PHILIPPINE BIDDING DOCUMENTS

(As Harmonized with Development Partners)

Procurement of INFRASTRUCTURE PROJECTS

Government of the Republic of the Philippines

Sixth Edition
July 2020

TABLE OF CONTENTS

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

INVITATION TO BID

for

PROCUREMENT AND IMPLEMENTATION OF THE MAINTENANCE AND REPAIR OF MAJOR ROAD AND SECONDARY ROADS

Project Identification No. Infra-07-2020

1. The John Hay Management Corporation (JHMC), through the *Corporate Operating Budget for CY 2020* intends to apply the sum of Seventy-Four Million Four Hundred Fifty-Three Thousand Seven Hundred Sixty Pesos (PhP74,453,760) being the Approved Budget for the Contract (ABC) to payments under the contract for the *Procurement and Implementation of the Maintenance and Repair of Major Road and Secondary Roads*. Bids received in excess of the ABC shall be automatically rejected at bid opening.

2. The John Hay Management Corporation (JHMC) now invites bids for the above Procurement Project. Completion of the Works is required within One-Hundred Seventy-Seven (177) Working 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 *JHMC* and inspect the Bidding Documents at the address given below starting 12 October 2020 from *10 A*.M. to 2 P.M., every Tuesday or Wednesday.

5. A complete set of Bidding Documents may be acquired by interested bidders *starting* 10 October *2020* from the address and website 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 Fifty Thousand (50,000) Pesos. The Procuring Entity shall allow the bidder to present its proof of payment for the fees in person, by facsimile, or through electronic means. It may also be downloaded free of charge from the website of the Philippine Government Electronic Procurement System (PhilGEPS) and the website of JHMC, provided that bidders shall pay the applicable fee for the Bidding Documents not later than the submission of their bids.

6. The JHMC will hold a Pre-Bid Conference at 10:00 a.m. of 28 October 2020 at the JHMC Conference Room, Sheridan Drive, Camp John Hay, Baguio City and/or through videoconferencing/webcasting via google meet, which shall be open to prospective bidders.

7. Bids must be duly received on or before 10:00 a.m. of 18 November 2020 by the BAC Secretariat through manual submission at the office address as indicated below or online/electronic submission as indicated below. 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.

9. Bid opening shall be at 11:00 a.m. of 18 November 2020 at the given address below and/or through video conferencing. Bids will be opened in the presence of the bidders' representatives who choose to attend the activity.

10. The Pre-bid conference will be conducted in person or face-to-face through video conferencing. Prospective Bidders who opt for video conferencing must inform the BAC Secretariat of their intent through the electronic mail address listed below. The Pre-Bid Conference is open to prospective bidders but attendance shall not be mandatory.

    JHMC allows the submission of bids through personal appearance or video conferencing. Bidders may submit their bids using the two (2) separate sealed bid envelopes system or **two (2) password-protected Bidding Documents in compressed archive folders, in case of electronic bid submission**, and which shall be submitted simultaneously. The first shall contain the technical component of the bid, including the eligibility requirements, and the second shall contain the financial component of the bid.

    In compliance with the health protocols against the COVID-19 Pandemic, JHMC is limiting the physical presence of participants for the Pre-bid conference and Bid Opening to ten (10) persons with one (1) representative from each prospective bidder. Selection of the ten (10) participants shall be based on the earliest time such a request was made. It is highly encouraged that other prospective bidders attend the Pre-Bid Conference and Bid Opening through video conferencing.

    Prospective Bidders who are confirmed to attend in person shall submit themselves to the DOH and /or LGU permits/passes and certificates.

11. The *JHMC* reserves the right to reject any and all bids, declare a failure of bidding, or not award the contract at any time prior to contract award in accordance with Section 41 of RA 9184 and its IRR, without thereby incurring any liability to the affected bidder or bidders.

12. For further information, please refer to:

    FLORENCE JOY MALLARE-ABAD
    Head, BAC Secretariat
    John Hay Management Corporation
    JHMC Office, Camp John Hay, Baguio City
    Telephone Number 074-444-5824
    Email: bac@jhmc.com.ph

(SGD) JANE THERESA G. TABALINGCOS
BAC Chairperson

Section II. Instructions to Bidders

1. Scope of Bid

The Procuring Entity, The John Hay Management Corporation (JHMC) invites Bids for the *Improvement of the Main Road and selected Secondary Roads within the John Hay Special Economic Zone*, with Project Identification Number *Infra-07-2020*.

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 *CY 2020* in the amount of Seventy Four Million Four Hundred Fifty-Three Thousand Seven Hundred Sixty Pesos (PhP74,453,760).

2.2. The source of funding is:

a. GOCC and GFIs, the proposed Corporate Operating Budget.

3. Bidding Requirements

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

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

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

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

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

5. Eligible Bidders

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

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

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

5.3. For Foreign-funded Procurement, the Procuring Entity and the foreign government/foreign or international financing institution may agree on another track record requirement, as specified in the Bidding Document prepared for this purpose.

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

6. Origin of Associated Goods

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

7. Subcontracts

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 allowed. The portions of Project and the maximum percentage allowed to be subcontracted are indicated in the **BDS,** which shall not exceed fifty percent (50%) of the contracted Works.

7.1. The Bidder must submit together with its Bid the documentary requirements of the subcontractor(s) complying with the eligibility criterial stated in **ITB** Clause 5 in accordance with Section 23.4 of the 2016 revised IRR of RA No. 9184 pursuant to Section 23.1 thereof.

7.2. The Supplier may identify its subcontractor during the contract implementation stage. Subcontractors identified during the bidding may be changed during the implementation of this Contract. Subcontractors must submit the documentary requirements under Section 23.1 of the 2016 revised IRR of RA No. 9184 and

comply with the eligibility criteria specified in **ITB** Clause 5 to the implementing or end-user unit.

7.3. Subcontracting of any portion of the Project does not relieve the Contractor of any liability or obligation under the Contract. The Supplier will be responsible for the acts, defaults, and negligence of any subcontractor, its agents, servants, or workmen as fully as if these were the Contractor's own acts, defaults, or negligence, or those of its agents, servants, or workmen.

8. 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 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 *[indicate date]*. 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

Bid Data Sheet

<table>
<tr><th>ITB Clause</th><th></th></tr>
<tr><td>5.2</td><td>For this purpose, contracts similar to the Project refer to contracts which have the same major categories of work, which shall be:

a) Application of Bituminous Concrete Surface Wearing Course (50mm thick, hot laid)
b) Painting of centerlines, edge lines and other pavement markings; and
c) Installation of road safety devices at critical sections.
d) Portland Cement Concrete Pavement.
e) Grouted Riprap
f) Guard Rails</td></tr>
<tr><td>7.1</td><td>All works stated in the ITB may be subcontracted except the following:
a) Project Billboard/Signboard
b) Occupational Safety and Health Program
c) Road Works Safety and Traffic Management
d) Mobilization/Demobilization
e) Aggregate Base Course
f) Bituminous Tack Coat (Emulsified Asphalt: CSB-3)
g) Bituminous Concrete Surface Wearing Course, Hot-Laid, 50mm thick
h) Portland Cement Concrete Pavement
i) Guardrail (Metal Guardrail, W-Beam, Including Post)
j) Road Sign (Warning Signs)
k) Reflectorized Thermoplastic Pavement Markings White
l) Reflectorized Thermoplastic Pavement Markings Yellow</td></tr>
<tr><td>10.3</td><td>Prospective bidders must have at least a Size Range Medium A with a valid license category “B” from the Philippine Contractors Accreditation Board (PCAB) for General Engineering (Road, Highways, Pavement, Railways, Airport Horizontal Structure, and Bridges)</td></tr>
<tr><td>10.4</td><td>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>
One (1) Project Engineer — Must be a license Civil Engineer for at least Ten (10) Years and at least five (5) years’ experience as a Project Engineer. — Roads and Highways
One (1) Materials Engineer — Must be a DPWH Accredited Materials Engineer I for at least Five (5) Years and with at least three (3) years — Roads and Highways</td></tr>
</table>

		minimum experience as Materials Engineer.	
	One (1) Construction Safety and Health Officer	Must be a DOLE Accredited Safety Officer for at least five (5) Years with at least three (3) years minimum experience as Health and Safety Officer.	Roads and Highways
	One (1) Foreman	With at least three (3) years minimum experience as Foreman	Roads and Highways

10.5 The minimum major equipment requirements are the following:

EQUIPMENT TO BE USED	NUMBER OF UNITS
Stake Truck (5T)	1
Barricade Flasher Light (3 Volts, Battery Operated, Amber Color)	6
Cargo Truck (2-5 mt)	1
Dumptruck	3
Generator Set	1
Jackhammer	1
Backhoe (0.8 cu.m.)	1
Motorized Road Grader	1
Vibratory Roller (10 m.t.)	1
Water Truck (1000 gal)	1
Asphalt Distributor, 10ft. Wide (5 tons)	1
Power Boom	1
Total Station with complete accessories	1
Tandem Steel Roller (10 m.t.)	1
Pneumatic Tire Roller (10 m.t.)	1
Asphalt Paver/Mixer	1
Payloader (1.5 cu.m.)	1
Batching Plant (30 cu.m.)	1
Concrete Paver, GP-2000 Slipform	1
Transit Mixer (5 cu.m.)	1

	<table><tr><td>Payloader (1.50 cu.m.), LX80-2C</td><td>1</td></tr><tr><td>Speed cutter</td><td>1</td></tr><tr><td>Cutting Outfit</td><td>1</td></tr><tr><td>Welding Machine</td><td>1</td></tr><tr><td>One Bagger Mixer</td><td>1</td></tr><tr><td>Applicator Machine</td><td>1</td></tr><tr><td>Kneading Machine</td><td>1</td></tr><tr><td>Plate Compactor</td><td>2</td></tr></table>
12	No Value Engineering.
15.1	The bid security shall be in the form of a Bid Securing Declaration or any of the following forms and amounts: a. The amount of not less than ***PhP 1,489,075.20***, 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 ***PhP 3,722,688.00*** if bid security is in Surety Bond.
19.2	Partial bids are not allowed.
20	JHMC Permits (Gate Pass, Contractor's employees identification Card)
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

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

Special Conditions of Contract

GCC Clause	
2	Intended completion date is on 23 July 2021
4.1	Delivery of the site to the Contractor is on 18 December 2020
6	The site investigation reports shall be based on any site inspection conducted by the prospective bidders.
7.2	Five (5) years.
10	Dayworks are applicable at the rate shown in the Contractor's original Bid.
11.1	The Contractor shall submit the Program of Work to the Procuring Entity's Representative within seven (7) working 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 One Thousand Pesos (PhP 1,000.00).
13	The amount of the advance payment is 15% of the total contract price and to be released and paid within sixty (60) calendar days from signing of the contract.
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 "as-built" drawings are required for every progress billing until final billing.
15.2	The amount to be withheld for failing to produce "as-built" drawings by the date required by the Implementing Unit is One-Thousand Pesos (PhP 1,000.00) for each day of delay.

Section VI. Specifications

All works for this project shall be consistent with the specifications as required by the latest DPWH Standard Specifications for Highways, Bridges and Airports.

1. CONTRACTOR'S OTHER RESPONSIBILITIES:

1.1 To provide the infrastructure required in the application of Hot Mix Asphalt (HMA) Overlay along the Main road and selected Secondary roads within the JHSEZ.

1.2 To furnish necessary equipment and material to survey, stake, calculate, and record data for the control of work in conformity with the approved plans.

1.3 To impose required construction safety practices during the implementation of the project in compliance with the approved Traffic Management Plan and Occupational Safety and Health Program as established by the Department of Labor and Employment (DOLE).

1.4 To provide and maintain an accessible temporary field office/storage, portable toilets/latrines for workers and/or testing laboratory. The Contractor shall be held responsible for the maintenance and protection of all facilities to be provided during the duration of the Contract.

1.5 To conduct removal and proper disposal of structures and/or obstructions as indicated in the approved plans. All designated salvageable material shall be removed, without unnecessary damages, for safekeeping and turn-over to the end-user.

1.6 To properly and safely dispose all wastes generated during the construction phase.

1.7 To supervise or monitor the presence of the assigned Project Personnel (Project Engineer, Materials Engineer or Safety Officer) during project implementation.

1.8 To conduct site visits to familiarize with the on-site conditions and existing facilities.

1.9 To provide as-staked and as-built plans for the road system, one (1) set original CAD drawing in A3 size, two (2) additional photocopies, and electronic file of the following:

a. Major roads
b. Selected secondary roads
c. Pavement markings
d. And all other details that maybe required

1.10 As-built plans shall indicate the following drawings in any scale not less than 1:100 meters:

a. Road layout
b. Elevation
c. Section

1.11 To submit weekly accomplishment reports during the duration of the Contract.

1.12 To shoulder all costs for power and water utilities to be used during the implementation of the project.

1.13 The contractor shall be responsible for all tests and engineering services required by the Specifications. The cost for inspection or test not required by the specifications but which are required by JHMC, will be borne by JHMC.

1.14 All tests shall be performed by accredited testing facilities and approved by JHMC, and shall be in accordance with the current standards of the American Society for testing and materials, otherwise specified by JHMC. Two (2) copies of the test procedures including results shall be furnished to JHMC.

1.15 To immediately report to JHMC all unearthed hazardous materials, buried treasures or artifacts, and shall be coordinated by JHMC to the concerned agencies for their appropriate action. All activities in area of concern shall cease until such time that the hazardous materials, treasures have been properly dealt with.

2. DPWH STANDARDS and SPECIFICATIONS

The scope of work shall be in conformity with of the DPWH standards and specifications.

ITEM B.4(10) – Miscellaneous Survey ang Staking

B.4.1 Description

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

B.4.2 Construction Requirements

B.4.2.1 General

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

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

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

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

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

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

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

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

6. Any other procedures and controls necessary for the work

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

Staking phase	Horizontal	Vertical
Existing Government network control points Local supplemental control points set from existing Government network points Centerline points (PC), **(PT)**, (POT), and (POC) including references Other centerline points	±20mm ±10 mm ±10 mm ±50 mm ±50 mm	±8 mm x K[1] ±3 mm x N[3] ±10 mm ±50mm ±50 mm
Cross-section points and slope stakes[5]	±50 mm	±50 mm
Slope stakes references	±50 mm	±20 mm
Culve rts, ditches, and minor drainage structures	±20mm	±10 mm
Retaining walls and curb and gutter	±10 mm[6]	±10 mm
Bridge substructures Bridge superstructures	±10 mm(G) ±500 mm	±10 mm -
Clearing and grubbing limits Roadway subgrade finish stakes[7]	±50 mm	±10 mm
Roadway finish grade stakes[7]	±50 mm	±10 mm

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

The Contractor shall prepare field notes in an approved format. All field notes and supporting documentation shall become the property of the government upon completion of the work.

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

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

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

B.4.2.2 Equipment

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

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

B.4.2.3 Survey and Staking Requirements

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

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

2. Roadway Cross-Sections

   Roadway cross-sections shall be taken normal or perpendicular to the centerline. When the centerline horizontal curve radius is less than or equal to 150 meters and vertical parabolic curve radius is less than or equal to 100 meters, cross-sections shall be taken at a maximum centerline spacing of 10 meters. When the centerline horizontal curve radius is greater than 150 meters and vertical parabolic curve radius is greater than 100 meters, cross-sections shall be taken at a maximum centerline spacing of 20 meters. Additional cross- sections shall be taken at significant breaks in topography and at changes in the typical roadway section including transition change to superelevated sections. Along each cross-section, points shall be measured and recorded at breaks in topography and at changes in typical roadway section including transition change to superelevated sections and shall be no further apart than 5 meters. Points shall be measured and recorded to at least the anticipated slope stake and reference locations. All cross-section distances shall be reduced to horizontal distances from centerline.

