise specified on Plans. Wire basket strainers shall be galvanized, gauge 24.

Roof ventilators, whenever required shall be fabricated from gauge 26 plain G.I. sheets and constructed to the dimensions and details shown on Plans.

1013.3 Construction Requirements

1013.3.1 Preparatory Work

Preparatory Work to the installation of the corrugated G.I. roofing, purlins should have been placed and spaced properly to fit the length of roofing sheets to be used such that the centerline of the purlins at end laps are 150 mm from the bottom line of end laps and intermediate purlins are placed equidistantly. Top of purlins should be at the same plane.

1013.3.2 Installation of Corrugated G.I. Sheets

Installation of corrugated G.I. sheets with end laps shall start at the lower part of the roof and proceed towards the direction of monsoon wind with side laps of two-and-a-half (2-1/2) corrugations. End laps shall be 250 mm minimum. Each sheet shall be fastened temporarily by 1.83 mm diameter by 25 mm long galvanized flat head nails at valleys of corrugations covered by side or end laps.

Succeeding upper rows of corrugated G.I. sheets shall be installed in the same manner until the entire roof area is covered.

Valleys, ridge/hip rolls and flashings when required, shall be installed before fastening the roofing sheets with galvanized straps and rivets. One strap shall be riveted at each alternate corrugation at the gutter line, the ridge line and at end laps and the straps bent around and nailed to the purlins. Riveting at intermediate purlins between end laps shall be done at every fourth corrugation. Rivet shall be provided with a galvanized mild iron washer below and one lead and one galvanized iron washer above the sheet. Rivet shall be sufficiently long to permit forming a hemispherical head. Riveting shall be done such that the lead washer shall be compressed to provide a watertight fit around the rivet.

1013.3.3 Installation of Roofing Accessories

a) Ridge and Hip Rolls

Ridge and hip rolls shall lap at least 250 mm over roofing sheets and, together, shall be riveted at every second corrugation.

b) Valleys

Valleys shall lap at least 450 mm each way under the roofing sheets and shall be secured to the framework with galvanized nails, such nails placed below the roofing sheets. Rivets along side of the valley shall be at every second corrugation.

c) Flashing

Flashing, of gauge 26 plain G.I. sheets, unless otherwise specified, shall be installed along intersections of roofs with concrete or masonry walls in accordance with details shown on Plans. Flashing running parallel to sheet corrugation shall lap at least two

corrugations with edge turned down. Flashing across sheet corrugation or at an angle thereto, shall lap at least 250 mm and the edge of flashing turned down at each corrugation. The vertical portion of flashing adjoining wall shall be at least 200 mm wide and provided with counter flashing.

d) Counter Flashing

Counter flashing sheets of gauge 24 plain GI shall be built into preformed wedge-shape groove of concrete or masonry wall. The edge to be built into wall groove shall have a 25 mm strip bent 45 degrees and shall be sealed in the groove with cement mortar or caulking compound.

e) Reglets

Reglets when required per plans in connection with counter flashing shall be fabricated products approved by the Engineer, complete with fittings. Reglets shall be located not less than 200 mm or more than 40 mm above roofing. Reglet plugs shall be spaced not more than 300 mm on centers. Open-type reglets shall be filled with fiber board or other suitable separator to prevent crushing of the slot during installation. The counter flashing shall be inserted into the full depth of reglet and the reglet lightly punched- every 300' mm to crimp the reglet and the counter flashing together.

f) Gutters

Gutters, from gauge 24 plain G.I. sheets, shall be fabricated to the shape and dimensions indicated on the Plans. The rear side of the gutter shall have a 12.5 mm strip bent 30 degrees and shall be not less than 12.5 mm higher than the opposite side. Gutter joints shall be flat seam folded in the direction of flow and soldered evenly. Otherwise, gutter joints shall be lapped at least 25 mm, fastened together with 3.175 mm diameter (No.8) copper rivets and burrs, and sealed by soldering along both exposed edges of lap.

Gutter shall be attached to fascia board or roof nailer with galvanized nails or screws spaced at not more than 900 mm on centers and at a point slightly higher than leading edge of gutter. As additional support, gutter shall have plain G.I. strap hangers 25 mm wide fastened to roof nailers by screw shank-type nails and riveted to the gutter'; leading edge. Strap hangers shall be spaced at not more than 900 mm on centers. When shown on Plans that gutter is not fixed to fascia board or purlin, gutter shall be supported by wrought iron (W.I.) hangers not less than 4.75 mm thick and 19 mm wide spaced at not more than 900 mm on centers. W.I. hanger shall be fabricated to fit configuration of the gutter and attached to fascia board or purlin with two (2) No.8 flat head wood screws.

Gutter shall be installed with a pitch of 1 in 100 slope to downspout.

g) Downspouts

1) Downspouts

Unless specified otherwise, downspouts shall be plain G.I., thickness fabricated to the dimensions shown on the Plans and installed at indicated locations. Downspout shall be secured to the wall with G.I. straps 25 mm wide, spaced at more than 1000 mm

and anchored with concrete nails. Inlets of downspouts shall be fitted with gauge 14 wire basket strainers.

2) Unplasticized Polyvinyl Chloride Downspouts

When shown on Plans that downspouts are other than G.I. sheets, downspouts shall be unplasticized polyvinyl chloride (UPVC) pipes and fittings with dimensions indicated and conforming with ASTM D 3033 and D 3034. Joints shall be made with either solvent cement or rubber "O-rings" depending on the design of fitting for the joints. Rubber "O-rings" shall be neoprene type, heat and oil resistant, complying with ASTM F-477. Downspout shall be secured to adjoining wall with plain G.I. straps 25 mm wide and spaced at not more than 1000 mm.

g) Roof Ventilators

Roof ventilators, whenever shown on Plans shall be firmly secured to the roofing or roof structure by means of rivets, Roof ventilators installed on the roof at places other than the ridge shall be provided with adequate flashing around intersection with roofing to ensure watertight joints.