3. Slope Stakes and References

   Slope stakes and references shall be set on both sides of centerline at the cross-section

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

4. Clearing and Grubbing Limits

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

5. Centerline Reestablishment

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

6. Grade Finishing Stakes

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

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

The maximum longitudinal spacing between stakes shall be 10 meters when the centerline horizontal curve radius is less than or equal to 150 meters and vertical parabolic curve radius is less than or equal to 100 meters. When the centerline horizontal curve radius is greater than 150 meters and vertical parabolic curve radius is greater than 100 meters, the maximum longitudinal spacing between stakes shall be 20 meters. The maximum transverse spacing between stakes shall be 5 meters. Brushes or guard stakes shall be used at each stake.

7. Culverts

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

a. Survey and record the ground profile along the culvert centerline including inlet and outlet

channel profile of at least 10 meters and as additionally directed by the Engineer so as to gather all necessary data for the preparation of pipe projection plan.

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

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

d. Plot into scale the profile along the culvert centerline reflecting the natural ground elevation, invert elevation

he flowline, the roadway section, and the size, length and the degree of elbow of culvert, end treatments, grade and other appurtenances.

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

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

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

8. Bridges

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

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

9. Retaining Walls and Other Types of Slope Protection Works

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

10. Borrow and Waste Sites

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

11. Permanent Monuments and Markers

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

12. Miscellaneous Survey and Staking

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

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

B.4.1 Method of Measurement

Construction survey and staking shall be measured by the kilometer.

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

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

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

Culvert survey and staking shall be measured by the each.

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

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

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

B.4.2 Basis of Payment

The accepted quantities, measured as provided in Section 8.4 .3, shall be paid for at the contract unit price for each of the Pay Item listed below that is included in the bill of Quantities.

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

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

a. 25% of the lump sum, not to exceed 0.5% of the original contract amount, shall be paid following completion of 10% of the original contract amount.

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

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

ITEM 101 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

101.1 Description

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

101.2 Construction Requirements

101.2.1 General

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

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

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

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

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

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

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

101.2.3 Removal of Pipes Other than Pipe Culverts

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

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

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

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

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

101.3 Method of Measurement

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

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

101.4 Basis of Payment

The accepted quantities, measured as prescribed in Section 101.3, shall be paid for at the Contract unit price or lump sum price bid for each of the Pay Items listed below that is included in the Bill of Quantities which price and payment shall be full compensation for removing and disposing of obstructions, including materials, labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item. The price shall also include backfilling, salvaging of materials removed, their custody, preservation, storage on the right-of-way and disposal as provided herein.

ITEM 102 – EXCAVATION

102.1 Description

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

102.1.1 Roadway Excavation

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

(1) Unclassified Excavation. Unclassified excavation shall consist of the excavation and disposal of all materials regardless of its nature, not classified and included in the Bill of Quantities under other pay items.
(2) Rock Excavation. Rock excavation shall consist of excavation of igneous, sedimentary and metamorphic rocks which cannot be excavated without blasting or the use of rippers, and all boulders or other detached stones each having a volume of 1 cubic meter or more as determined by physical measurements or visually by the Engineer.
(3) Common Excavation. Common excavations shall consist of all excavation not included in the Bill of Quantities under "rock excavation" or other pay items.

(4) Muck Excavation. Muck excavation shall consist of the removal and disposal of deposits of saturated or unsaturated mixtures of soils and organic matter not suitable for foundation materials regardless of moisture content.

102.1.2 Borrow Excavation

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

(1) Borrow, Case 1

Borrow Case 1 will consist of material obtained from sources designated on the Plans or in the Special Provisions.

(2) Borrow, Case 2

Borrow Case 2 will consist of material obtained from sources provided by the Contractor. The material shall meet the quality requirements determined by the Engineer unless otherwise provided in the Contract.

102.2 Construction Requirements

102.2.1 General

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

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

102.2.2 Conservation of Topsoil

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

102.2.3 Utilization of Excavated Materials

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

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

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

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

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

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

102.2.4 Prewatering

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

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

102.2.5 Presplitting

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

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

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

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

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

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

102.2.6 Excavation of Ditches, Gutters, etc.

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

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

Furrow ditches shall be formed by plowing a continuous furrow along the line staked by the Engineer. Methods other than plowing may be used if acceptable to the Engineer. The ditches shall be cleaned out by hand shovel work, by ditcher, or by some other Suitable method, throwing all loose materials on the downhill side so that the bottom of the finished ditch shall be approximately 450 mm below the crest of the loose material piled on the downhill side. Hand finish will not be required, but the flow lines shall be in satisfactory shape to provide drainage without overflow.

102.2.7 Excavation of Roadbed Level

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

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

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

102.2.8 Borrow Areas

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

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

102.2.9 Removal of Unsuitable Material

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

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

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

102.3 Method of Measurement

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

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

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

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

102.4 Basis of Payment

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

ITEM 104 – EMBANKMENT

104.1 Description

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

104.2 Material Requirements

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

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

Selected Borrow, for topping - soil of such gradation that all particles will pass a sieve with 75 mm 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 AASHTO T 90 and a liquid limit of not more than 30 as determined by AASHTO T 89.

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

104.3 Construction Requirements

104.3.1 General

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

Embankment construction shall consist of constructing roadway embankments, including preparation of the areas upon which they are to be placed; the construction of dikes within or adjacent to the roadway; the placinq 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 and to the specified requirements of this Item.

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

104.3.2 Methods of Construction

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

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

Unless shown otherwise on the Plans or special Provisions, where an embankment of less than 1.2 m 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 of the subgrade, such old road surface shall be scarified to a depth of at least 150 mm whenever directed by the Engineer. This scarified material shall then be compacted as provided in Subsection 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, 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.

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

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

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

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

104.3.3 Compaction

Compaction Trials

Before commencing the formation of embankments, the Contractor shall submit in writing to the Engineer for approval his proposals for the compaction of each type of fill material to be used in the works. The proposals shall include the relationship between the types of compaction equipment, the number of passes required and the method of adjusting moisture content. The Contractor shall carry out full scale compaction trials on areas not less than 10m wide and 50 m long as required by the Engineer and using his proposed procedures or such amendments thereto as may be found necessary to satisfy the Engineer that all 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 m2 of each layer of compacted fill.

Rock

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

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

104.3.4 Protection of Roadbed During Construction

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

104.3.5 Protection of Structure

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

104.3.6 Rounding and Warping Slopes

Rounding-Except in solid rock, the tops and bottoms of all slopes, including the slopes of drainage ditches, shall be rounded as indicated on the Plans. A layer of earth overlaying rock shall be rounded above the rock as done in earth slopes.
Warping-adjustments in slopes shall be made to avoid injury in standing trees or marring of weathered rock, or to harmonize with existing landscape features, and the transition to such adjusted slopes shall be gradual. At intersections of cuts and fills, slopes shall be adjusted and warped to flow into each other or into the natural ground surfaces without noticeable break.

104.3.7 Finishing Roadbed and Slopes

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

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

104.3.8 Serrated Slopes

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

104.3.9 Earth Berms

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

Compacted Berm

Compacted berm construction shall consist of moistening or drying and placing material as necessary in locations shown on the drawinqs 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.

104.4 Method of Measurement

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

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

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

104.5 Basis of Payment

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

ITEM 201 – AGGREGATE BASE COURSE

201.1 Description

This Item shall consist of furnishing, placing and compacting an aggregate base course on a prepared subgrade/subbase in accordance with this Specification, and the lines, grades, thickness and. Typical cross-sections shown on the Plans, or as established by the Engineer.

201.2 Material Requirements

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

In some areas where the conventional base course materials are scarce or non-available, the use of 40% weathered limestone blended with 60% crushed stones or gravel shall be allowed, provided that the blended materials meet the requirements of this Item.

The base course material shall conform to Table 201.1, whichever is called for in the Bill of Quantities.

Table 201.1 – Grading Requirements

Sieve Designation		Mass Percent Passing	
Standard, mm	Alternate US Standard	Grading A	Grading B
50	2"	100	
37.5	1-1/2"	-	100
25.0	1"	60 – 85	-
19.0	¾"	-	60 – 85
12.5	½"	35 – 65	-
4.75	No. 4	20 – 50	30 – 55
0.425	No. 40	5 – 20	8 – 25
0.075	No. 200	0 – 12	2 – 14

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

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

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

The material passing the 19 mm sieve shall have a soaked CBR value of not less than 80% as determined by AASHTO T 193. The CBR value shall be obtained at the maximum dry density (MOD) as determined by AASHTO T 180, Method D.

If filler, in addition to that naturally present, is necessary for meeting the grading requirements or for satisfactory bonding, it shall be uniformly blended with the base course material on the road or in a pugmill unless otherwise specified or approved. Filler shall be taken from sources approved by the Engineer, free from hard lumps and shall not contain more than 15 percent of material retained on the 4.75 mm (No.4) sieve.

201.3 Construction Requirements

201.3.1 Preparation of Existing Surface

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

201.3.2 Placing

It shall be in accordance with all the requirements of Subsection 200.3.2, Placing.

201.3.3 Spreading and Compacting

It shall be in accordance with all the requirements of Subsection 200.3.3, Spreading and Compacting.

201.3.4 Trial Sections

Trial sections shall conform in all respects to the requirements specified in Subsection 200.3.4.

201.3.5 Tolerances

The aggregate base course shall be laid to the designed level and transverse slopes shown on the Plans. The allowable tolerances shall be in accordance with following:

Permitted variation from design THICKNESS OF LAYER	±10 mm
Permitted variation from design LEVEL OF SURFACE	+ 5 mm -10 mm
Permitted SURFACE IRREGULARITY Measured by 3-m straight-edge	5 mm
Permitted variation from design CROSSFALL OR CAMBER	±0.2%
Permitted variation from design LONGITUDINAL GRADE over 25 m in length	±0.1%

201.4 Method of Measurement

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

201.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 201.4, shall be paid for at the contract unit price for Aggregate Base Course which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

ITEM 302 – BITUMINOUS TACK COAT

302.1 Description

This Item shall consist of preparing and treating an existing bituminous or cement concrete surface with bituminous material in accordance with the Plans and Specifications, preparatory to the construction of a bituminous surface course.

302.2 Material Requirements

Bituminous material shall be Emulsified Asphalt.It shall conform to the requirements of Item 702, Bituminous Materials.The type and grade will be specified in the Special Provisions.

302.3 Construction Requirements

302.3.1 Surface Condition

Tack coat shall be applied only to surfaces which are dry or slightly moist. No tack coat shall be applied when the weather is foggy or rainy.

302.3.2 Equipment

Equipment shall conform in all respects to Subsection 301.3.2**...**

302.3.3 Application of Bituminous Material

Immediately before applying the tack coat, the full width of the surface to be treated shall be cleaned of loose and foreign materials by means of a power broom or power blower, supplemented as necessary by hand sweeping.Where required by the JHMC representative, immediately prior to the application of the tack coat, the surface shall be lightly sprayed with water but not saturated. Bituminous material shall be applied by means of a pressure distributor at the temperature given in Item 702, Bituminous Materials, of the particular material being used.The rate of application of the Emulsified Asphalt shall be within the range of 0.2 to 0.7 liter/m^2, the exact rate as determined by the JHMC representative.

Care shall be taken that the application of bituminous material is not in excess of the specified amount; any excess shall be blotted by sand or removed as directed by the JHMC representative. All areas inaccessible to the distributor shall be treated manually using the device for hand spraying.The surfaces of structures and trees adjacent to the areas being treated shall be protected in such a manner so as to prevent their being spattered or marred.

Traffic shall be kept off the tack coat at all times. The tack coat shall be sprayed only so far in advance on the surface course as will permit it to dry to a "tacky" condition.The Contractor shall maintain the tack coat until the next course has been applied. Any area that has become

fouled by traffic or otherwise, shall be cleaned and re-sprayed at the Contractor's expense before the next course is applied.

302.4 Method of Measurement

The bituminous tack coat shall be measured by the tonne (t), completed and accepted in-place.

302.5 Basis of Payment

The accepted quantity, measured as prescribed in Section 302.4 shall be paid for at the contract unit price for Bituminous Tack Coat which price and payment shall be full compensation for furnishing and placing all materials including all labor, equipment, tools and incidentals necessary to complete this Item.

ITEM 310 – BITUMINOUS CONCRETE SURFACE COURSE, HOT-LAID

310.1 Description

This Item shall consist of constructing a bituminous concrete surface course composed of aggregates, mineral filler, and bituminous material mixed in a central plant, constructed and laid hot on the prepared base in accordance with this Specification and in conformity with lines, grades, thickness and typical cross- section shown on the Plans.

310.2 Material Requirements

310.2.1 Composition and Quality of Bituminous Mixture (Job-Mix Formula)

Same as Subsection 307.2.1

310.2.2 Bituminous Material

It shall be Asphalt Cement, which is called for in the Bill of Quantities. It shall conform to the requirements of Item 702, Bituminous Materials. The penetration grade, type and grade of bituminous material shall be specified in the Special Provisions.

310.2.3 Aggregates

Aggregates shall conform to the requirements of Item 307, Bituminous Plant Mix Surface Course-General.

310.2.4 Mineral Filler

It shall conform to the requirements of Item 307, Bituminous Plant Mix Surface Course-General.

310.2.5 Hydrated Lime

It shall conform to the requirements of Item 307, Bituminous Plant-Mix Surface Course-

General.

310.2.6 Proportioning of Mixtures

The proportion of bituminous material on the basis of total dry aggregate shall be from 5.0 to 8.0 mass percent. The exact percentage to be used shall be fixed by the JHMC representative in accordance with the job-mix formula and the other quality control requirements.

During the mixing operation, one-half to one (0.5 to 1.0) mass percent of hydrated lime, dry aggregate basis, shall be added to the mixture. The lower percentage limit is applicable to aggregates which are predominantly calcareous.

310.3 Construction Requirements

The construction requirements shall be in accordance whenever applicable, with Section 307.3.

310.4 Method of Measurement

The area to be paid for under this item shall be the number of square meters (m^2) of asphalt pavement placed, compacted and accepted based on the thickness and density of the cores taken in accordance with subsection 307.3.10 (Acceptance, Sampling and Testing).

310.5 Basis of Payment

The accepted quantity, measured as prescribed in Section 310.4, shall be paid for at the contract unit price for Bituminous Concrete Surface Course, Hot- Laid, which price and payment shall be full compensation for furnishing all materials, handling, mixing, hauling, placing,rolling,compacting,labor, equipment, tools and incidentals necessary to complete this Item.
Payment will be made under:

Pay Item Number	Description	Unit of Measurement
310	Bituminous Concrete Surface Course, Hot-Laid	Square Meter

ITEM 311 – PORTLAND CEMENT CONCRETE PAVEMENT

311.1 Description

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

311.2 Material Requirements

311.2.1 Portland Cement

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

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

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

311.2.2 Fine Aggregate

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

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

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

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

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

Table 311.1 – Grading Requirements for Fine Aggregate

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

311.2.3 Coarse Aggregate

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

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

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

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

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

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

Only one grading specification shall be used from anyone source.

Table 311.2 – Grading Requirement for Coarse Aggregate

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

311.2.4 Water

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

311.2.5 Reinforcing Steel

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

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

311.2.6 Wire Mesh

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

311.2.6.1 Fabrication of Wire Mesh

The spacing on the lateral direction is twice wider than that of the longitudinal direction. The weight if wire mesh shall not be less than 3 kg/m^2. It shall be fabricated by welding or binding at each crossing point and shall meet the requirements of ASTM A 185.

311.2.6.2 Installation of Wire Mesh

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

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

311.2.7 Joint Fillers

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

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

311.2.8 Admixtures

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

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

Fly Ash, if specified or permitted as a mineral admixture and not exceeding 20% partial replacement of Portland Cement In concrete mix shall conform to the requirements of ASTM C 618.

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

311.2.9 Curing Materials

Curing materials shall conform to the following requirements as specified;
a) Burlap cloth- AASHTO M 182
b) Liquid membrane forming compounds- AASHTO M 148
c) Sheeting (film) materials- AASHTO M 171

Cotton mats and water-proof paper can be used.

311.2.10 Calcium Chloride/Calcium Nitrate

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

311.2.11 Storage of Cement and Aggregate

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

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

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

311.2.12 Proportioning, Consistency and Strength of Concrete

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

It is the intent of this Specification to require at least 364 kg of cement per cubic meter of concrete to meet the minimum strength requirements. The Engineer shall determine from laboratory tests of the materials to be used, the cement content and the proportions of aggregate and water that will produce workable concrete having a slump of between 40 and 75 mm if not vibrated or between 10 and 40 mm if vibrated, and a flexural strength of not less than 3.8 MPa when tested by the third-point method or 4.5 MPa when tested by the mid-point method at fourteen (14) days in accordance with AASHTO T 97 and T 177 respectively; or a compressive

strength of 24.1 MPa for cores taken at fourteen (14) days and tested in accordance with AASHTO T 24.

Slump shall be determined using AASHTO T 119.

The designer shall consider the use of lean concrete (econocrete) mixtures using local materials or specifically modified conventional concrete mixes in base course and in the lower course composite, monolithic concrete pavements using a minimum of 75 mm of conventional concrete as the surface course.

The mix design shall be submitted to the Engineer for approval and shall be accompanied with certified test data from an approved laboratory demonstrating the adequacy of the mix design. A change in the source of materials during the progress of work may necessitate a new design mix.

311.3 Construction Requirements

311.3.1 Quality Control of Concrete

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

2. Quality Control Plan
The Contractor shall furnish the Engineer a Quality Control Plan detailing his production control procedures and the type and frequency of sampling and testing to ensure that the concrete produced complies with the Specifications. The Engineer shall be provided free access to recent plant production records, and if requested, informational copies of mix design, materials certifications and sampling and testing reports.

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

a. Concrete Batcher. The person performing the batching or mixing operation shall be capable of accurately conducting aggregate surface moisture determination and establishing correct scale weights for concrete materials. He shall be capable of assuring that the proportioned batch weights of materials are in accordance with the mix design.
b. Concrete Technician. The person responsible for concrete production control and sampling and testing for quality control shall be proficient in concrete technology, and shall have a sound knowledge of the Specifications as they relate to concrete production. He shall be capable of conducting tests on concrete and concrete materials in accordance with these Specifications. He shall be capable of adjusting concrete mix designs for improving workability and Specification compliance, and preparing trial mix designs. He shall be qualified to act as the concrete batcher in the batcher's absence.

4. Quality Control Testing

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

5. Documentation

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

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

311.3.2 Equipment

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

1. Batching Plant and Equipment

a. General. The batching shall include bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. If cement is used in bulk, a bin, a hopper, and separate scale for cement shall be included. The weighing hopper shall be properly sealed and vented to preclude dusting operation. The batch plant shall be equipped with a suitable non-resettable batch counter which will correctly indicate the number of batches proportioned.

b. Bins and Hoppers. Bins with adequate separate compartments for fine aggregate and for each size of coarse aggregate shall be provided in the batching plant.

c. Scales. Scales for weighing aggregates and cement shall be of either the beam type or the spring less-dial type. They shall be accurate within one-half percent (0.5%) throughout the range of use. Poises shall be designed to be locked in any position and to prevent unauthorized change. Scales shall be inspected and sealed as often as the Engineer may deem necessary to assure their continued accuracy.

d. Automatic Weighing Devices. Unless otherwise allowed on the Contract, batching plants shall be equipped with automatic weighing devices of an approved type to proportion aggregates and bulk cement.

2. Mixers.

a. General. Concrete may be mixed at the site of construction or at a central plant, or wholly or in part in truck mixers. Each mixer shall have a manufacturer's plate attached in a

prominent place showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

b. Mixers at Site of Construction. Mixing shall be done in an approved mixer capable of combining the aggregates, cement and water into a thoroughly mixed and uniform mass within the specified mixing period and discharging and distributing the mixture without segregation on the prepared grade. The mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum has been charged and released it at the end of the mixing period. In case of failure of the timing device, the mixer may be used for the balance of the day while it is being repaired, provided that each batch is mixed 90 seconds. The mixer shall be equipped with a suitable non-resettable batch counter which shall correctly indicate the number of the batches mixed.

c. Truck Mixer and Truck Agitators. Truck mixers used for mixing and hauling concrete, and truck agitators used for hauling central-mixed concrete, shall conform to the requirements of AASHTO M 157.

d. Non-Agitator Truck. Bodies of non-agitating hauling equipment for concrete shall be smooth, mortar-tight metal containers and shall be capable of discharging the concrete at a satisfactory controlled rate without segregation.

3. Paving and Finishing Equipment

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

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

4. Concrete Saw

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

5. Forms

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

All forms shall be rigidly supported on bed of thoroughly compacted material during the entire operation of placing and finishing the concrete. Forms shall be provided with adequate devices

for secure setting so that when in place, they will withstand, without visible spring or settlement, the impact and vibration of the consolidation and finishing or paving equipment.

311.3.3 Preparation of Grade

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

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

311.3.4 Setting Forms

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

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

3. Grade and Alignment
The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete. Testing as to crown and elevation, prior to placing of concrete can be made by means of holding an approved template in a vertical position and moved backward and forward on the forms.

When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

311.3.5 Conditioning of Subgrade or Base Course

When side forms have been securely set to grade, the subgrade or base course shall be brought to proper cross-section. High areas shall be trimmed to proper elevation. Low areas shall be filled and compacted to a condition similar to that of surrounding grade. The finished grade shall be maintained in a smooth and compacted condition until the pavement is placed.

Unless waterproof subgrade or base course cover material is specified, the subgrade or base course shall be uniformly moist when the concrete is placed. If it subsequently becomes too dry,

the subgrade or base course shall be sprinkled, but the method of sprinkling shall not be such as to form mud or pools of water.

311.3.6 Handling, Measuring and Batching Materials

The batch plant site, layout, equipment and provisions for transporting material shall be such as to assure a continuous supply of material to the work.

Stockpiles shall be built up in layers of not more than one (1) meter in thickness. Each layer shall be completely in place before 'beginning the next which shall not be allowed to "cone" down over the next lower layer. Aggregates from different sources and of different grading shall not be stockpiled together.

All washed aggregates and aggregates produced or handled by hydraulic methods, shall be stockpiled or binned for draining at least twelve (12) hours before being batched.

When mixing is done at the side of the work. aggregates shall be transported from the batching plant to the mixer in batch boxes, vehicle bodies, or other containers of adequate capacity and construction to properly carry the volume required. Partitions separating batches shall be adequate and effective to prevent spilling from one compartment to another while in transit or being dumped. When bulk cement is used the Contractor shall use a suitable method of handling the cement from weighing hopper to transporting container or into the batch itself for transportation to the mixer, with chute, boot or other approved device, to prevent loss of cement, and to provide positive assurance of the actual presence in each batch of the entire cement content specified.

Bulk cement shall be transported to the mixer in tight compartments carrying the full amount of cement required for the batch. However, if allowed in the Special Provisions, it may be transported between the fine and coarse aggregate. When cement is placed in contact with the aggregates, batches may be rejected unless mixed within 1-1/2 hours of such contact. Cement in original shipping packages may be transported on top of the aggregates, each batch containing the number of sacks required by the job mix.

The mixer shall be charged without loss of cement. Batching shall be so conducted as to result in the weight to each material required within a tolerance of one (1) percent for the cement and two (2) percent for aggregates. Water may be measured either by volume or by weight. The accuracy of measuring the water shall be within a range of error of not more than one (1) percent. Unless the water is to be weighed, the water-measuring equipment shall include an auxiliary tank from which the measuring tank shall be equipped with an outside tap and valve to provide checking the setting, unless other means are provided for readily and accurately determining the amount of water in the tank. The volume of the auxiliary tank shall be at least equal to that of the measuring tank.

311.3.7 Mixing Concrete

The concrete may be mixed at the site of the work in a central-mix plant, or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time will be measured from the time all materials, except water, are in the drum. Ready-mixed concrete shall be mixed and delivered in accordance with requirements of AASHTO M 157, except that the minimum required

revolutions at the mixing speed for transit-mixed concrete may be reduced to not less than that recommended by the mixer manufacturer. The number of revolutions recommended by the mixer manufacturer shall be indicated on the manufacturer's serial plate attached to the mixer. The Contractor shall furnish test data acceptable to the Engineer verifying that the make and model of the mixer will produce uniform concrete conforming to the provision of AASHTO M 157 at the reduced number of revolutions shown on the serial plate.

When mixed at the site or in a central mixing plant, the mixing time shall not be less than fifty (50) seconds nor more than ninety (90) seconds for drum type mixers, unless mixer performance tests prove adequate mixing of the concrete in shorter time period.

The operation and mixing time for pan, twin shaft and other type of central mixers shall be based on the mixer manufacturer's instructions.

Four (4) seconds shall be added to the specified mixing time if timing starts at the instant the skip reaches its maximum raised positions. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.
The mixer shall be operated at the drum speed as shown on the manufacturer's name plate attached on the mixer. Any concrete mixed less than the specified time shall be discarded and disposed off by the Contractor at his expense. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic metre, as shown on the manufacturer's standard rating plate on the mixer, except that an overload up to ten (10) percent above the mixer's nominal capacity may be permitted provided concrete test data for strength, segregation, and uniform consistency are satisfactory, and provided no spillage of concrete takes place.

The batches shall be so charged into the drum that a portion of the mixing water shall be entered in advance of the cement and aggregates. The flow of water shall be uniform and all water shall be in the drum by the end of the first fifteen (15) seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators or non-agitating truck specified in Subsection 311.3.2, Equipment. The time elapsed from the time water is added to the mix until the concrete is deposited in place at the Site shall not exceed forty five (45) minutes when the concrete is hauled in nonagitating trucks, nor ninety (90) minutes when hauled in truck mixers or truck agitators, except that in hot weather or under other conditions contributing to quick hardening of the concrete, the maximum allowable time may be reduced by the Engineer.

In exceptional cases and when volumetric measurements are authorized for small project requiring less than 75 cu.m. of concrete per day of pouring, the weight proportions shall be converted to equivalent volumetric proportions. In such cases, suitable allowance shall be made for variations in the moisture condition of the aggregates, including the bulking effect in the fine aggregate. Batching and mixing shall be in accordance with ASTM C 685, Section 6 through 9.

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

Retempering concrete by adding water or by other means shall not be permitted, except that when concrete is delivered in truck mixers, additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements, if permitted by the Engineer, provided all these operations are performed within forty-five (45) minutes after the initial mixing operation and the water-cement ratio is not exceeded. Concrete that is not within the specified slump limits at the time of placement shall not be used. Admixtures for increasing the workability or for accelerating the setting of the concrete will be permitted only when specifically approved by the Engineer.

311.3.8 Limitation of Mixing

No concrete shall be mixed, placed or finished when natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

During hot weather, the Engineer shall require that steps be taken to prevent the temperature of mixed concrete from exceeding a maximum temperature of 32 C.

Concrete not in place within ninety (90) minutes from the time the ingredients were charged into the mixing drum or that has developed initial set shall not be used. Retmpering of concrete or mortar which has partially hardened, that is remixing with or without additional cement, aggregate, or water, shall not be permitted. In order that the concrete may be properly protected against the effects of rain before the concrete is sufficiently hardened, the Contractor will be required to have available at all times materials for the protection of the edges and surface of the unhardened concrete.

311.3.9 Placing Concrete

Concrete shall be deposited in such a manner to require minimal rehandling. Unless truck mixers or non-agitating hauling equipment are equipped with means to discharge concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade in such a manner as to prevent segregation. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances.

When concrete is to be placed adjoining a previously constructed lane and mechanical equipment will be operated upon the existing lane, that previously constructed lane shall have attained the strength for fourteen (14) day concrete. If only finishing equipment is carried on the existing lane, paving in adjoining lanes may be permitted after three (3) days.

Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than fifteen (15) seconds in anyone location.

Concrete shall be deposited as near as possible to the expansion and contraction joints without disturbing them, but shall not be dumped from the discharge bucket or hopper into a joint

assembly unless the hopper is well centered on the joint assembly. Should any concrete material fall on or be worked into the surface of a completed slab, it shall be removed immediately.

311.3.10 Test Specimens

As work progresses, at least one (1) set consisting of three (3) concrete beam test specimens, 150 mm x 150 mm x 525 mm shall be taken from each 330 m^2 of pavement, 230 mm depth, or fraction thereof placed each day. Test specimens shall be made under the supervision of the Engineer, and the Contractor shall provide all concrete and other facilities necessary in making the test specimens and shall protect them from damage by construction operations. Cylinder samples shall not be used as substitute for determining the adequacy of the strength of concrete.

The beams shall be made, cured, and tested in accordance with MSHTO T 23 and T 97.

311.3.11 Strike-off of Concrete and Placement of Reinforcement

Following the placing of the concrete, it shall be struck off to conform to the cross-section shown on the Plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement will be at the elevation shown on the Plans. When reinforced concrete pavement is placed in two (2) layers, the bottom layer shall be struck off and consolidated to such length and depth that the sheet of fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off and screeded. Any portion of the bottom layer of concrete which has been placed more then 30 minutes without being covered with the top layer shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be firmly positioned in advance of concrete placement or it may be placed at the depth shown on the Plans in plastic concrete, after spreading by mechanical or vibratory means.

Reinforcing steel shall be free from dirt, oil, paint, grease, mill scale and loose or thick rust which could impair bond of the steel with the concrete.

311.3.12 Joints

Joints shall be constructed of the type and dimensions, and at the locations required by the Plans or Special Provisions. All joints shall be protected from the intrusion of injurious foreign material until sealed.

1. Longitudinal Joint

Deformed steel tie bars of specified length, size, spacing and materials shall be placed perpendicular to the longitudinal joints, they shall be placed by approved mechanical equipment or rigidly secured by chair or other approved supports to prevent displacement. Tie bars shall not be painted or coated with asphalt or other materials or enclosed in tubes or sleeves. When shown on the Plans and when adjacent lanes of pavement are constructed separately, steel side forms shall be used which will form a keyway along the construction joint. Tie bars, except those made of rail steel, may be bent at right angles against the form of the first lane constructed

and straightened into final position before the concrete of the adjacent lane is placed. In lieu of bent tie bars, approved two-piece connectors may be used.

Longitudinal formed joints shall consist of a groove or cleft, extending downward from and normal to the surface of the pavement. These joints shall be effected or formed by an approved mechanically or manually operated device to the dimensions and line indicated on the Plans while the concrete is in a plastic state. The groove or cleft shall be filled with either a premolded strip or poured material as required.

The longitudinal joints shall be continuous. There shall be no gaps in either transverse or longitudinal joints at the intersection of the joints.

Longitudinal sawed joints shall be cut by means of approved concrete saws to the depth, width and line shown on the Plans. Suitable guide lines or devices shall be used to assure cutting the longitudinal joint on the true line. The longitudinal joint shall be sawed before the end of the curing period or shortly thereafter and before any equipment or vehicles are allowed on the pavement. The sawed area shall be thoroughly cleaned and, if required, the joint shall immediately be filled with sealer.

Longitudinal pavement insert type joints shall be formed by placing a continuous strip of plastic materials which will not react adversely with the chemical constituent of the concrete.

2. Transverse Expansion Joint.

The expansion joint filler shall be continuous from form to form, shaped to subgrade and to the keyway along the form. Preformed joint filler shall be furnished in lengths equal to the pavement width or equal to the width of one lane. Damaged or repaired joint filler shall not be used.

The expansion joint filler shall be held in a vertical position. An approved installing bar, or other device, shall be used if required to secure preformed expansion joint filler at the proper grade and alignment during placing and finishing of the concrete. Finished joint shall not deviate more than 6 mm from a straight line. If joint fillers are assembled in sections, there shall be no offsets between adjacent units. No plugs of concrete shall be permitted anywhere within the expansion space.