1013.3.4 Joints of G.I. Roofing Accessories

a) Soldered Joints

Joints made by lapping coupled with riveting shall be rendered watertight by soldering. All edges of uncoated sheet metal to be soldered shall be pre-tinned before soldering. Soldering shall be done slowly with well heated iron in order to thoroughly heat the seam and sweat the solder completely through the full length of the seam. Upon completion of soldering, acid shall be neutralized by washing thoroughly with water.

b) Non-soldered Joints

Non-soldered joints of G.I. gutters, downspouts and flashings shall be done by flat lock seams. Two adjoining edges of lock seam shall be bent 90°. One bent strip shall be at least 15 mm wide and the connecting piece shall have a bent strip twice in width which shall be bent down over the upturned narrower strip and pressed together. Once properly interlocked, the joint shall be flattened such that the edge of the wider strip be concealed.

1013.3.5 Roof Installation on Metal Purlins

Installation on metal purlins shall follow the same procedure as that on wood purlins, except that fastening shall be done with thread-cutting, zinc-coated steel screws, No. 12 by 50 mm. having hexagonal heads and provided with neoprene washers. Screw holes shall be drilled using 5 mm (13/64") diameter bit.

1013.3.6 Water Leak Test

The completed roofing shall be tested for water tightness at side and end laps at joints of roofing sheets with ridge/hips rolls, valleys and flashings by means of water spray system. The water-spray system shall have nozzle which will deliver water pressure of 2 kg/cm² directly to the joint being tested in such manner and for a duration directed by the Engineer.

All defective works as determined by this test shall be remedied by the contractor at his expense and the test shall be repeated until the work is found satisfactory.

1013.4 Method of Measurement

Roofing sheets shall be measured and paid for on an area basis in square meters or part thereof, such roofing sheets including all laps, fasteners and rivets as installed complete and accepted.

Ridge/hip rolls, flashings, valleys, gutters and down-spouts shall be measured in linear metre of completed and accepted work such measurement shall include necessary straps and fixings required for complete installation.

Roof ventilators shall be measured and paid for per unit completely installed and accepted.

The different pay Items under roofing work shall be designated the following number, description and unit of measure:

Pay Item Number	Description	Unit of Measurement
1013(2)	Fabricated metal roofing accessories (Ridge Roll)	Ln. M.
1013(2)c	Fabricated metal roofing accessories (Gutter)	Ln. M.

ITEM 1027 - CEMENT PLASTER FINISH

1027.1 Description

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

1027.2 Material Requirements

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

1027.2.1 Cement

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

1027.2.2 Hydrated Lime

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

1027.2.3 Fine Aggregates

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

1027.3 Construction Requirements

1027.3.1 Mixture

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

1027.3.2 Surface Preparation

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

1027.3.3 Application

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

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

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

1027.3.4 Workmanship

Cement plaster finish shall be true to details and plumed. Finish surface shall have no visible junction marks where one (1) Day's work adjoins the other. Where directed by the Engineer or as shown on the Plans vertical and horizontal groove joints shall be 25 mm wide and 10 mm deep.

1027.4 Method of Measurement

All cement plaster finish shall be measured in square meters or part thereof for work actually completed in the building.

1027.5 Basis of Payment

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

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1027	Cement Plaster Finish	Sq.m.

ITEM 1032 - PAINTING, VARNISHING AND OTHER RELATED WORKS

1032.1 Description

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

1032.2 Material Requirements

1032.2.1 Paint Materials

All types of paint material, varnish and other related product shall be subject to random test as to material composition by the Bureau of Research and Standard, DPWH or the National

Institute of Science and Technology. (Use the following approved and tested brand name: Boysen, Davies, Dutch Boy, Fuller O Brien, or any approved equal).

1032.2.2 Tinting Colors

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

1032.2.3 Concrete Neutralizer

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

1032.2.4 Silicon Water Repellant

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

1032.2.5 Patching Compound

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

1032.2.6 Varnish

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

1032.2.7 Lacquer

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

1032.2.8 Shellac

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

1032.2.9 Sanding Sealer

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

1032.2.10 Glazing Putty

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

1032.2.11 Natural Wood Paste Filler

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

1032.2.12 Schedule

Exterior

- | | |
|--|---|
| a) Plain cement plastered finish to be painted | -3 coats Acrylic base masonry paint |
| b) Concrete exposed aggregate &/or tool finish | -1 coat water repellent |
| c) Ferrous metal | -1 coat primer and 2 coats enamel paint |
| d) Galvanized metal | -1 coat zinc chromate primer and
2 coats portland cement paint |
| e) Wood painted finish | -3 coats oil based paint |
| f) Wood varnished finish | -varnish water repellent |

Interior

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

1032.3 Construction Requirements

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

1032.3.1 Surface Preparation

All surfaces shall be in proper condition to receive the finish. Woodworks shall be hand-sanded smooth and dusted clean. All knotholes pitch pockets or sappy portions shall be sealed with natural wood filler. Nail holes, cracks or defects shall be carefully puttied after the first coat, matching the color of paint.

Interior woodworks shall be sandpapered between coats. Cracks, holes of imperfections in plaster shall be filled with patching compound and smoothed off to match adjoining surfaces.

Concrete and masonry surfaces shall be coated with concrete neutralizer and allowed to dry before any painting primer coat is applied. When surface is dried apply first coating. Hairline cracks and unevenness shall be patched and sealed with approved putty or patching compound.