3. Transverse Contraction Joint/Weakened Joint

When shown on the Plans, it shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement and shall include load transfer assemblies. The depth of the weakened plane joint should at all times not be less than 50 mm, while the width should not be more than 6 mm.

a. Transverse Strip Contraction Joint. It shall be formed by installing a parting strip to be left in place as shown on the Plans.

b. Formed Groove. It shall be made by depressing an approved tool or device into the plastic concrete. The tool or device shall remain in place at least until the concrete has attained its initial set and shall then be removed without disturbing the adjacent concrete, unless the device is designed to remain in the joint.

c. Sawed Contraction Joint. It shall be created by sawing grooves in the surface of the pavement of the width not more than 6 mm, depth should at all times not be less than 50 mm, and at the spacing and lines shown on the Plans, with an approved concrete saw. After each joint is sawed, it shall be thoroughly cleaned including the adjacent concrete surface.

Sawing of the joint shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive ravelling, usually 4 to 24 hours. All joints shall be sawed before uncontrolled shrinkage cracking takes place. If necessary, the sawing operations shall be carried on during the day or night, regardless of weather conditions. The sawing of any joint shall be omitted if crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discounted when a crack develops ahead of the saw. In general, all joints should be sawed in sequence. If extreme condition exist which make it impractical to prevent erratic cracking by early sawing, the contraction joint groove shall be formed prior to initial set of concrete as provided above.

4. Transverse Construction Joint

It shall be constructed when there is an interruption of more than 30 minutes in the concreting operations. No transverse joint shall be constructed within 1.50 m of an expansion joint, contraction joint, or plane of weakness. If sufficient concrete has been mixed at the time of interruption to form a slab of at least 1.5 m long, the excess concrete from the last preceding joint shall be removed and disposed off as directed.

5. Load Transfer Device

Dowel, when used, shall be held in position parallel to the surface and center line of the slab by a metal device that is left in the pavement.

The portion of each dowel painted with one coat of lead or tar, in conformance with the requirements of Item 404, Reinforcing Steel, shall be thoroughly coated with approved bituminous materials, e.g., MC-70, or an approved lubricant, to prevent the concrete from binding to that portion of the dowel. The sleeves for dowels shall be metal designed to cover 50 mm plus or minus 5 mm, of the dowel, with a watertight closed end and with a suitable stop to hold the end of the sleeves at least 25 mm from the end of the dowel.

In lieu of using dowel assemblies at contraction joints, dowel may be placed in the full thickness of pavement by a mechanical device approved by the Engineer.

311.3.13 Final Strike-off (Consolidation and Finishing)

1. Sequence

The sequence of operations shall be the strike-off and consolidation, floating, removal of laitance, straight-edging and final surface finish. Work bridges or other devices necessary to provide access to the pavement surface for the purpose of finishing, straight-edging, and make corrections as hereinafter specified, shall be provided by the Contractor.

In general, the addition of water to the surface of the concrete to assist in finishing operations will not be permitted. If the application of water to the surface is permitted, it shall be applied as fog spray by means of an approved spray equipment.

2. Finishing Joints

The concrete adjacent to joints shall be compacted or firmly placed without voids or segregation against the joint material assembly, also under and around all load transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated as required in Subsection 311.3.9, Placing Concrete.

After the concrete has been placed and vibrated adjacent to the joints as required in Subsection 311.3.9, the finishing machine shall be brought forward, operating in a manner to avoid damage or misalignment of joints. If uninterrupted operation of the finishing machine, to over and beyond the joints causes segregation of concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the front screed is approximately 20 cm from the joint, Segregated concrete shall be removed from in front of and off the joint. The front screed shall be lifted and set directly on top of the joint and the forward motion of the finishing machine resumed. When the second screed is close enough to permit the excess mortar in front of it to flow over the joint, it shall be lifted and carried over the joint. Thereafter, the finishing machine may be run over the joint without lifting the screeds, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

3. Machine Finishing

a. Non-vibratory Method.

The concrete shall be distributed or spread as soon as placed. As soon as the concrete has been placed, it shall be struck off and screeded by an approved finishing machine. The machine shall go over each area of pavement as many times and at such intervals as necessary to give the proper compaction and leave a surface of uniform texture. Excessive operation over a given area shall be avoided. The tops of the forms shall be kept clean by an effective device attached to the machine and the travel of the machine on the forms shall be maintained true without wobbling or other variation tending to affect the precision finish. During the first pass of the finishing machine, a uniform ridge of concrete shall be maintained ahead of the front screed in its entire length.

b. Vibratory Method.

When vibration is specified, vibrators for full width vibration of concrete paving slabs, shall meet the requirements in Subsection 311.3.2, Equipment. If uniform and satisfactory density of the concrete is not obtained by the vibratory method at joints, along forms, at structures, and throughout the pavement, the Contractor will be required to furnish equipment and method which will produce pavement conforming to the Specifications. All provisions in item (a) above not in conflict with the provisions for the vibratory method shall govern.

4. Hand Finishing

Hand finishing methods may only be used under the following conditions:

a. In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade.

b. In narrow widths or areas of irregular dimensions where operations of the mechanical equipment is impractical, hand methods may be used.

Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used. A second screed shall be provided for striking off the bottom layer of concrete if reinforcement is used.

The screed for the surface shall be at least 60 cm longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and constructed either of metal or other suitable material shod with metal.

Consolidation shall be attained by the use of suitable vibrator or other approved equipment.

In operation, the screed shall be moved forward on the forms with a combined longitudinal and transverse shearing motion, moving always in the direction in which the work is progressing and so manipulated that neither end is raised from the side forms during the striking off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross-section, and free from porous areas.

5. Floating

After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated by means of a longitudinal float, either by hand or mechanical method.

a. Hand Method. The hand-operated longitudinal float shall be not less than 365 cm in length and 15 cm in width, properly stiffened to prevent flexibility and warping. The longitudinal float, operated from foot bridges resting on the side forms and spanning but not touching the concrete, shall be worked with a sawing motion while held in a floating position parallel to the road center line, and moving gradually from one side of the pavement to the other. Movement ahead along the center line of the pavement shall be in successive advances of not more than one-half the length of the float. Any excess water or soupy material shall be wasted over the side forms on each pass.

b. Mechanical Method. The mechanical longitudinal float shall be of a design approved by the Engineer, and shall be in good working condition. The tracks from which the float operates shall be accurately adjusted to the required crown. The float shall be accurately adjusted and
coordinated with the adjustment of the transverse finishing machine so that a small amount of mortar is carried ahead of the float at all times. The forward screed shall be adjusted so that the float will lap the distance specified by the Engineer on each transverse trip. The float shall pass over each areas of pavement at least two times, but excessive operation over a given area will not be permitted. Any excess water or soupy material shall be wasted over the side forms on each pass.

c. Alternative Mechanical Method. As an alternative, the Contractor may use a machine composed of a cutting and smoothing float or floats suspended from and guided by a rigid

frame. The frame shall be carried by four or more visible wheels riding on, and constantly in contact with the side forms. If necessary, following one of the preceding method of floating, long handled floats having blades not less than 150 cm in length and 15 cm in width may be used to smooth and fill in open-textured areas in the pavement. Long-handled floats shall not be used to float the entire surface of the pavement in lieu of, or supplementing, one of the preceding methods of floating. When strike off and consolidation are done by the hand method and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of the long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and
laitance shall be removed from the surface of the pavement by a 3-m straight-edge or more in length. Successive drags shall be lapped one-half the length of the blade.

6. Straight-edge Testing and Surface Correction

After the floating has been completed and the excess water removed, but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a 300 cm long straight-edge. For this purpose, the Contractor shall furnish and use an accurate 300-cm straight-edge swung from handles 100 cm longer than one-half the width of the slab. The straight-edge shall be held in contact with the surface in successive positions parallel to the road center line and the whole area gone over from one side of the slab to the other as necessary. Advances along the road shall be in successive stages of not more than one-half the length of the straight-edge. Any depressions found shall be immediately filled with freshly mixed concrete, struck off, consolidated and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straight-edge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straight-edge and the slab conforms to the required grade and cross-section.

7. Final Finish

If the surface texture is broom finished, it shall be applied when the water sheen has practically disappeared. The broom shall be drawn from the center to the edge of the pavement with adjacent strokes slightly overlapping. The brooming operation should be so executed that the corrugations produced in the surface shall be uniform in appearance and not more than 1.5 mm in depth. Brooming shall be completed before the concrete is in such condition that the surface will be unduly roughened by the operation. The surface thus finished shall be free from rough and porous
areas, irregularities, and depressions resulting from improper handling of the broom. Brooms shall be of the quality, size and construction and be operated so as to produce a surface finish meeting the approval of the Engineer. Subject to satisfactory results being obtained and approval of the Engineer, the Contractor will be permitted to substitute mechanical brooming in lieu of the manual brooming herein described.

If the surface texture is belt finished, when straight-edging is completed and water sheen has practically disappeared and just before the concrete becomes non-plastic, the surface shall be belted with 2-ply canvass belt not less than 20 cm wide and at least 100 cm longer than the pavement width. Hand belts shall have suitable handles to permit controlled, uniform

manipulation. The belt shall be operated with short strokes transverse to the center line and with a rapid advances parallel to the center line.

If the surface texture is drag finished, a drag shall be used which consists of a seamless strip of damp burlap or cotton fabric, which shall produce a uniform gritty texture after dragging it longitudinally along the full width of pavement. For pavement 5 m or more in width, the drag shall be mounted on a bridge which travels on the forms. The dimensions of the drag shall be such that a strip of burlap or fabric at least 100 cm wide is in contact with the full width of pavement surface
while the drag is used. The drag shall consist of not less than 2 layers of burlap with the bottom layer approximately 15 cm wider than the layer. The drag shall be maintained in such condition that the resultant surface is of uniform appearance and reasonably free from grooves over 1.5 mm in depth. Drag shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags be substituted.

Regardless of the method used for final finish, the hardened surface of pavement shall have a coefficient of friction of 0.25 or more. Completed pavement that is found to have a coefficient of friction less than 0.25 shall be grounded or scored by the Contractor at his expense to provide the required coefficient of friction.

8. Edging at Forms and Joints

After the final finish, but before the concrete has taken its initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, formed joints, transverse construction joints, and emergency construction joints, shall be worked with an approved tool and rounded to the radius required by the Plans. A well – defined and continuous radius shall be produced and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting the tool during the use.

At all joints, any tool marks appearing on the slab adjacent to the joints shall be eliminated by brooming the surface. In doing this, the rounding of the corner of the slab shall not be disturbed. All concrete on top of the joint filler shall be completely removed.

All joints shall be tested with a straight-edge before the concrete has set and correction made if one edge of the joint is higher than the other.

311.3.14 Surface Test

As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 3-m straight-edge or other specified device. Areas showing high spots of more than 3 mm but not exceeding 12 mm in 3 m shall be marked and immediately ground down with an approved grinding tool to an elevation where the area or spot will not show surface deviations in excess of 3 mm when tested with 3 m straight-edge. Where the departure from correct cross-section exceeds 12 mm, the pavement shall be removed and replaced by and at the expense of the Contractor.

Any area or section so removed shall be not less than 1.5 m in length and not less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement,

any remaining portion of the slab adjacent to the joints that is less than 1.5 m in length, shall also be removed and replaced.

311.3.15 Curing

Immediately after the finishing operations have been completed and the concrete has sufficiently set, the entire surface of the newly placed concrete shall be cured in accordance with either one of the methods described herein. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or the lack of water to adequately take care of both curing and other requirements, shall be a cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than y, hour between stages of curing or during the curing period.

In all congested places, concrete works should be designed so that the designed strength is attained.

1. Cotton of Burlap Mats

The surface of the pavement shall be entirely covered with mats. The mats used shall be of such length (or width) that as laid they will extend at least twice the thickness of the pavement beyond the edges of the slab. The mat shall be placed so that the entire surface and the edges of the slab are completely covered. Prior to being placed, the mats shall be saturated thoroughly with water. The mat shall be so placed and weighted down so as to cause them to remain in intimate contact with the covered surface. The mat shall be maintained fully wetted and in position for 72 hours after the concrete has been placed unless otherwise specified.

2. Waterproof Paper

The top surface and sides of the pavement shall be entirely covered with waterproof paper, the units shall be lapped at least 45 cm. The paper shall be so placed and weighted down so as to cause it to remain in intimate contact with the surface covered. The paper shall have such dimension but each unit as laid will extend beyond the edges of the slab at least twice the thickness of the pavement, or at pavement width and 60 cm strips of paper for the edges. If laid longitudinally, paper not manufactured in sizes which will provide this width shall be securely sewed or cemented together, the joints being securely sealed in such a manner that they do not open up or separate during the curing period. Unless otherwise specified, the covering shall be maintained in place for 72 hours after the concrete has been placed. The surface of the pavement shall be thoroughly wetted prior to the placing of the paper.

3. Straw Curing

When this type of curing is used, the pavement shall be cured initially with burlap or cotton mats, until after final set of the concrete or, in any case, for 12 hours after placing the concrete. As soon as the mats are removed, the surface and sides of the pavement shall be thoroughly wetted and covered with at least 20 cm of straw or hay, thickness of which is to be measured after wetting. If the straw or hay covering becomes displaced during the curing period, it shall be replaced to the

original depth and saturated. It shall be kept thoroughly saturated with water for 72 hours and thoroughly wetted down during the morning of the fourth day, and the cover shall remain in place until the concrete has attained the required strength.

4. Impervious Membrane Method

The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place, or if the pavement is cured initially with jute or cotton mats, it may be applied upon removal of the mass. The curing compound shall not be applied during rain.

Curing compound shall be applied under pressure at the rate 4 L to not more than 14 m2 by mechanical sprayers. The spraying equipment shall be equipped with a wind guard. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by effective mechanical means. Hand spraying of odd widths or shapes and concrete surface exposed by the removal of forms will be permitted. Curing compound shall not be applied to the inside faces of joints to be sealed, but approved means shall be used to ensure proper curing at least 72 hours and to prevent the intrusion of foreign material into the joint before sealing has been completed. The curing compound shall be of such character that the film will harden within 30 minutes after application. Should the film be damaged from any cause within the 72 hour curing period, the damaged portions shall be repaired immediately with additional compound.

5. White Polyethylene Sheet

The top surface and sides of the pavement shall be entirely covered with polyethylene sheeting. The units used shall be lapped at least 45 cm. The sheeting shall be so placed and weighted down so as to cause it to remain intimate contact with the surface covered. The sheeting as prepared for use shall have such dimension that each unit as laid will extend beyond the edges of the slab at least twice the thickness of the pavement. Unless otherwise specified, the covering shall be maintained in place for 72 hours after the concrete has been placed.

311.3.16 Removal of Forms

Forms for concrete shall remain in place undisturbed for not less than twenty four (24) hours after concrete pouring. In the removal of forms, crowbars should be used in pulling out nails and pins. Care should be taken so as not to break the edges of the pavement. In case portions of the concrete are spalled, they shall be immediately repaired with fresh mortar mixed in the proportion of one part of Portland Cement and two parts fine aggregates. Major honeycomb areas will be considered as defective work, and shall be removed and replaced at the expense of the Contractor. Any area or section so removed shall not be less than the distance between weakened plane joint nor less than the full width of the lane involved.

311.3.17 Sealing Joints

Joints shall be sealed with asphalt sealant soon after completion of the curing period and before the pavement is opened to traffic, including the Contractor's equipment. Just prior to sealing,

each joint shall be thoroughly cleaned of all foreign materials including membrane curing compound and the joint faces shall be clean and surface dry when the seal is applied.

The sealing material shall be applied to each joint opening to conform to the details shown on the Plans or as directed by the Engineer. Material for seal applied hot shall be stirred during heating so that localized overheating does not occur. The pouring shall be done in such a manner that the material will not be spilled on the exposed surfaces of the concrete. The use of sand or similar material as a cover for the seal will not be permitted.

Preformed elastomeric gaskets for sealing joints shall be of the cross-sectional dimensions shown on the Plans. Seals shall be installed by suitable tools, without elongation and secured in placed with an approved lubricant adhesive which shall cover both sides of the concrete joints. The seals shall be installed in a compressive condition and shall at time of placement be below the level of the pavement surface by approximately 6 mm.

The seals shall be in one piece for the full width of each transverse joint.

311.3.18 Protection of Pavement

The Contractor shall protect the pavement and its appurtenances against both public traffic, and traffic caused by his own employees and agents. This shall include watchmen to direct traffic, and the erection of and maintenance of warning signs, lights, pavement bridges or crossovers, etc. The Plans or Special Provisions will indicate the location and type of device or facility required to protect the work and provide adequately for traffic.

All boreholes after thickness and/or strength determinations of newly constructed asphalt and concrete pavements shall be immediately filled/restored with the prescribed concrete/asphalt mix after completion of the drilling works.

Any damage to the pavement, occurring prior to final acceptance, shall be repaired or the pavement be replaced.

311.3.19 Concrete Pavement - Slip Form Method

If the Contract calls for the construction of pavement without the use of fixed forms, the following provisions shall apply:

1. Grade

After the grade or base has been placed and compacted to the required density, the areas which will support the paving machine shall be cut to the proper elevation by means of a properly designed machine. The grade on which the pavement is to be constructed shall then be brought to the proper profile by means of properly designed machine. If the density of the base is disturbed by the grading operation, it shall be corrected by additional compaction before concrete is placed. The grade should be constructed sufficiently in advance of the placing of the concrete. If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately before the placing of concrete.

2. Placing Concrete

The concrete shall be placed with an approved slip-form paver designed to spread, consolidate, screed and float-finish the freshly placed concrete in one complete pass of the machine in such a manner that a minimum of hand finish will be necessary to provide a dense and homogenous pavement in conformance with the Plans and Specifications. The machine shall vibrate the concrete for the full width and depth of the strip of pavement being placed. Such vibration shall be accompanied with vibrating tubes or arms working in the concrete or with a vibrating screed or pan operating on the surface of the concrete. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The forms shall trail behind the paver for such a distance that no appreciable slumping of the concrete will occur, and that necessary final finishing can be accomplished while the concrete is still within the forms. Any edge slump of the pavement, exclusive of edge rounding, in excess of 6 mm shall be corrected before the concrete has hardened.

The concrete shall be held at a uniform consistency, having a slump of not more than 40 mm. The slip form paver shall be operated with as nearly as possible a. continuo.us forward movement and that all operations of mixing, delivering and spreading concrete shall be coordinated so as to provide uniform progress with stopping and starting of the paver held to a minimum. If, for any reason, it is necessary to stop the forward movement of the paver the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

3. Finishing

The surface smoothness and texture shall meet the requirements of Subsections 311.3.13 and 311.3.14.

4. Curing

Unless otherwise specified, curing shall be done in accordance with one of the methods included in Subsection 311.3.15. The curing media shall be applied at the appropriate time and shall be applied uniformly and completely to all surfaces and edges of the pavement.

5. Joints

All joints shall be constructed in accordance with Subsection 311.3.12.

6. Protection Against Rain

In order that the concrete may be properly protected against rain before the concrete is sufficiently hardened, the Contractor will be required to have available at all times, materials for the protection of the edges and surface of the unhardened concrete. Such protective materials shall consist of standard metal forms or wood planks having a nominal thickness of not less than 50 mm and a nominal width of not less than the thickness of the pavement at its edge for the protection of the pavement edges, and covering material such as burlap or cotton mats, curing paper or plastic sheeting materials for the protection of the surface of the pavement. When rain appears imminent, all paving operations shall stop and all available personnel shall begin placing forms against the sides of the pavement and covering the surface of the unhardened concrete with the protective covering.

311.3.20 Acceptance of Concrete

The strength level of the concrete will be considered satisfactory if the averages of all sets of three (3) consecutive strength test results equal or exceed the specified strength, fe' and no individual strength test result is deficient by more than 15% of the specified strength, fe'. A set shall consist of a minimum of three (3) concrete beam specimens.

Concrete deemed to be not acceptable using the above criteria may be rejected unless the Contractor can provide evidence, by means of core tests, that the quality of concrete represented by failed test results is acceptable in place. At least three (3) representative cores shall be taken from each member or area of concrete in place that is considered deficient. The location of cores shall be determined by the Engineer so that there will be at least impairment of strength of the structure. The obtaining and testing of drilled cores shall be in accordance with AASHTO T 24.

Concrete in the area represented by the cores will be considered adequate if the average strength of the cores is equal to at least 85% of, and if no single core is less than 75% of, the specified strength, fe'.

If the strength of control specimens does not meet the requirements of this Subsection, and it is not feasible or not advisable to obtain cores from the structure due to structural considerations, payment of the concrete will be made at an adjusted price due to strength deficiency of concrete specimens as specified hereunder:

Deficiency in the Average Thickness per lot (mm)	Percent (%) of Contract Price Per Lot
0 – 5	100% payment
6 – 10	95% payment
11 – 15	85% payment
16 – 20	70% payment
21 – 25	50% payment
More than 25	Remove and replace/ No payment

+ No acceptance and final payment shall be made on completed pavement unless core test for thickness determination is conducted, except for Barangay Roads where the implementing office is allowed to waive such test.

311.3.21 Opening to Traffic

The Engineer will decide when the pavement may be opened to traffic. The road will not be opened to traffic until test specimens molded and cured in accordance with AASHTO T 23 have attained the minimum strength requirements in Subsection 311.2.12. If such tests are not conducted prior to the specified age, the pavement shall not be operated to traffic until 14 days after the concrete was placed. Before opening to traffic, the pavement shall be cleaned and joint sealing completed.

311.3.22 Tolerance in Pavement Thickness

1. General

The thickness of the pavement will be determined by measurement of cores from the completed pavement in accordance with AASHTO T 148.

The completed pavement shall be accepted on a lot basis. A lot shall be considered as 1000 linear meters of pavement when a single traffic lane is poured or 500 linear meters when two lanes are poured concurrently. The last unit in each slab constitutes a lot in itself when its length is at least ½ of the normal lot length. If the length of the last unit is shorter than ½ of the normal lot length, it shall be included in the previous lot.

Other areas such as intersections, entrances, crossovers, ramp, etc., will be grouped together to form a lot. Small irregular areas may be included with other unit areas to form a lot.

Each lot will be divided into five (5) equal segments and one core will be obtained from each segment in accordance with AASHTO T 24.

2. Pavement Thickness

It is the intent of this Specification that the pavement has a uniform thickness as called for on the Plans for the average of each lot as defined. After the pavement has met all surface smoothness requirements, cores for thickness measurements will be taken.

In calculating the average thickness of the pavement, individual measurements which are in excess of the specified thickness by more than 5 mm will be considered as the specified thickness plus 5 mm and measurement which are less than the specified thickness by more than 25 mm shall not be included in the average. When the average thickness for the lot is deficient, the contract unit price will be adjusted for thickness in accordance with paragraph (3 below).

Individual areas within a segment found deficient in thickness by more than 25 mm shall be evaluated by the Engineer, and if in his judgment, the deficient areas warrant removal, they shall be removed and replaced by the Contractor with pavement of the specified thickness at his entire expense. However, if the evaluation of the Engineer is that the deficient area should not be removed and replaced, such area will not be paid.

When the measurement of any core is less than the specified thickness by more than 25 mm, the actual thickness of the pavement in this area will be determined by taking additional cores at no less than 5 m intervals parallel to the center line in each direction from the affected location until a core is found in each direction, which is not deficient in thickness by more than 25 mm. The area of slab for which no payment will be made shall be the product of the paving width multiplied by the distance along the center line of the road between transverse sections found not deficient in thickness by more than 25 mm. The thickness of the remainder of the segment to be used to get the average thickness of each lot shall be determined by taking the average thickness of additional cores which are not deficient
by more than 25 mm.

3. Adjustment for Thickness

When the average thickness of the pavement per lot is deficient, payment for the lot shall be adjusted as follows:

Deficiency in the Average Thickness per lot (mm)	Percent (%) of Contract Price Per Lot
0 – 5	100% payment
6 – 10	95% payment
11 – 15	85% payment
16 – 20	70% payment
21 – 25	50% payment
More than 25	Remove and replace/ No payment

+ No acceptance and final payment shall be made on completed pavement unless core test for thickness determination is conducted, except for Barangay Roads where the implementing office is allowed to waive such test.

311.4 Method of Measurement

The area to be paid for under this Item shall be the number of square meters (m2) of concrete placed and accepted in the completed Pavement with or without rebar or wire mesh reinforcement. The width for measurements will be the width from outside edge to outside edge of completed pavement as placed in accordance with the Plans or as otherwise required by the Engineer in writing. The length will be measured horizontally along the center line of each roadway or ramp. Any curb and gutter placed shall not be included in the area of concrete pavement measured.

311.5 Basis of Payment

The accepted quantity, measured as prescribed in Section 311.4, shall be paid for at the contract unit price for Portland Cement Concrete Pavement and Portland Cement Concrete Pavement (Reinforced with Wire Mesh) which price and payment shall be full compensation for preparation of roadbed and finishing of shoulders, unless otherwise provided by the Special Provisions, furnishing all. materials, for mixing, placing, finishing and curing all concrete, for furnishing and placing all joint materials, for sawing weakened plane Joints, for fitting the prefabricated center metal joint, for facilitating and controlling traffic, and for furnishing all labor, equipment, tools and Incidentals necessary to complete the Item.

ITEM 401 – RAILINGS

401.1 Description

This Item shall consist of furnishing or fabricating and/or placing railings, for bridges and other structures of the materials or combination of materials shown on the Plans, constructed in reasonably close conformity with this Specification and to the lines, grades and dimensions shown on the plans. Railings shall be classified as concrete, steel, aluminum or timber in accordance with the predominating material contained in each other.

401.2 Material Requirements

401.2.1 Concrete

It shall conform to the applicable requirements prescribed in item 405, Structural Concrete.

401.2.2 Reinforcing Steel

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

401.2.3 Steel

Structural steel consisting of steel and iron plates, shapes, pipes, fittings and castings shall conform to the requirements of Item 403, Metal Structures.

401.2.4 Aluminum

It shall conform to the requirements of AASHTO M 193 ASTM B 221 or ASTM B 308 or as called for on the Plans.

401.2.5 Timber

It shall conform to the requirements of Item 713, Treated and Untreated Timber.

401.2.6 Stones and Bricks

These shall conform to the requirements of Item 506, Stone Masonry and Item 704, Masonry Units.

401.2.7 Paint

It shall conform to the requirements of Item 709, Paints.

401.3 Construction Requirements

401.3.1 General

Railings shall be constructed to the lines and grades shown on the Plans and shall not reflect any unevenness in the structure. All railing posts shall be set plumb in hand or mechanically dug holes, unless driving is permitted. In the latter case, the manner of driving shall be such as to avoid battering or distorting of post. Post holes shall be backfilled with acceptable material placed in layers and thoroughly compacted. When it is necessary to cut post holes in existing pavement, all loose materials shall be removed and the paving replaced in kind. Bridge railings shall not be placed on a span until centering or falsework has been removed, rendering the span self-supporting.

Rail elements shall be erected according to Plans and in a manner resulting in a smooth, continuous installation with laps in the direction of traffic flow. All bolts except adjustment bolts shall be drawn tight. Bolts shall be of sufficient length to extend beyond the nuts by more than 25
mm.

Where painting of railing component is specified, any damage to the shop coat of paint shall be corrected by an application of an approved rust-inhibitive primer prior to painting. Ungalvanized surfaces inaccessible to painting after erection shall be field painted before erection. The railing

components shall be given the specified number of coats of paint uniformly applied by thorough brushing or by approved pressure spray.

Galvanized surfaces which have been abraded so that the base metal is exposed, threaded portions of all fittings, fasteners and cut ends of bolts shall be painted with two (2) coats of zinc-dust and zinc oxide paint.

401.3.2 Metal Railing

Fabrication and erection shall be done in accordance with the requirements of Item 403, Metal Structures. In the case of welded railings, all exposed joints shall be finished by grinding or filing after welding to give a neat appearance.

Metal railing shall be carefully adjusted prior to fixing in-place to insure proper matching of abutting joints, correct alignment and camber throughout their length. Holes for field connection shall be drilled with the railing in-place in the structure at proper grade and alignment. Welding may be substituted for rivets or bolts in field connections with the approval of the Engineer.

401.3.3· Concrete Railing

1. Railing Cast-In-Place

The portion of the railing or parapet which is to be cast-in-place shall be constructed in accordance with the requirements of Item 405, Structural Concrete. Special care shall be exercised to secure smooth and tight fitting forms which can be rigidly held in line and grade and removed without injury to the concrete.

Forms shall either be of Single width boards or shall be lined with suitable material to have a smooth surface which shall meet the approval of the Engineer or as shown on the Plans.

All moldings, panel work and bevel strips shall be constructed according to the detailed Plans with metered joints. All corners in the finished work shall be true, sharp and cleancut, and shall be free from cracks, spalls and other defects.

2. Precast Railings

Moist tamped mortar precast members shall be removed from the molds as soon as practicable and shall be kept damp for a period of at least ten (10) days. Any member that shows
checking of soft corners of surfaces shall be rejected.

Expansion joints shall be constructed as to permit freedom of movement. After all work is completed, all loose or thin shells of mortar likely to spall under movement shall be carefully removed from all expansion joints by means of a sharp chisel.

401.3.4 Wooden Railing

Wooden railing shall be constructed in accordance with the requirements of Item 402, Timber Structures.

401.3.5 Stone and Brick Railing

The materials used in masonry brick railing and parapet, and the work to be done shall conform to the requirements of this Specification. The workmanship shall be first class and the finished construction shall be neat in appearance and true to line and grade.

401.4 Method of Measurement

The quantity to be paid for shall be the number of linear meters of specified railing actually completed and accepted measured from center to center of end posts.

401.5 Basis of Payment

The accepted quality, measured as prescribed in Section 401.4, shall be paid for at the contract unit price for Railing, which price and payment shall be full compensation for furnishing and placing all materials including all labor, equipment, tools and incidentals necessary to complete this Item.

ITEM 404 – REINFORCING STEEL

404.1 Description

This Item shall consist of furnishing, bending, fabricating and placing of steel reinforcement of the type, size, shape and grade required in accordance with this Specification and in conformity with the requirements shown on the Plans or as directed by the JHMC representative.

404.2 Material Requirements

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

404.3 Construction Requirements

404.3.1 Order Lists

Before materials are ordered, all order lists and bending diagrams shall be furnished by the Contractor, for approval of the JHMC representative. The approval of order lists and bending diagrams by the JHMC representative 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 JHMC representative. 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 JHMC representative 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 JHMC representative, the minimum distance between bars shall be 40mm. Reinforcement in any member shall be placed and then inspected and approved by the JHMC representative 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 JHMC representative. 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 JHMC representative in writing. Spiral reinforcement shall be spliced by lapping at least one and a half turns or by butt welding unless otherwise shown on the Plans.

404.4 Method of Measurement

The quantity of reinforcing steel to be paid for will be the final quantity placed and accepted in 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 JHMC representative 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 JHMC representative.

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.

ITEM 405 – STRUCTURAL CONCRETE

405.1 Description

405.1.1 Scope

This Item shall consist of furnishing, bending, placing and finishing concrete in all structures except pavements in accordance with this Specification and conforming to the lines, grades, and dimensions shown on the Plans. Concrete shall consist of a mixture of Portland Cement, fine aggregate, coarse aggregate, admixture when specified, and water mixed in the proportions specified or approved by the JHMC representative.

405.1.2 Classes and Uses of Concrete

The classes of concrete will generally be used as follows:

Class A – All superstructures and heavily reinforced substructures. The important parts of the structure included are slabs, beams, girders, columns, arch ribs, box culverts, reinforced abutments, retaining walls, and reinforced footings.

Class B – Footings, pedestals, massive pier shafts, pipe bedding, and gravity walls, unreinforced or with only a small amount of reinforcement.

405.2 Material Requirements

405.2.1 Portland Cement

It shall conform to all the requirements of Subsection 311.2.1.

405.2.2 Fine Aggregate

It shall conform to all the requirements of Subsection 311.2.2.

405.2.3 Coarse Aggregate

It shall conform to all the requirements of Subsection 311.2.3 except that gradation shall conform to Table 405.1.