After all defects are corrected apply the finish coats as specified on the Plans (color scheme approved).

Metal shall be clean, dry and free from mill scale and rust. Remove all grease and oil from surfaces. Wash unprimed galvanized metal with etching solution and allow it to dry. Where required to prime coat surface with Red Lead Primer same shall be approved by the Engineer.

In addition the Contractor shall undertake the following:

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

1032.3.2 Application

Paints when applied by brush shall become non-fluid, thick enough to lay down as adequate film of wet paint. Brush marks shall flaw out after application of paint.

Paints made for application by roller must be similar to brushing paint. It must be nonstick when thinned to spraying viscosity so that it will break up easily into droplets.

Paint is atomized by high pressure pumping rather than broken up by the large volume of air mixed with it. These procedures change the required properties of the paint.

1032.3.3 Mixing and Thinning

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

1032.3.4 Storage

All material to be used under this Item shall be stored in a single place to be designated by the Engineer and such place shall be kept

neat and clean at all time. Necessary precaution to avoid fire must be observed by removing oily rags, waste, etc. at the end of daily work.

1032.3.5 Cleaning

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

1032.3.6 Workmanship in General

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

1032.3.7 Procedure for Sea-Mist Finish

- a) Depress wood grain by steel brush and sand surface lightly.
- b) Apply sanding sealer.
- c) Apply two coats of industrial lacquer paint.
- d) Spray last coat of industrial lacquer paint mixed with sanding sealer.

- e) Apply wood paste filler thinned with turpentine or paint thinner into the wood surface.
- f) Wipe off wood paste filler immediately.
- g) Spray flat or gloss lacquer whichever is specified.

1032.3.8 Procedure for Varnish Finish

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

1032.3.9 Procedure for Ducco Finish

- a) Sand surface thoroughly.
- b) Apply primer surface white or gray by brush or spray.
- c) Apply lacquer spot putty in thin coat. Allow each coat for become thoroughly dry before applying next coat.
- d) Apply primer surfaces and then allow drying in two (2) hours before applying the next coat.
- e) Apply a coat of flat tone semi-gloss enamel as per color scheme submitted and approved by the Engineer.

1032.4 Method of Measurement

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

1032.5 Basis of Payment

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

Payment will made under:

Pay Item Number	Description	Unit of Measurement
1032(1)a	Painting Works (Masonry Painting)	Square Meters
1032(1)c	Painting Works (Metal Painting)	Square Meters
SPL A	Rubberized Paint	Square Meters

ITEM 1038 – REFLECTIVE INSULATION

1038.1 Description

This item shall consist of furnishing all thermal insulation materials of one or more low emittance surfaces bounding one or more enclosed air spaces, tools and equipment, plant including labor required in undertaking the proper installation complete as shown on the Plans and in accordance with this Specification.

1038.2 Material Requirements

Reflective insulation materials shall consist of low emittance surface(s) with, or without, substrates and adhesives required to meet the specified thermal performance and physical properties.

Multiple layer reflective insulations shall be designed to attain the intended separation of layers in normal application. Such multiple layer insulation shall form an attachment flange suitable for stapling, or other means of attachment.

Insulation shall be furnished in dimensions to fit framing members, at spacings standard in the construction industry, or as specifically agreed upon between the producer and the buyer.

1038.2.1 Physical Properties Requirements

1038.2.1.1 Low emittance materials shall have a surface with an emittance of 0.1 or less, as determined in accordance with Subsection 1038.3.3.1.

1038.2.1.2 *Permeance*—If the reflective insulation is to serve as a vapor retarder, the permeance of the material shall not exceed one perm, as determined in accordance with Subsection 1038.3.3.2.

1038.2.1.3 *Surface Burning Characteristics*—Building code requirements specify flame spread and smoke development values determined in accordance with Subsection 1038.3.3.3, except as follows:

(1) Maximum surface burning characteristics shall not exceed 25 flame spread index and 50 smoke development index in either marine or inside plenum applications.

(2) Maximum surface burning characteristics shall not exceed 25 flame spread index and 450 smoke development index in exposed building applications or

other installations that may have specific requirements not covered by the National Building Code.

1038.2.1.4 *Humidity Resistance*—The laminates of the reflective insulation shall be tested in accordance with Subsection 1038.3.3.4. Three specimens shall be exposed. Shield the test specimens from condensate that may drip from the ceiling of the humidity chamber.

1038.2.1.4.1 The specimens shall be evaluated for visible corrosion and delamination. For purposes of corrosion evaluation, the outer 6.4 mm (0.25 in.) perimeter may be disregarded. No tested specimen shall exhibit visible crystalline deposits exceeding 2 % of the test area nor exhibit unaided delamination of layers.

1038.2.1.5 *Adhesive Performance:*

1038.2.1.5.1 *Bleeding*—Adhesives, when used, shall show no sign of bleeding when tested in accordance with the test procedure in ASTM C1224. Bleeding at cut edges may be disregarded. Bleeding or delamination, covering over 2 % of the specimen area, shall be cause for rejection.

1038.2.1.5.2 *Pliability*—Specimens tested in accordance with the test procedure in ASTM C1224 shall not show cracking or delamination.

1038.2.1.6 *Fungi Resistance*—Specimens shall not have growth greater than comparative item when tested in accordance with Subsection 1038.3.3.6. Use interpretation of results of ASTM Test Method C 1338.

1038.2.1.7 *Thermal Resistance*—Determine the thermal resistance in accordance with procedures in Subsection 1038.3.3.7. The results of the procedures shall indicate the R-value of the product, in the assembly tested.