Table 405.1 – Grading Requirements for Coarse Aggregate

Sieve Designation		Mass Percent Passing				
Standard Mm	Alternate US Standard	Class A	Class B	Class C	Class P	Class Seal
63	2-1/2”		100			
50	2”	100	95 – 100			
37.5	1-1/2”	95 – 100	-			100
25	1”	-	35 – 70		100	95 – 100
19.0	¾”	35 – 70	-	100	95 – 100	-
12.5	½”	-	10 – 30	90 – 100	-	25 – 60
9.5	3/8”	10 – 30	-	40 – 70	20 – 55	-
4.75	No.4	0 - 5	0 - 5	0 – 15*	0 – 10*	0 – 10*

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

405.2.4 Water

It shall conform to the requirements of Subsection 311.2.4

405.2.5 Reinforcing Steel

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

405.2.11 Storage of Cement and Aggregates

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

405.3 Sampling and Testing of Structural Concrete

As work progresses, at least one (1) sample consisting of three (3) concrete cylinder test specimens, 150 x 300mm (6 x 12 inches), shall be taken from each seventy-five (75) cubic meters of each class of concrete or fraction thereof placed each day.

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

Sampling of fresh concrete	T 141
Weight per cubic meter and air content (gravi- Metric) of concrete	T 121
Sieve analysis of fine and coarse aggregates	T 27
Slump of Portland Cement Concrete	T 119
Specific gravity and absorption of fine aggregate	T 84

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

Making and curing concrete compressive and flexural tests specimens in the field	T 23
Compressive strength of molded concrete Cylinders	T 22

405.4 Production Requirements

405.4.1 Proportioning and Strength of Structural Concrete

The concrete materials shall be proportioned in accordance with the requirements for each class of concrete as specified in Table 405.2, using the absolute volume method as outlined in the American Concrete Institute (ACI) Standard 211.1. "Recommended Practice for Selecting Proportions for Normal and Heavy weight Concrete". Other methods of proportioning may be employed in the mix design with prior approval of the JHMC representative. The mix shall either be designed or approved by the JHMC representative. A

change in the source of materials during the progress of work may necessitate a new mix design.

The strength requirements for each class of concrete shall be as specified in Table 405.2.

Table 405.2 - Composition and Strength of Concrete for Use in Structures

Class Of Concrete	Minimum Cement Content Per m^3 kg	Maximum Water/Cement Ratio kg/kg	Consistency Range in Slump mm (inch)	Designated Size of Coarse Aggregate Square Opening Std. mm	Minimum Compressive Strength of 150x300mm Concrete Cylinder Specimen at
A	360 (9 bags)	0.53	50 – 100 (2 – 4)	37.5 – 4.75 (1-1/2" – No. 4)	20.7 (3000)
B	320 (8 bags)	0.58	50 – 100 (2 – 4)	50 – 4.75 (2" – No. 4)	16.5 (2400)
C	380 (9.5 bags)	0.55	100 max. (4 max.)	12.5 – 4.75 (1/2" – No. 4)	20.7 (3000)
P	440 (11 bags)	0.49	100 – 200 (4 - 8)	19.0 – 4.75 (3/4" – No. 4)	37.7 (5000)

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

** *Based on 40 kg/bag*

405.4.2 Consistency

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

405.4.4 Mixing and Delivery

Concrete shall be mixed at the site of construction. Mixing of concrete shall be in accordance with the appropriate requirements of AASHTO M 157.

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

Mixer having a rated capacity of less than a one-bag batch shall not be used. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity as shown on the manufacturer's standard rating plate on the mixer except that an overload up to 10 percent above the mixer's nominal capacity may be permitted, provided concrete test data for strength, segregation, and uniform consistency are satisfactory and provided no spillage of

concrete takes place.

The mixer shall be operated at the drum speed as shown on the manufacturer's name plate on the mixer. Any concrete mixed less than the specified time shall be discarded and disposed-off by the Contractor at his own expenses.

The timing device on stationary mixers shall be equipped with a bell or other suitable warning device adjusted to give a clearly audible signal each time the lock is released. In case of failure of the timing device, the Contractor will be permitted to continue operations while it is being repaired, provided he furnishes an approved time piece equipped with minute and second hands.If the timing device is not placed in good working order within 24 hours further use of the mixer will be prohibited until repairs are made.

Retempering concrete will not be permitted. Admixtures for increasing the workability, for retarding the set, or for accelerating the set or improving the pumping characteristics of the concrete will be permitted only when specifically provided for in the Contract, or authorized in writing by the JHMC representative.

1. Mixing Concrete: General

   Concrete shall be thoroughly mixed in a mixer of an approved size and type that will insure a uniform distribution of the materials throughout the mass.

   All concrete shall be mixed in mechanically operated mixers. The auxiliary supply of concrete shall be sufficient to complete the casting of a section up to a construction joint that will meet the approval of the JHMC representative.

   Equipment having components made of aluminum or magnesium alloys, which would have contact with plastic concrete during mixing, transporting or pumping of Portland cement concrete, shall not be used.

   Concrete mixers shall be equipped with adequate water storage and a device of accurately measuring and automatically controlling the amount of water used.

   Materials shall be measured by weighing. The apparatus provided for weighing the aggregates and cement shall be suitably designed and constructed for this purpose.

   The accuracy of all weighing devices except that for water shall be such that successive quantities can be measured to within one percent of the desired amounts. The water measuring device shall be accurate to plus or minus 0.5 mass percent. All measuring devices shall be subject to the approval of the JHMC representative. Scales and measuring devices shall be tested at the expense of the Contractor as frequently as the JHMC representative may deem necessary to insure their accuracy.

   Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the entire plant is running, the scale reading at cut-off shall not vary from the weight designated by the JHMC representative more than one mass percent for cement, 1-1/2 mass percent for any size of aggregate, or one (1) mass percent for the total aggregate in any batch.

2. Mixing Concrete at Site

Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. The pick-up and throw-over blades of mixers shall be restored or replaced when any part or section is worn 20mm or more below the original height of the manufacturer's design. Mixers and agitators which have an accumulation of hard concrete or mortar shall not be used.

When bulk cement is used and volume of the batch is $0.5m^3$ or more, the scale and weigh hopper for Portland Cement shall be separate and distinct from the aggregate hopper or hoppers. The discharge mechanism of the bulk cement weigh hopper shall be interlocked against opening before the full amount of cement is in the hopper. The discharging mechanism shall also be interlocked against opening when the amount of cement in the hopper is underweight by more than one (1) mass percent or overweight by more than 3 mass percent of the amount specified.

When the aggregate contains more water than the quantity necessary to produce a saturated surface dry condition, representative samples shall be taken and the moisture content determined for each kind of aggregate.

The batch shall be so charged into the mixer that some water will enter in advance of cement and aggregate. All water shall be in the drum by the end of the first quarter of the specified mixing time.

Cement shall be batched and charged into the mixer so that it will not result in loss of cement due to the effect of wind, or in accumulation of cement on surface of conveyors or hoppers, or in other conditions which reduce or vary the required quantity of cement in the concrete mixture.

The entire content of a batch mixer shall be removed from the drum before materials for a succeeding batch are placed therein. The materials composing a batch except water shall be deposited simultaneously into the mixer.

All concrete shall be mixed for a period of not less than 1-1/2 minutes after all materials, including water, are in the mixer. During the period of mixing, the mixer shall operate at the speed for which it has been designed.

Mixers shall be operated with an automatic timing device that can be locked by the JHMC representative. The time device and discharge mechanics shall be so interlocked that during normal operation no part of the batch will be charged until the specified mixing time has elapsed.

The first batch of concrete materials placed in the mixer shall contain a sufficient excess of cement, sand, and water to coat inside of the drum without reducing the required mortar content of the mix. When mixing is to cease for a period of one hour or more, the mixer shall be thoroughly cleaned.

405.5 Method of Measurement

The quantity of structural concrete to be paid for will be the final quantity placed and accepted in the completed structure. No deduction will be made for the volume occupied by pipe less than 100mm (4 inches) in diameter or by reinforcing steel, anchors, conduits, weep holes or expansion joint materials.

405.6 Basis of Payment

The accepted quantities, measured as prescribed in Section 405.5, shall be paid for at the contract unit price for each of the Pay Item listed below that is included in the Bill of Quantities.

Payment shall constitute full compensation for furnishing, placing and finishing concrete including all labor, equipment, tools and incidentals necessary to complete the work prescribed in the item.

7.2.

ITEM 500 - PIPE CULVERTS AND STORM DRAINS

500.1 Description

This item shall consist of the construction or reconstruction of pipe culverts and storm drains, hereinafter referred to as "conduit" in accordance with this Specification and in conformity with the lines and grades shown on the Plans or as established by the Engineer.

500.2 Material Requirements

Material shall meet the requirements specified in the following specifications:

Zinc coated (galvanized) corrugated iron or steel culverts and underdrains	AASHTO M 36
Cast iron culvert pipe	AASHTO M 64
Concrete sewer, storm drain and culvert	AASHTO M 86 pipe
Reinforced concrete culvert, storm drain and sewer pipe	AASHTO M 170
Bituminous coated corrugated metal culvert pipe and pipe arches	AASHTO M 190
Reinforced concrete arch culvert, storm drain and sewer pipe	AASHTO M 206
Reinforced concrete elliptical culvert, storm drain and sewer pipe	AASHTO M 207
Asbestos cement pipe for culverts and storm drains	AASHTO M 217

Joint Mortar - Joint mortar for concrete pipes shall consist of 1 part, by volume of Portland Cement and two (2) parts of approved sand with water as necessary to obtain the required consistency.

Portland Cement and sand shall conform to the requirements of Item 405, Structural Concrete. Mortar shall be used within 30 minutes after its preparation.

Rubber gaskets AASHTO M 198

Oakum - Oakum for joints in bell and spigot pipes shall be made from hemp (Cannavis Sativa) line or Benares Sunn fiber or from a combination of these fibers. The oakum shall be thoroughly corded and finished and practically free from lumps, dirt and extraneous matter.

Hot poured joint sealing compound AASHTO M 173 Bedding material shall conform to the requirements of Subsection 500.3.2, Bedding.

Backfill material shall conform to the requirements of Subsection 500.3.6, Backfilling.

When the location of manufacturing plants allow, the plants will be inspected periodically for compliance with specified manufacturing methods, and material samples will be obtained for laboratory testing for compliance with materials quality requirements. This shall be the basis for acceptance of manufacturing lots as to quality.

Prior to and during incorporation of materials in the work, these materials will be subjected to the latest inspection and approval of the Engineer.

500.3 Construction Requirements

500.3.1 Trenches Excavation

Trenches shall be excavated in accordance with the requirement of Item 103, Structure Excavation, to a width sufficient to allow for proper jointing of the conduit and thorough compaction of the bedding and
backfill materials under and around the conduit. Where feasible, trench wall shall be vertical.

The completed trench bottom shall be firm for its full length and width. Where required, in the case of crop drains, the trench shall have a longitudinal camber of the magnitude specified.

When so specified on the Plans, the excavation for conduits placed in embankment fill, shall be made after the embankment has been completed to the specified or directed height above the designed grade of the conduit.

500.3.2 Bedding

The bedding shall conform to one of the classes specified. When no bedding class is specified, the requirements for Class C bedding shall apply.

Class A bedding shall consist of a continuous concrete cradle conforming to the plan details.

Class B bedding shall consist of bedding the conduit to a depth of not less than 30 percent of the vertical outside diameter of the conduit. The minimum thickness of bedding material beneath the pipe shall be 100 mm. The bedding material shall be sand or selected sandy soil all of which passes a 9.5 mm sieve and not more than 10 percent of which passes a 0.075 mm sieve . The layer of the bedding material shall be shaped to fit the conduit for at least 15 percent of its total height. Recesses in the trench bottom shall be shaped to accommodate the bell when bell and spigot type conduit is used.

Class C bedding shall consist of bedding the conduit to a depth of not less than 10 percent of its total height. The foundation surface, completed in accordance with Item 103, Structure Excavation, shall be shaped to fit the conduit and shall have recesses shaped to receive the bells, if any.

For flexible pipe, the bed shall be roughly shaped and a bedding blanket of sand or fine granular material as specified above shall be provided as follows:

Pipe Corrugation Depth	Minimum Bedding Depth
10 mm	25 mm
25 mm	50 mm
50 mm	75 mm

For large diameter structural plate pipes the shaped bed need not exceed the width of bottom plate.

500.3.3 Laying Conduit

The conduit laying shall begin at the downstream end of the conduit line. The lower segment of the conduit shall be in contact with the shaped bedding throughout its full length. Bell or groove ends of rigid conduits and outside circumferential laps of flexible conduits shall be placed facing upstream. Flexible conduit shall be placed with longitudinal laps or seams at the sides.

Paved or partially-lined conduit shall be laid such that the longitudinal center line of the paved segment coincides with the flow line. Elliptical and elliptically reinforced conduits shall be placed with the major axis within 5 degrees of a vertical plane through the longitudinal axis of the conduit.

500.3.4 Jointing Conduit

Rigid conduits may either be of bell and spigot or tongue and groove design unless another type is specified. The method of joining conduit sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even.

Joints shall be made with (a) Portland Cement mortar, (b) Portland Cement grout, (c) rubber gaskets, (d) oakum and mortar, (e) oakum and joint compound, (f) plastic sealing compound, or by a combination of these types, or any other type, as may be specified. Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the conduit and finished smooth on the inside. For grouted joints, molds or runners shall be used to retain the poured grout. Rubber ring gaskets shall be installed so as to form a flexible water-tight seal. Where oakum is used, the joint shall be called with this material and then sealed with the specified material.

When Portland Cement mixtures are used, the completed joints shall be protected against rapid drying by any suitable covering material.

Flexible conduits shall be firmly joined by coupling bands.

Conduits shall be inspected before any backfill is placed. Any pipe found to be out of alignment, unduly settled, or damaged shall be taken up and relaid or replaced.

500.3.5 Field Strutting

When required by the Plans, vertical diameter of round flexible conduit shall be increased 5 percent by shop elongation or by means of jacks applied after the entire line of conduit has been installed on the bedding but before backfilling. The vertical elongation shall be maintained by means of sills and struts or by horizontal ties shall be used on paved invert pipe.

Ties and struts shall be 300 mm in place until the embankment is completed and compacted, unless otherwise shown on the Plans.

These construction specifications shall also apply in the case of relaid conduits. In addition, all conduits salvaged for relaying shall be cleaned of all foreign materials prior to reinstallation.

500.3.6 Backfilling

Materials for backfilling on each side of the conduit for the full trench width and to an elevation of 300 mm above the top of the conduit shall be fine, readily compactible soil or granular material selected from
excavation or from a source of the Contractor's choice, and shall not contain stones that would be retained on a 50 mm sieve, chunks of highly plastic clay, or other objectionable material. Granular backfill material shall have not less than 95 percent passing a 12.5 mm sieve and not less than 95 percent retained on a 4.75 mm sieve. Oversized material, if present, shall be removed at the source of the material, except as directed by the Engineer.

When the top of the conduit is flushed with or below the top of the trench, backfill material shall be placed at or near optimum moisture content and compacted in layers not exceeding 300 mm (compacted) on both sides to an elevation 300 mm above the top of the conduit. Care shall be exercised to thoroughly compact the backfill under the haunches of the conduit. The backfill shall be brought up evenly on both sides of the conduit for the full required length. Except where negative projecting embankment-type installation is specified, the backfill material shall be placed and compacted for the full depth of the trench.

When the top of the conduit is above the top of the trench, backfill shall be placed at or near optimum moisture content and compacted in layers not exceeding 300 mm (compacted). It shall be brought up evenly on both sides of the conduit for its full length to an elevation 300 mm above the top of the conduit. The width of the backfill on each side of the conduit for the portion above the top of the trench shall be equal to twice the diameter of the conduit or 3.5 m, whichever is less. The backfill material used in the trench section and the portion above the top of the trench for a distance on each side of the conduit equal to the horizontal inside diameter and to 300 mm above the top of the conduit shall conform to the requirements for backfill materials in this Subsection. The remainder of the backfill shall consist of materials from excavation and borrow that is suitable for embankment construction.