1038.3 Construction Requirements

1038.3.1 Preparatory Work

1038.3.1.1 In areas where insulation is to be installed, components of the electrical system shall be in good condition. If the electrical

system is found to be faulty, proper inspection and repair shall be accomplished.

- 1038.3.1.2** Inspect the roof, walls, ceilings, and floors to identify areas where a previous or existing moisture problem has caused paint peeling, warpage, stain, visible fungus growth, rotting, or other structural damage.
- 1038.3.1.3** Do not install insulation in such areas until the Government has been informed, and these conditions have been corrected and their source(s) eliminated.
- 1038.3.1.4** Provide proper attic ventilation and the use of vapour retarders if required prior to installation in accordance with building requirements or practices. Install insulation in such a way as to ensure free movement of air through all vents.
- 1038.3.1.5** In the areas where insulation is to be installed, the applicator shall locate and plan for subsequent blocking around recessed lighting fixtures, motors, fans, blowers, heaters, flues, chimneys, and other heat-producing electrical or mechanical devices.
 - 1038.3.1.5.1** Securely fasten blocking, such as wood, metal, or unfaced mineral wool batts, around all heat-producing devices to permanently maintain the clearances specified in 1038.3.1.5.2, 1038.3.1.5.3, or the exception in 1038.3.1.5.4. Install all required blocking at least as high as the height of the finished insulation and in a manner that ensures all devices that require maintenance or servicing remain accessible after the insulation is installed.
 - 1038.3.1.5.2** Install blocking to provide a minimum 76 mm (3 in.) clearance around all sides of recessed lighting fixtures, unless such fixtures are approved for installation in direct contact with insulation, including fixture wiring compartments and ballasts and other heat-producing devices not covered with thermal insulation.
 - 1038.3.1.5.3** The open area above heat producing devices must not be covered, unless they are specifically approved devices for operation when covered with thermal insulation.

1038.3.1.5.4 Install blocking around gas-fired appliances to provide the minimum clearances specified in Philippine National Standard (PNS). Install blocking around oil-fired appliances to provide the minimum clearances specified in PNS. Install blocking around masonry chimneys or masonry enclosing a flue to provide a minimum 50 mm (2 in.) clearance from the outside face of the masonry. Install blocking around vents, chimney, and vent connectors and chimneys other than masonry chimneys to provide the minimum clearances specified in National Building Code.

1038.3.2 Installation

1038.3.2.1 The insulation material shall be handled in accordance with manufacturer's instructions and should be kept free of extraneous materials. The materials should be kept dry and should not be in contact with the ground or other sources of water.

1038.3.2.2 Manufacturer's installation instructions and National Building Code shall be followed to ensure proper installation. The thermal performance of reflective insulation is based on the maintenance of a totally enclosed air space adjacent to the low emittance surface(s).

1038.3.2.3 The thermal performance of a reflective insulation depends upon adherence to manufacturer's spacing recommendations. When instructions for insulating undersize and oversize cavities is not provided the manufacturer shall be consulted.

1038.3.2.4 Damaged areas will result in loss of performance and shall be repaired with low emittance material(s). Minor damage such as rips, tears, or punctures shall be repaired with low emittance materials while larger damaged areas shall be replaced with new reflective insulation.

1038.3.2.5 The thermal performance of a reflective insulation may be reduced by a corrosive environment. Reflective insulations should not be installed in environments that are corrosive to the low emittance surface.

1038.3.2.6 The thermal performance of a reflective insulation may be adversely affected by materials such as dust, oil, or paint on the

surfaces. These materials shall be removed during installation taking care not to damage the insulation.

1038.3.2.7 Moisture will affect the thermal performance of the reflective insulation as long as it remains on the surface. Insulation shall be free of moisture at the time of installation.

1038.3.2.8 It is important that reflective insulation be fitted closely around all non-heat producing components and taped to eliminate gaps or voids through which air, dust, or water vapour might pass.

1038.3.3 Testing

1038.3.3.1 *Emittance*—The emittance of the product shall be tested in accordance with ASTM Test Method C 1371.

1038.3.3.2 *Permeance*—The permeance of the product shall be tested in accordance with ASTM Test Method E 96, Desiccant Method.

1038.3.3.3 *Surface Burning*—Surface burning characteristics shall be tested in accordance with ASTM Test Method E 84.

1038.3.3.4 *Humidity Resistance*—The humidity resistance of the product shall be tested in accordance with ASTM Test Method C 1258.

1038.3.3.5 *Adhesive Performance* – The adhesive performance shall be tested in accordance with the applicable requirements in ASTM C 1224.

1038.3.3.6 *Fungi Resistance*—The fungi resistance of the product shall be determined in accordance with Test Method C 1338.

1038.3.3.7 *Thermal Performance*—The thermal performance of reflective insulation shall be determined in accordance with the applicable requirements in ASTM Test Method C 1363.

1038.4 Method of Measurement

The work done under this Item shall be measured by actual area covered or installed with reflective insulation in square meters and accepted to the satisfaction of the Engineer/Architect.

1038.5 Basis of Payment

The area of reflective insulation in square meters as provided in Section 1038.4 shall be paid for at the unit bid or contract unit price which payment shall constitute full compensation including labor, materials, tools and incidents necessary to complete this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1038.2	Reflective Insulation	Square Meter

ITEM SPL A - RUBBERIZED PAINT

(Refer to Item 1032)

ITEM 1001 - STORM DRAINAGE AND SEWERAGE SYSTEM

1001.1 Description

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

1001.2 Material Requirements

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

Portland Cement	ASTM C-150
Fine and Coarse Aggregate	ASTM C-33
Reinforcing Steel	ASTM A-615
Non-reinforced Concrete Pipes	ASTM C-14
Reinforced Concrete Pipes	ASTM C-76 (AASHTO M-86)
Cast Iron Pipes (for conductors)	ASTM A-74

and downspout)

Galvanized Iron Pipes Scheduled 40 ASTM A-120

(for conductors and downspouts)

Polyvinyl Chloride (PVC) ASTM 2729

(for conductors and downspouts)

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

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

Cast Iron Pipes and Fittings ASTM A-74

Pig Lead(for securing and sealing joint) ASTM B 29-77

PVC Pipes and Fittings (where called in Plans) ASTM 01784

Solvent Cement (for securing PVC joints) ASTM 02564

Where PVC pipes and fittings are used, joints shall be secured with rubber "O" ring or solvent cement, as the case maybe.

Oakum for joints in bell and spigot pipes shall be made from hemp fiber, braided or twisted and oil impregnated free from lumps, dirt and extraneous matter.

1001.3 Construction Requirements

1001.3.1 Installation of Pipes

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

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

b. Laying of Pipes. Proper facilities shall be provided for lowering and' placing pipes into trenches in order to preclude damage. Laying of pipes shall start upgrade with the spigot end of bell-and-spigot pipe, or the tongue end of tongue-and-groove pipe, positioned towards the direction of the flow. The pipes shall be laid in accordance with the grades and alignments shown in the Plans.

The spigots or tongues shall be adjusted in bells or grooves to provide uniform space around joints to receive mortar. Blocking or wedging between spigot and bell or between

tongue and groove to attain proper spacing shall be allowed provided such blocking/wedging shall not interfere and shall not affect the water tightness of the joint.

c. Bell and Spigot Joint for Drain Pipe. The first pipe shall be properly bedded at the required grade. Just below the spigot of the first unit, a sufficient space shall be provided for engaging the bell end of the second pipe.

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

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

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

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

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

1001.3.2 Sewer Connections and Clean-Outs

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

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

1001.3.4 Incidental Earthwork

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

1001.3.5 Inspection and Quality Control

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

1001.4 Method of Measurement

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

1001.5 Basis of Payment

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

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1001(6)	Catch Basin (Concrete/CHB)	Each
1001(1)a	50mm dia to 100mm dia PVC Pipe, S-1000	Meters

ITEM 1100 - CONDUITS, BOXES & FITTINGS

1100.1 Description

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

1100.2 Material Requirements

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

Conduits

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

Conduit Boxes

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

Conduit Fittings

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

1100.3 Construction Requirements

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

Conduits

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

No conduits shall be used in any system smaller than 12 mm diameter electric trade size nor shall have more than four (4) 90-degree bends in anyone run and where necessary, pull boxes shall be provided.

All ends of conduits which are left empty in cabinets and conduit boxes shall be plugged with lead or approved pipe caps so as to prevent the entrance of white ants and dirt within the conduit system. Pull wires shall be inserted in the empty ducts before they are closed with lead or pipe caps and shall be left therein for future use.

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

Conduit Boxes & Fittings

Provide conduit boxes for pulling and splicing wires and outlet boxes for installation of wiring devices.

As a rule, provide junction boxes or pull boxes in all runs greater than 30 meters in length, for horizontal runs. For other lengths, provide boxes as required for splices or pulling. Pull boxes shall be installed in inconspicuous but accessible locations.

Support boxes independently of conduits entering by means of bolts, red hangers or other suitable means.

Conduit boxes shall be installed plumb and securely fastened. They shall be set flush with the surface of the structure in which they are installed where conduits are run concealed.

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

Floor mounted outlet boxes required shall be waterproof type with flush brass floor plate and brass bell nozzle.

All boxes shall be painted with antirust red lead paint after installation.

All conduits shall be fitted with approved standard galvanized bushing and locknuts where they enter cabinets and conduit boxes.

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

1100.4 Method of Measurement

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

1100.5 Basis of Payment

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

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
(1)	RSC Conduit Pipe - mm dia., with couplings	length
(2)	Locknut & Bushings	pairs
(3)	Condulet type	pieces
(4)	Conduit pipe elbow	pieces
(5)	Connector	pieces
(6)	Conduit clamp	pieces
(7)	PVC adapter	pieces
(8)	G.I Wire G.A # 14	kilos
(9)	Hacksaw Blade	pieces
(10)	PVC Tape 19 mm dia x 18 mm	rolls
(11)	Rubber Tape 19 mm dia x 227g	rolls
(12)	PVC Solvent Cement @ 400 cc	cans
(13)	PVC End Ball	pieces
(14)	Octagonal junction boxes	pieces
(15)	Utility Boxes	pieces
(16)	Metal Pull Box	pieces
(17)	Square Box	pieces
(18)	Telephone Cabinet	set

(19)	Reinforced Concrete pedestal Pole	lot
(20)	Read Lead Point	lot
(21)	Wetherhead with type "F" conduit	pieces
(22)	Grounding Rod copperweld 20 mm dia x 3 m	length
(23)	Apitong or Approved equal creosoted wood pole	pieces
(24)	Anchor Rod-mm dia	pieces
(25)	Anchor Log-mm dia	pieces
(26)	Powerload Studs with nuts	pieces

1100.6 General Specifications

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

1100.7 Specifications on:

1. Lighting fixtures and lamp

All lighting fixtures and lamps are as specified and listed on lighting fixture schedule.

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

2. Material Requirements

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

3. Construction Requirements

All grounding system installation shall be executed in accordance with the approved plans.

Grounding system shall include building perimeter ground wires, ground rods, clamps, connectors, ground wells and ground wire taps as shown in the approved design.