Compaction to the density specified in Item 104, Embankment, shall be achieved by use of mechanical tampers or by rolling.

All conduits after being bedded and backfilled as specified in this Subsection shall be protected by one metre cover of fill before heavy equipment is permitted to cross during construction of the roadway.

500.3.7 Imperfect Trench

Under this method, for rigid conduit, the embankment shall be completed as described in Subsection 500.3.6, Backfilling, to a height above the conduit equal to the vertical outside diameter of the conduit plus 300 mm. A trench equal in width to the outside horizontal diameter of the conduit and to the length shown on the plans or as directed by the Engineer shall then be excavated to within 300 mm of the top of the conduit, trench walls being as nearly vertical as possible. The trench
shall be loosely filled with highly compressible soil. Construction of embankment above shall then proceed in a normal manner.

500.4 Method of Measurement

Conduit of the different types and sizes, both new and relaid, will be measured by the linear meter in place. Conduit with sloped or skewed ends will be measured along the invert.

Each section will be measured by the number of units installed.

Branch connection and elbows will be included in the length measurement for conduit, or they may be measured by the number of units installed.

Class B bedding material placed and approved shall be measured by the cubic metre in place.

When the Bid Schedule contains an estimated quantity for "Furnishing and Placing Backfill Material, Pipe Culvert", the quantity to be paid for will be the number of cubic metre completed in place and accepted, measured in final position between limits as follows:

1. Measurement shall include backfill material in the trench up to the top of the original ground line but will not include any material placed outside of vertical planes 450 mm up outside of and parallel to the inside wall of pipe at its widest horizontal dimension.

2. When the original ground line is less than 300 mm above the top of the pipe, the measurement will also include the placing of all backfill materials, above the original ground line adjacent to the pipe for a height of 300 mm above the top of pipe and for a distance on each side of the pipe not greater than the widest horizontal dimension of the pipe.

3. The measurement shall include the placing of backfill material in all trenches of the imperfect trench method. Materials re- excavated for imperfect trench construction will be measured for payment under Item 103, Structure Excavation.

500.5 Basis of Payment

The accepted quantities of conduit, determined as provided in Section 500.4, Method of Measurement, shall be paid for at the contract unit price per linear meter for the conduit of the types and sizes specified complete in place. End sections and, when so specified, branch connections and elbows, shall be paid for at the contract unit price per piece for the kind and size specified complete in place.

Excavation for culverts and storm drains, including excavation below flow line grade and for imperfect trench, shall be measured and paid for as provided in Item 103, Structure Excavation.

Concrete for Class A bedding will be paid for under Item 405, Structural Concrete. When the Bid Schedule does not contain as estimated quantity for "Furnishing and Placing Backfill Material, Pipe Culvert" payment for placing backfill material around pipe culverts will be considered as included in the payment for excavation of the backfill material.

7.3.

ITEM 502- MANHOLES, INLETS AND CATCH BASINS

500.1 Description

This item shall consist of the construction, reconstruction or adjustment of manholes, inlets and catch basins in accordance with this Specification and in reasonably close conformity with the lines and grades shown on the Plans or as established by the Engineer.

500.2 Material Requirements

Concrete for these structures shall meet the requirements of Item 405, Structural Concrete. Other materials shall meet the following specifications:

Corrugated Metal Units - The units shall conform to Plan dimensions and the metal to AASHTO M 36. Bituminous coating, when specified, shall conform to ASTM D 1187, Asphalt-base Emulsion for use as Protective Coating for Metal.

Sewer and manhole brick (Made from clay or shale) AASHTO M 91

Building brick (Solid masonry units made from clay or shale) AASHTO M 114

Joint Mortar- Unless otherwise indicated on the Plans, joints mortar shall be composed of one-part Portland Cement and two parts fine aggregate by volume to which hydrated lime has been added in an amount equal to 10 percent of the cement by weight. All materials for mortar shall meet the requirements of Item 405, Structural Concrete.

Frames, Gratings, Covers and Ladder Rungs - Metal units shall conform to the Plan dimensions and to the following specification requirements for the designated materials.

Metal gratings and covers which are to rest on frames shall bear on them evenly. They shall be assembled before shipment and so marked that the same pieces may be reassembled readily in the same position when installed. Inaccuracy of bearings shall be corrected by machining, if necessary. A frame and a grating or cover to be used with it shall constitute one pair.

All castings shall be uniformly coated with asphalt-based emulsion meeting the requirements of ASTM D 1187, Asphalt-base Emulsion for use as Protective Coating for Metal.

Samples of the material in casting shall be taken during the casting of the units and shall be separate casting poured from the same material as the casting they represent.

Gray iron casting AASHTO M 105

Mild to medium-strength carbon steel castings for general application AASHTO M 103

Structural steel AASHTO M 183

Galvanizing, where specified for these units, shall conform to the requirements of AASHTO M 111

Reinforcing Steel AASHTO M 31

Pre-cast Concrete Units - These units shall be cast in substantial permanent steel forms. Structural concrete used shall attain a minimum 28-day compressive strength of 20.682 MPa. The pre-cast units shall be cured in accordance with AASHTO M 171. Water absorption of Additional reinforcement shall be provided as necessary to provide for handling of the pre-cast units.
A sufficient number of cylinders shall be cast from the concrete of each unit for compression tests at 7, 14 and 28 days, and to allow for at least 3 cylinders for each test. If the strength requirement is met at7 or 14 days, the units shall be certified for use 14 days from the date of casting. If the strength is not met at 28 days, all units made from that batch or load will be rejected.

Cracks in units, honeycombed or patched areas in excess of2 000 square millimeters, excessive water absorption and failure to meet strength requirements shall be the causes for rejection. Pre-cast reinforced concrete manhole risers and tops shall conform to the requirements of AASHTO M 199.

The plants will be inspected periodically for compliance with specified manufacturing methods, and material samples will be obtained for laboratory testing for compliance with material quality requirements. This may be the basis for acceptance of manufacturing lots as to
quality.

All materials shall be subjected to inspection for acceptance as to condition at the latest practicable time the Engineer has the opportunity to check for compliance prior to or during incorporation of materials into the work.

500.3 Construction Requirements

Concrete construction shall conform to the requirements for Item 405, Structural Concrete.

Metal frames shall be set in full mortar bed. Pipe sections shall be flushed on the inside of the structure wall and projected outside sufficiently for proper connection with next pipe section. Masonry shall fit neatly and tightly around the pipe.

When grade adjustment of existing structures is specified, the frames, covers and gratings shall be removed and the walls reconstructed as required. The cleaned frames shall be reset at the required elevation. Upon completion, each structure shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind and shall be kept clear of such accumulation until final acceptance of the work.

Excavation and backfill shall be done in accordance with Item 103, Structure Excavation.

500.4 Method of Measurement

Standard manholes, inlets and catch basins, both new and reconstructed as applicable, will be measured by the unit. Any additional concrete, reinforcing steel, or masonry required for authorized increases in heights of structures paid of under this Item and in excess of the standard height shown on the Plans will be measured and paid for under Item 405, Structural Concrete and Item 404, Reinforcing Steel, as applicable. Structures noted on the Plans as "junction boxes" will be measured for payment as manholes.

The number of concrete covers, pairs of metal frames and gratings, and pairs of metal frames and covers will be measured as acceptably completed.

The number of existing manholes, inlets and catch basins adjusted as directed will be measured as acceptably completed.

500.5 Basis of Payment

The accepted quantities, determined as provided in Section 502.4, Method of Measurement of the Pay Items in the Bill of Quantities will be paid for at the contract unit prices, which shall constitute full compensation for furnishing and placing all materials and for all labor, equipment, tools and incidentals necessary to complete the Item.

Excavation and backfill will be measured and paid for as provided in Item 103, Structure Excavation.

7.4. ITEM 503 – DRAINAGE STEEL GRATING WITH FRAME

7.5.

503.1 Description

This item shall consist of furnishing all materials, tools, and equipment including labor required in undertaking the proper application of steel grating with frame as shown on the approved Plans and in accordance with this Specification.

503.2 Classes and Uses of Road Grates and Frames

Classes of grates that are commonly use in drainage work are sump, trench and box.

Sump grates shall be used to create a trafficable ground level entry area for surface rainwater to flow into the underground stormwater drainage system. Sump grates shall be used in paved or grassed areas that are graded to direct the surface water to a single pit or to a series of pits. Sump grates shall be plain or hinged.

Trench grates shall be used to collect surface rainwater run off from areas that cannot be graded to direct flow into a single pit.

Box grates or road drainage shall be used to transfer road surface storm water into an underground drainage system. Normally used in conjunction with kerb entry, the addition of the grate significantly increases the hydraulic capacity of the inlet, particularly on steep slopes.

503.3 Strength Classifications and the Loading Conditions for Sump, Trench and Box Grates

Class A- Test Load 10kN

For locations trafficked only by pedestrians, wheelchairs and cyclists - inaccessible to motor vehicles by virtue of barriers, narrow passages or stepped or unpaved approaches.

Class B - Test Load 80kN

For locations normally trafficked by pedestrians and slow moving passenger cars or light agricultural tractors. These locations include areas accessible to infrequent slow moving heavy trucks. Typical locations include footpaths, ground level and multistoried car parks, suburban driveways and back yards.

Class C - Test Load 150kN

For locations trafficked by slow moving fully laden trucks such as pedestrians, malls and industrial or commercial areas.

Class D - Test Load 210kN

For locations trafficked by fast moving fully laden trucks and forklifts with wheel loads to 5.0T. This includes all public roads from residential to freeway.

Class E, For G - Test Load 400kN, 600kN or 900kN

For locations subject to vehicles such as large forklifts, earthmoving or container handling equipment and aircraft. Typical locations include wharves, container storage areas, heavy industry or construction sites and domestic or international airports.

All loading conditions specified above are applicable to the three classes of grates depending on their specific uses and locations.

503.4 Material Requirement

503.4.1 Steel Grating

The steel grating shall be made of fabricated mild steel provided with hot dip galvanized in accordance with ASTM A 153/AASHTO M 232 for superior corrosion protection. Steel grating shall be machine made grating comprised of steel flat bars standing on edge equispaced from each other. To prevent them from falling over and to provide restraint in buckling, a twisted cross rod (6mm) is forge-welded[1] into the top of the flat bars.

503.4.2*Steel Frame*

The steel frame clear openings of drainage grates shall be 15mm larger than nominal sizes of industry standard sized pits. These pits increase in size in increments of 150mm. This shall be done to allow frames to be placed over standard panel formwork and cast in while p ouring the pit walls , to speed up installation and ensure the frame is fully embedded in the concrete.

503.4.3*Drainage Grate Sizes*

The drainage grates shall be identified by their internal clear opening dimensions of the frame. For square and rectangular grates, the normal convention shall be the width x length. Metal units shall conform to the approved plan dimensions and specifications requirement for the designated materials.

Grates shall consist of 25mm to 65mm x 3mm , 4.5mm or 5mm thick flat bars with length of not more than 6.1m spaced at 30mm o.c. with 6mm twisted rod spaced at 100mm o.c.. Angular frame (L 75mm x 75mm x 9mm thick) shall be coated with hot dipped galvanized for superior corrosion protection finish and extended life. If required, I Beam support shall be provided in the grates in accordance with the approved plan. It shall also conform to the requirements of ASTM A 153 or its equivalents AASHTO M 232.The metal unit shall conform to ASTM A 36 / MSHTO M 183

Dimension Tolerances:	Thickness	= ± 0.20mm
	Width	= ± 0.80mm
	Length	= + 50mm/NIL mm
	Straightness	= 6mm in each 1.5m length

503.4.5 Joint Mortar

Unless otherwise indicated on the Plans, joint mortar shall be composed of one part Portland Cement and two parts fine aggregate by volume to which hydrated lime has been added in an amount equal to 10 percent of the cement by weight. All materials for mortar shall meet the requirements of Item 405, Structural Concrete. Structural concrete used shall attain a minimum 28-day compressive strength of 20.682 MPa.

503.5 Construction Requirements

Concrete construction shall conform to the requirements for Item 405, Structural Concrete.

Metal gratings which are to rest on frames shall bear on them evenly. They shall be assembled before shipment and so marked that the same pieces may be reassembled readily in the same position when installed. Inaccuracy of bearings shall be corrected by machining, if necessary. The steel grating and its corresponding frame shall constitute one pair.

When grade adjustment of existing drainage grates is specified, the frames and steel gratings shall be removed and the walls shall be reconstructed as required. The cleaned frames shall be reset at the required elevation. Upon completion, each drainage grates shall be cleaned of any accumulations of silt, debris, or foreign matter of any kind and shall be kept clear of such accumulation until final acceptance of the work.

Excavation and backfill shall be done in accordance with Item 102, Excavation.

503.6 Acceptance Requirement

A sufficient number of cylinders for concrete construction shall be cast from the concrete for each unit for compression tests at 7, 14 and 28 days, and to allow for at least 3 cylinders of each test. If the strength requirement is met at 7 or 14 days, the units shall be certified for use 14 days from the date of casting. If the strength is not met at 28 days, all units made from that batch or load will be rejected.

The steel grating plants will be inspected periodically for compliance with specified manufacturing and fabricating methods and bars samples will be obtained for laboratory testing for compliance with material quality requirements .

All draining grates materials shall be subjected to inspection for acceptance as to condition at the latest practicable time the Engineer has the opportunity to check for compliance prior to or during incorporation of materials into the work.

503.7 Method of Measurement

The quantity to be measured and paid for will be the number of pairs of metal frames and gratings completed and accepted. Concrete and reinforcing steel (AASHTO M 31) will be measured and paid for under Item 405, Structural Concrete and Item 404, Reinforcing Steel respectively.

Excavation and backfill will be measured and paid for as provided in Item 102, Excavation.

503.8 Basis of Payment

The accepted quantities, determined as provided in Section 503.7, Method of Measurement of the Pay Items in the Bill of Quantities will be paid for at the contract unit prices, which shall constitute full compensation for furnishing and placing all materials and for all labor requirement, tools and incidentals necessary to complete the item.

ITEM 505 – RIPRAP AND GROUTED RIPRAP

505.1 Description

This Item shall consist of the furnishing and placing of riprap with or without grout as the case may be, with or without filter backing, furnished and constructed in accordance with this Specification and to the lines and grades and dimensions shown on the Plans.

505.2 Material Requirements

505.2.1 Stones

Stones for riprap shall consist of rock as nearly as rectangular in section as is practical, except that riprap of Class A may consist of round natural stones. The stones shall be sound, tough, durable, dense, resistant to the action of air and water, and suitable in all respects for the purpose intended.

Stones for riprap shall be one of the following classes as shown on the Plans or determined by the Engineer.

Class A -	Stones ranging from a minimum of 15kg to a maximum of 25kg with at least 50 percent of the stones weighing more than 20kg
Class B -	Stones ranging from minimum of 30kg to a maximum of 70kg with at least 50 percent of the stones weighing more than 50kg
Class C -	Stones ranging from minimum of 60kg to a maximum of 100kg with at least 50 percent of the stones weighing more than 80kg
Class D -	Stones ranging from minimum of 100kg to a maximum of 200kg with at least 50 percent of the stones weighing more than 150kg

Sound pieces of broken concrete obtained from the removal of bridges, culverts and other structures may be substituted for stone with the approval of the Engineer.

505.2.2 Filter Materials

When required, the riprap shall be placed on a filter layer to prevent fine embankment materials to be washed out through the voids of the face stones. The grading of the filter material shall be as specified on the Plans, or in the Special Provisions. If not so specified, it will be required that D15 of the filter is at least 4 times the size D_{s8} for the embankment material, where D1s percent and 85 percent, respectively, passing (by mass) in a grain size analysis. Fine aggregate passing grading requirements for Item 405, Structural Concrete, will satisfy foregoing requirements.

505.2.3 Mortar

Mortar for grouted riprap shall consist of sand, cement and water conforming to the requirements given under Item 405, Structural Conc r e te, mixed in the proportion of one part cement to three parts sand by volume, and sufficient water to obtain the required consistency.