1100.8 Auxiliary Systems

All auxiliary systems such as telephone and intercom system, time clock system, fire alarm system and public address/nurse's call/paging system installations shall be done in accordance with the approved design.

All materials to be used shall conform to the Bureau of Product Standards (BPS) specifications.

1100.9 Important requirement regarding supervision of the work and submission of certificate of completion.

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

1100.10 Test and guarantee

Upon completion of the electrical construction work, the contractor shall provide all test equipment and personnel and to submit written copies of all test results.

The contractor shall guarantee the electrical installation are done and in accordance with the approved plans and specifications. The contractor shall guarantee that the electrical systems are free from' all grounds and from all defective workmanship and materials and will remain so for a period of one year from date and acceptance of works. Any defect shall be remedied by the Contractor at his own expense.

ITEM 1101 - WIRES AND WIRING DEVICES

1101.1 Description

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

1101.2 Material Requirements

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

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

All wiring devices shall be standard products of reputable electrical manufacturers. Wall switches shall be rated at least 1 OA, 250 volts and shall be spring

operated, flush, tumbler type. Duplex convenience receptacles shall be rated at least 15A, 250 volts, flush, parallel slots.

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

1101.3 Construction Requirements

Conductors or wires shall not be drawn in conduits until after the cement piaster is dry and the conduits are thoroughly cleaned and free from dirt and moisture. In drawing wires into conduits, sufficient slack shall be allowed to permit easy connections for fixtures, switches, receptacles and other wiring devices without the use of additional splices.

All conductors of convenience outlets and lighting branch circuit home runs shall be wired with a minimum of 3.5 mm in size. Circuit home runs to panel boards shall not be smaller than 3.5 mm but all home runs to panel board more than 30 meters shall not be smaller than 5.5 mm. No conductor shall be less than 2 mm in size.

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

All joints, taps and splices on wires larger than 14 mm shall be made of suitable solder less connectors of the approved type and size. They shall be taped with rubber and PVC tapes providing insulation not less than that of the conductors.

No splices or joints shall be permitted in either feeder or branch conductors except within outlet boxes or accessible junction boxes or pull boxes. All joints in branch circuit wiring shall be made mechanically and electrically secured by approved splicing devices and taped with rubber and PVC tapes in a manner which will make their insulation as that of the conductor.

All wall switches and receptacles shall be fitted with standard Bakelite face plate covers. Device plates for flush mounting shall be installed with all four edges in continuous contact with finished wall surfaces without the use of coiled wire or similar devices. Plaster fillings will not be permitted. Plates installed in wet locations shall be gasketed.

When more than one switch or device is indicated in a single location, gang plate shall be used.

1101.4 Method of Measurement

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

1101.5 Basis of Payment

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

Payment shall be made under:

Pay ItemNumber	Description	Unit of Measurement
(1)	Electric Wire	meter of rolls
(2)	Single pole tumblerswitch	pieces
(3)	Two-gang tumbler switch	pieces
(4)	Three-gang tumbler switch	pieces
(5)	Three-way tumbler switch	pieces
(6)	Duplex Convenience receptacles	set
(7)	Heavy Duty Convenience receptacles	set
(8)	Standard Telephone outlet bakelite cover with 9.52 center hole	pieces
(9)	Window type air conditioning outlet 3-prong polarized type	pieces
(10)	Bare copper wire	meters
(11)	Grounding clamps for electric wires	pieces
(12)	Messenger wire	meters
(13)	Guy wire	meters
(14)	Vibrating Bell	set
(15)	Traffic light Control Panel	set
(16)	Traffic light metal enclosures complete with red and green light provided with reflectors and 152 mm diameter vibrating bell	set

ITEM 1102 - POWER LOAD CENTER, SWITCHGEAR AND PANELBOARDS

1102.1 Description

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

1102.2 Material Requirements

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

Power Load Center Unit Substation

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

High Voltage Primary Section:

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

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

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

Transformer Section

The transformer section shall consist of a power transformer with ratings and capacities as shown on the plans. It shall be oil liquid-filled non-flammable type and designed in accordance with the latest applicable standards.

The transformer shall be provided with four (4) approximately 2 1/2 % rated KVA taps on the primary winding in most cases one (1) above and three (3) below rated primary voltage and shall be changed by means of externally gang-operated manual tap changer only when the transformer is de-energized. Tap changing under load is acceptable if transformer has been so designed.

The following accessories shall be provided with the transformer, namely: drain valve, sampling device, filling connection, oil liquid level gauge, ground pad, top filter press connection, lifting lugs, diagrammatic nameplate, relief valve, thermometer and other necessary related accessories.

The high-voltage and low-voltage bushings and transition flange shall be properly coordinated for field connection to the incoming line section and low voltage switchboard section, respectively.

Low-Voltage Switchboard Section

The low-voltage switchboard shall be standard modular-unitized units, metal-built, dead front, and safetytype construction and shall consist of the following:

(a) Switchboard Housing

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

(b) Secondary Metering Section

The secondary metering section shall consist of one (1) ammeter, AC, indicating type; one (1) voltmeter, AC, indicating type, one (1) ammeter transfer switch for 3-phase; one (1) voltmeter transfer switch for 3phase; and current transformers of suitable rating and capacity.

The above-mentioned instruments shall be installed in one compartment above the main breaker and shall be complete with all necessary accessories completely wired, ready for use.

(c) Main Circuit Breaker

The main circuit breaker shall be draw-out type, manually or electrically operated as required with ratings and capacity as shown on the approved Plans.

The main breaker shall include insulated control switch if electrically operated, manual trip button, magnetic tripping devices, adjustable time over current protection and instantaneous short circuit trip and all necessary accessories to insure safe and efficient operation.

(d) Feeder Circuit Breakers

There shall be as many feeder breakers as are shown on the single line diagram or schematic riser diagram and schedule of loads and computations on the plans. The circuit breakers shall be draw out or molded case as required. The circuit breakers shall each have sufficient interrupting capacity and shall be manually operated complete with trip devices and all necessary accessories to insure safe and efficient operation. The number, ratings, capacities of the feeder branch circuit breakers shall be as shown on the approved Plans.

Circuit breakers shall each be of the indicating type, providing "ON" - "OFF" and "TRIP" positions of the operating handles and shall each be provided with nameplate for branch circuit designation. The circuit breaker shall be so designed that an overload or short on one pole automatically causes all poles to open.

Low-Voltage' Switchgear

(For projects requiring 'low-voltage switchgear only).

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

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

Grounding System:

All non-current carrying metallic parts like conduits, cabinets and equipment frames shall be properly grounded in accordance with the Philippine Electrical Code, latest edition.

The size of the ground rods and ground wires shall be as shown on the approved Plans. The ground resistance shall not be more than 5 ohms.

Panel boards and Cabinets

Panel boards shall conform to the schedule of panel boards as shown on the approved Plans with respect to supply characteristics, rating of main lugs or main circuit breaker, number and ratings and capacities of branch circuit breakers.

Panel boards shall consist of a factory completed dead front assembly mounted in an enclosing flush type cabinet consisting of code gauge galvanized sheet steel box with trim and door. Each door shall be provided with catch lock and two(2) keys. Panel boards shall be provided with - directories and shall be printed to indicate load served by each circuit.

Panel board cabinets and trims shall be suitable for the type of mounting shown on the approved Plans. The inside and outside of panel board cabinets and trims shall be factory painted with one rust proofing primer coat and two finish shop coats of pearl gray enamel paint.

Main and branch circuit breakers for panel boards shall have the rating, capacity and number of poles as shown on the approved Plans. Breakers shall be thermal magnetic type. Multiple breaker shall be of the common trip type having a single operating handle. For 50-ampere breaker or less, it may consist of single-pole breaker permanently assembled at the factory into a multi-pole unit.

1102.3 Construction Requirements

The Contractor shall install the Power Load Center Unit Substation or Low-Voltage Switchgear and Panel boards at the locations shown on the approved Plans.

Standard panels and cabinets shall be used and assembled on the job. All panels shall be of dead front construction furnished with trims for flush or surface mounting as required.

1102.4 Method of Measurement

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

1102.5 Basis of Payment

All works performed and measured and as provided for in the Bill of Quantities shall be paid for at the Unit Bid or Contract Unit Price which payment shall constitute

full compensation including labor, materials, tools and incidentals necessary to complete this Item.

Payment shall be made under:

Pay ItemNumber	Description	Unit of Measurement
(1)	Panel board (Circuit Breaker Type)	set
(2)	Panelboard (Safety Switch Type)	set
(3)	Low-Voltage Switchgear (LVS) complete with metering devices and accessories	set
(4)	Power Fuses	pieces
(5)	Lightning Arresters	pieces
(6)	Air Break Switch	set
(7)	Enclosed ACB NEMA Type I	set
(8)	Enclosed ACB NEMA Type 3R	set
(9)	Automatic Transfer Switch	set
(10)	Manual Transfer Switch without fuses	pieces
(11)	Motor Controller	set

ITEM 1103 - LIGHTING FIXTURES

Refer to Item 1100:

1100.7 Specifications on:

1. Lighting fixtures and lamp

All lighting fixtures and lamps are as specified and listed on lighting fixture schedule.

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

2. Material Requirements

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

3. Construction Requirements

All grounding system installation shall be executed in accordance with the approved plans.

Grounding system shall include building perimeter ground wires, ground rods, clamps, connectors, ground wells and ground wire taps as shown in the approved design.

1101.5 Basis of Payment

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

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1103(1)	Lighting Fixtures	L.S.

Section VII. Drawings

[Insert here a list of Drawings. The actual Drawings, including site plans, should be attached to this section, or annexed in a separate folder.]

Section VIII. Bill of Quantities

Item No.	Scope of Work	Unit	Quantity	Unit Price	TOTAL
B.5	Project Billboard/Signboard	Each	1.00		
B.7	Occupational Safety & Health	Mos.	4.00		
B.9	Mobilization/Demobilization	L.S.	1.00		
803(1)a	Structure Excavation (Common Soil)	Cu.m.	16.91		
804(1)a	Embankment from Structure Excavation	Cu.m.	9.42		
804(1)b	Embankment from Common Borrow by Equipment	Cu.m.	35.38		
804(4)	Gravel Bedding	Cu.m.	3.64		
900(1)c2	Structural Concrete for Footing and Slab on Fill (Class A, 28 days)	Cu.m.	44.44		
900(1)	Structural Concrete for Footing Tie Beam, Column and Suspended Slab, Girder/Beam (Class A, 28 days)	Cu.m.	3.27		
902(1)	Reinforcing Steel of Reinforced Concrete Structures for One Storey	Kgs.	2,484.27		
903(2)	Formworks and Falseworks	Sq.m.	50.91		
1046	150mm CHB Non Load Bearing (Including Reinforcing Steel)	Sq.m.	76.12		
1047(2)b	Structural Steel Roof Truss	Kgs.	2,567.25		
1047(2)c	Structural Steel Purlins	Kgs.	1,785.07		
1047(3)a	Metal Structure Accessories (Anchor Bolts)	Pcs.	45.00		

1047(3)b	Metal Structure Accessories (Sagrods)	Kgs.	100.75		
1047(3)c	Metal Structure Accessories (Turnbuckle)	Pcs.	24.00		
1047(3)d	Metal Structure Accessories (Cross Bracing)	Kgs.	170.59		
1047(5)	Metal Structure Accessories (Steel Plates)	Kgs.	122.94		
1014	Pre-Painted Metal Sheets (Rib-Type, Long Span)	Sq.m.	217.85		
1013(2)	Fabricated Metal Roofing Accessory (Ridge Rolls)	m.	12.35		
1013(2)c	Fabricated Metal Roofing Accessory (Gutter)	m.	41.50		
1027(1)	Cement Plaster Finish	Sq.m.	211.79		
1032(1)a	Painting Works (Masonry Painting)	Sq.m.	484.99		
1032(1)c	Painting Works (Metal Painting)	Sq.m.	538.85		
1038(1)	Reflective Insulation	Sq.m.	108.93		
SPL A	Rubberized Paint	Sq.m.	393.12		
1001(6)	Catch Basin (Concrete/CHB)	Each	16.00		
1001(1)a	50mm dia - 100mm dia PVC Pipes Series 1000	m.	138.00		
1100(30)	Conduit Works, Boxes and Fittings	L.S.	1.00		
1101(42)	Wires and Wiring Devices	L.S.	1.00		
1102	Panel Boards	Asy.	1.00		

1103(1)	Lighting Fixtures	Set	14.00		
TOTAL BID PRICE					
<p>Amount in Words: _____</p> <p>_____.</p>					

Section IX. Checklist of Technical and Financial Documents

Notes on the Checklist of Technical and Financial Documents

The prescribed documents in the checklist are mandatory to be submitted in the Bid, but shall be subject to the following:

- a. GPPB Resolution No. 09-2020 on the efficient procurement measures during a State of Calamity or other similar issuances that shall allow the use of alternate documents in lieu of the mandated requirements; or
- b. any subsequent GPPB issuances adjusting the documentary requirements after the effectivity of the adoption of the PBDs.

The BAC shall be checking the submitted documents of each Bidder against this checklist to ascertain if they are all present, using a non-discretionary “pass/fail” criterion pursuant to Section 30 of the 2016 revised IRR of RA No. 9184.

Checklist of Technical and Financial Documents

I. TECHNICAL COMPONENT ENVELOPE

Class “A” Documents

Legal Documents

- (a) Valid PhilGEPS Registration Certificate (Platinum Membership) (all pages);
or
- (b) Registration certificate from Securities and Exchange Commission (SEC), Department of Trade and Industry (DTI) for sole proprietorship, or Cooperative Development Authority (CDA) for cooperatives or its equivalent document;
and
- (c) Mayor’s or Business permit issued by the city or municipality where the principal place of business of the prospective bidder is located, or the equivalent document for Exclusive Economic Zones or Areas;
and
- (e) Tax clearance per E.O. No. 398, s. 2005, as finally reviewed and approved by the Bureau of Internal Revenue (BIR).

Technical Documents

- (f) Statement of the prospective bidder of all its ongoing government and private contracts, including contracts awarded but not yet started, if any, whether similar or not similar in nature and complexity to the contract to be bid; **and**
- (g) Statement of the bidder’s Single Largest Completed Contract (SLCC) similar to the contract to be bid, except under conditions provided under the rules;
and
- (h) Philippine Contractors Accreditation Board (PCAB) License;
or
Special PCAB License in case of Joint Ventures;
and registration for the type and cost of the contract to be bid; **and**
- (i) Original copy of Bid Security. If in the form of a Surety Bond, submit also a certification issued by the Insurance Commission;
or
Original copy of Notarized Bid Securing Declaration; **and**
- (j) Project Requirements, which shall include the following:
 - a. Organizational chart for the contract to be bid;
 - b. List of contractor’s key personnel (*e.g.*, Project Manager, Project Engineers, Materials Engineers, and Foremen), to be assigned to the contract to be bid, with their complete qualification and experience data;
 - c. List of contractor’s major equipment units, which are owned, leased, and/or under purchase agreements, supported by proof of ownership or certification of availability of equipment from the equipment lessor/vendor for the duration of the project, as the case may be; **and**
- (k) Original duly signed Omnibus Sworn Statement (OSS);

and if applicable, Original Notarized Secretary's Certificate in case of a corporation, partnership, or cooperative; or Original Special Power of Attorney of all members of the joint venture giving full power and authority to its officer to sign the OSS and do acts to represent the Bidder.

Financial Documents

- (l) The prospective bidder's audited financial statements, showing, among others, the prospective bidder's total and current assets and liabilities, stamped "received" by the BIR or its duly accredited and authorized institutions, for the preceding calendar year which should not be earlier than two (2) years from the date of bid submission; **and**
- (m) The prospective bidder's computation of Net Financial Contracting Capacity (NFCC).

Class "B" Documents

- (n) If applicable, duly signed joint venture agreement (JVA) in accordance with RA No. 4566 and its IRR in case the joint venture is already in existence;
or
duly notarized statements from all the potential joint venture partners stating that they will enter into and abide by the provisions of the JVA in the instance that the bid is successful.

II. FINANCIAL COMPONENT ENVELOPE

- (o) Original of duly signed and accomplished Financial Bid Form; **and**

Other documentary requirements under RA No. 9184

- (p) Original of duly signed Bid Prices in the Bill of Quantities; **and**
- (q) Duly accomplished Detailed Estimates Form, including a summary sheet indicating the unit prices of construction materials, labor rates, and equipment rentals used in coming up with the Bid; **and**
- (r) Cash Flow by Quarter.