The horizontal and vertical contact surface between stones shall be embedded by cement mortar having a minimum thickness of 20 mm. Sufficient mortar shall be used to completely fill all voids leaving the face of the stones exposed.

505.3 Construction Requirements

505.3.1 Excavation

The bed for riprap shall be excavated to the required depths and properly compacted, trimmed and shaped The riprap shall be founded in a toe trench dug below the depth of scour as shown on the Plans or as ordered by the Engineer. The toe trench shall be filled with stone of the same class as that specified for the riprap, unless otherwise specified.

505.3.2 Placing

Stones placed below the water line shall be distributed so that the minimum thickness of the riprap is not less than that specified.

Stones above the water line shall be placed by hand or individually by machines. They shall be laid with close, broken joints and shall be firmly bedded into the slope and against the adjoining stones. Each stone shall be laid with its longest axis perpendicular to the slope in close contact with each adjacent stone. The riprap shall be thoroughly rammed into place as construction progresses and the finished surface shall present an even, tight surface. Interstices between stones shall be filled with small broken fragments firmly rammed into place.

Unless otherwise provided, riprap shall have the following minimum thickness, measured perpendicular to the slope:

Class A - 300 mm
Class B - 500 mm
Class C - 600 mm
Class D - 800 mm

The surface of riprap shall not vary from the theoretical surface by more than 100 mm at any point.

505.3.3 Grouting

When grouted riprap is specified, stones shall be placed by hand, or individually by machine as specified for riprap placed above the water line. The spaces between the stones shall then be filled with cement mortar throughout the thickness of the riprap as specified in Subsection 505.2.3, Mortar. Sufficient mortar shall be used to completely fill all void s, except that the face surface of the stones shall be left exposed.

Grout shall be placed from bottom to top of the surface swept with a stiff broom. After grouting is completed, the surface shall be cured as specified in Item 405, Structural Concrete for a period of at least three days .

The stones shall also be laid in a manner that the vertical and horizontal alignments of the exposed face shall, as possible be maintained in a straight line.

505.3.4 Weepholes

All walls of the abutments shall be provided with weepholes. Unless otherwise shown on the Plans or as directed by the Engineer, the weepholes shall be placed horizontally at the lowest points where free outlets for water can be obtained and shall be spaced at not more than 2 m center to center in a staggered manner. The length of the weepholes shall not be less than the thickness of the walls of the abutment and shall be at least 50 mm diameter PVC or other pipe materials accepted by the Engineer. Weepholes must be provided with filter bags as specified in special provision or as directed by the Engineer , and shall be incidental to Pay Item 505.

505.4 Method of Measurement

The quantities to be measured for payment shall be the number of cubic meters of riprap or grouted riprap, as the case may be, including stones placed in the toe trench laid in position and accepted.

Filter layer of granular material, when required, shall be measured separately by the cubic meter in place and accepted.

The computation of the quantities will be based on the volume within the limiting dimensions designated on the Plans or as determined by the Engineer.

505.5 Basis of Payment

The quantities measured as provided under Subsection 505.4 shall be paid for at the contract unit price, respectively , for each of the Pay Items listed below and shown in the Bid Schedule, which price and payment shall be full compensation for excavation and preparation of thebe d , for furnishing and placing all materials including backfill and all additional fill to bring the riprap bed up to the lines, grades and dimensions shown on the Plans , and all labor, equipment, tools and incidentals necessary to complete the Item.

ITEM 508 – HAND-LAID ROCK EMBANKMENT

508.1 Description

This Item shall consist of hand-laid rock embankment, as designated in the Bid Schedule, constructed in accordance with this Specification and in conformity with the lines and grades shown on the Plans or established by the Engineer.

508.2 Material Requirements

Stones shall be sound and durable and furnished in a well-balanced range of sizes meeting the requirements herein.

Unless otherwise provided by the Plans or Special Provisions, all stones shall be more than 0.015 cubic meter in volume and not less than 75 percent of the total volume of rock embankment and shall consist of stones 0.03 cubic meter in volume. Stones obtained from excavation performed under this contract may be used. Adobe stone shall not be used, unless otherwise specified.

508.3 Construction Requirements

Sufficient excavation shall be made to expose a foundation bed that is satisfactory to the Engineer. The stones shall be founded on this bed and laid to the lines and dimensions required.

Stones shall be laid flat and securely placed with broken joint lines. The larger stones shall generally be located in the lower part of the structure and voids shall be eliminated to the extent possible. Spalls smaller than the minimum stone size specified in Section 506.2, Material Requirements, shall be used to check the larger stones solidly in position and to substantially fill voids between the major stones as laid in the embankment. The exposed face of the rock mass shall be reasonably uniform, with no projections of more than 150 mm beyond the neat lines shown on the Plans or as directed by the Engineer.

Backfill adjacent to the hand-laid rock embankment shall be filled entirely with acceptable material coming from excavation items and compacted.

508.4 Method of Measurement

The quantity to be paid for will be the number of cubic meter of hand-laid rock embankment measured in place, completed and accepted.

508.5 Basis of Payment

The quantity determined, as provided in Section 508.4, Method of Measurement , will be paid for at the contract price per cubic meter for Hand-Laid Rock Embankment, which price and payment shall constitute full compensation for furnishing, selecting, and transporting stones, for placing stones by hand, for backfilling, and for all labor, equipment , tools and incidentals necessary to complete the Item including foundation excavation.

ITEM 600 – CURB AND GUTTER

600.1 Description

This Item shall consist of the construction of curb and gutter either Precast or Cast in place, made of concrete in accordance with this Specification at the location, and in conformity with the lines, grades, dimensions and design, shown on the Plans or as required by the JHMC representative.

600.2 Material Requirements

600.2.1 Material for Bed Course

Bed course materials as shown on the Plans shall consist of cinders, sand, slag, gravel, crushed stone, or other approved porous material of such grading that all the particles will pass through 12.5 mm (1/2 inch) sieve.

600.2.2 Concrete

Concrete shall be of the class indicated on the Plans and shall conform to the requirements of Item 405, Structural Concrete.

600.3 Construction Requirements

600.3.1 Bedding

Excavation shall be made to the required depth and the base upon which the curb and/or gutter is to be set shall be compacted to a firm and even surface. All soft and unsuitable material shall be removed and replaced with suitable material.

Bed course material shall be placed and compacted to form a bed of the required thickness as shown on the Plans.

600.3.2 Cast in Place Curb and Gutter

600.3.2.1 Placing

Forms shall conform to the requirements of Item 407, Concrete Structures. Metal forms shall be of an approved section.

Forms to hold the concrete shall be built and set-in-place as described in Item 407, Concrete Structures. Forms for at least 50 m of curb and gutter shall be in- place and checked for alignment and grade before concrete is placed. Curbs and gutters constructed on curves shall have forms of either wood or metal and they shall be accurately shaped to the curvature shown on the Plans.

Mixing, placing, finishing and curing of concrete shall conform to the requirements of Item 405, Structural Concrete, as modified by the requirements below.

The concrete shall be placed in the forms in layers of 100 or 125 mm each, and to the depth required. It shall be tamped and spaded until mortar entirely covers the top and surfaces of the forms. The top of the concrete shall be finished to a smooth and even surface and the edges rounded to the radii shown on the Plans. Before the concrete is given the final finishing, the surface of the gutter shall be tested with a 3-m straight-edge and any irregularities of more than 10 mm in 3 m shall be corrected.

The curb and gutter shall be constructed in uniform sections of not more than 50 m in length except where shorter sections are required to coincide with the location of weakened planes or contraction joints of the concrete pavement, or for closures, but no section shall be less than 2 m long. The sections shall be separated by sheet templates set perpendicular to the face and top of the curb and gutter. The templates shall be approximately 5 mm in thickness and of the same width as that of the curb and/or gutter and not less than 50 mm deeper than the depth of the curb and/or gutter. Templates shall be set carefully and held firmly during the placing of the concrete and shall remain in place until the concrete has set sufficiently to hold its shape but shall be removed while the forms are still in place.

Expansion joints shall be formed at intervals shown on the Plans. Where a curb is placed next to a concrete pavement, expansion joints in the curb shall be located opposite expansion joints in the pavement.

The form shall be removed within 24 hours after the concrete has been placed. Minor defects shall be repaired with mortar containing one part of Portland Cement and two parts of fine aggregate. Plastering shall not be permitted and all rejected portions shall be removed and replaced at the Contractor's expense. The exposed surface shall be finished while the concrete is still fresh by rubbing the surfaces with a wetted soft brick or wood until they are smooth. The surfaces shall be wetted thoroughly, either by dipping the brick or wood in water, or by throwing water on the surfaces with a brush. After the concrete has been rubbed smooth using water, it shall then be rubbed with a thin grout containing one part of Portland Cement and one part of fine aggregates. Rubbing with grout shall continue until uniform color is produced. When completed, the concrete shall be covered with suitable material and kept moist for a period of 3 days, or a membrane-forming material may be applied as provided in Item 405, Structural Concrete. The concrete shall be suitably protected from the weather until thoroughly hardened.

After the concrete has set sufficiently, the spaces on the back of the curb which were excavated for placing the curb shall be refilled to the required elevation with suitable material which shall be tamped in layers of not more than 150 mm until consolidated.

600.4 Method of Measurement

The length of curb and gutter to be paid for shall be the number of linear meters of curb and gutter (cast in place) or the number of pieces of precast curb and gutter of the required dimensions shown on the Plans measured along its front face in-place, completed and accepted. No deductions shall be made for flattening of curbs at entrances and no additional allowances shall be made for curbs and gutters constructed on curves.

600.5 Basis of Payment

The length of curb and gutter determined in Subsection 600.4, Method of Measurement, shall be paid for at the contract unit price per linear meter for Curb and Gutter which price and payment shall constitute full compensation for furnishing and placing all materials for concrete, reinforcing steel if required on the Plans, expansion joint materials, forms for drainage openings, excavation for curb and gutter, backfilling, dumping and disposal of surplus materials, and for all labor, equipment, tools and incidentals necessary to complete the Item.

ITEM 601 – SIDEWALK

601.1 Description

This Item shall consist of the construction of asphalt or portland cement concrete sidewalk in accordance with this Specification and to the lines, grades, levels and dimensions shown on the Plans, or as required by the Engineer.

601.2 Material Requirements

601.2.1 Portland Cement Concrete

The cement concrete shall be Class A as specified in Item 405, Structural Concrete.

601.2.2 Asphalt

Asphaltic material shall be as specified in Item 308, Bituminous Plant-Mix Surface Course , Cold-Laid, or Item 310, Bituminous Concret e Surface Course, Hot-Laid.

601.2.3 Expansion Joint Filler

Unless otherwise ordered, the preformed joint filler shall have a thickness of 5 mm and shall conform to the requirements of Item 311, Portland Cement Concrete Pavement.

601.2.4 Forms

Forms shall be of wood or metal as approved by the Engineer and shall extend to the full depth of the concrete. All forms shall be straight, free from warps and of adequate strength to resist distortion.

601.2.5 Bed Course Material

Bed course material consists of cinders, sand, slag, gravel, crushed stone or other approved permeable granular material of such grading that all particles shall pass a 12.5 mm (1/2 inch) sieve.

601.2.6 Asphaltic Prime Coat

Prime coat shall be cut-back asphalt conforming to the requirements of Item 301, Bituminous Prime Coat.

601.3 Construction Requirements

601.3.1 Asphalt Sidewalk

Excavation shall be made to the depth and width required that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm and even surface conforming to the section shown on the Plans. All materials from soft areas shall be removed and replaced with suitable materials.

The bed course shall be compacted in layers not exceeding 100 mm to the depths, lines and levels shown on the Plans.

The prepared bed course material shall receive an application of prime coat in accordance with the requirements of Item 301, Bituminous Prime Coat.

The asphalt mixture shall be placed on the previously primed and prepared bed only when, in the opinion of the Engineer, the bed is sufficiently dry and weather conditions are suitable. The mixture shall be placed in one or more layers of uniform thickness to the total depth shown on the Plans. Each layer shall be smoothed by raking or screeding and shall be thoroughly compacted by rolling with a hand operated roller of a type satisfactory to the Engineer. After compaction , the surfacing shall be of the thickness and section shown on the Plans and shall be smooth, even and of a dense uniform texture. Forms, if used, shall be removed and the shoulders shaped and compacted to the required section.

601.3.2 Cement Concrete Sidewalk

Excavation shall be as specified above. The bed course material shall be placed in accordance with the Item 200, Aggregate Subbase Course.

All forms shall be staked securely in position at the correct line and level. Preformed joint filler shall be set in position shown on the Plans before placing of the concrete is started. The top of the joint filler shall be placed 5 mm below the top surface of the finished sidewalk.

The mixing, placing, finishing and curing of concrete shall be as specified in Item 405, Structural Concrete. The portland cement concrete shall be placed to the total depth shown on the Plans.

The surface shall be cut through to a depth of 10 mm with a trowel at intervals of 1 m or, were required , in straight lines perpendicular to the edge of sidewalk. The surface shall then be brushed. The edges of the sidewalk and the transverse cuts shall be shaped with a suitable tool so formed as to round the edges to a radius of 15 mm.

601.4 Method of Measurement

The area to be paid for shall be the number of square meters of sidewalk measured, completed in-place and accepted.

601.5 Basis of Payment

The quantity as determined in Subsection 601 .4, Method of Measurement, shall be paid for all the contract unit price per square meter for Sidewalk which price and payment shall constitute full compensation for furnishing and placing all materials for asphalt sidewalk, concrete sidewalk, expansion joint material, for excavating and compacting the foundation bed, for furnishing and placing cinders, gravel or other permeable bed course material, for prime coat material, for forms, and for all labor, equipment, tools and incidentals necessary to complete the Item.

ITEM 603 – GUARDRAIL

603.1 Description

This item shall consist of furnishing and constructing posts and guardrails of the types called for in the contract and in accordance with this Specification, at the locations, and in conformity with the lines and grades shown on the Plans, or as required by the JHMC representative.

603.2 Material Requirements

Materials for the desired type of guardrail shall meet the requirements specified in the following specifications:

1. Metal beam rail AASHTO M 180
2. Timber rail, unless otherwise indicated in the Plans or Special Provisions, any of the following first group Philippine Timber shall be used: Ipil, Molave, Tindalo or Yacal. Only one species of timber shall be used in the construction of any one continuous length of guardrail.

Timber guardrail shall be well-seasoned, straight and free of injurious defects. They shall be dressed and of sufficient length so that joints shall be on the rail posts.

Guardrail Hardware. Offset brackets of the resilient and non-resilient types shall be of the type specified, or as shown on the Plans, and shall meet the strength requirements specified.

Splices and end connections shall be of the type and design specified or as shown on the Plans, and shall be of such strength as to develop the full design strength of the rail elements.

Unless otherwise specified, all fittings, bolts, washers and other accessories shall be galvanized in accordance with the requirements of AASHTO M 111 or ASTM A 153, whichever may apply. All galvanizing shall be done after fabrication.

Guardrail Post. Posts shall be the existing concrete posts. Only one kind of post shall be used for any one continuous guardrail.

Paints for steel and concrete shall be specified and conform to the requirements specified in Item 411, Paint.

603.3 Construction Requirements

603.3.1 Posts

Posts shall be set vertically in the position shown on the Plans and, where embedded in a concrete foundation block, shall remain undisturbed for a minimum of 48 hours. The space around the post shall be backfilled to the ground line with approved material in layers not exceeding 100 mm and each layer shall be moistened and thoroughly compacted.

603.3.2 Rail Elements

Rail elements shall be erected in a manner resulting in a smooth continuous installation. All bolts, except adjustment bolts, shall be drawn tight. Bolts shall be of sufficient length to extend beyond the nuts at least 5 mm but not more than 10 mm.

Where painting of railing components is specified, any damage to the shop coat of paint shall be corrected by an application of an approved rust-inhibitive primer prior to further painting. Any surface inaccessible to painting after erection shall be given the specified number of coats of paint uniformly applied by thorough brushing using an approved pressure spray.

Galvanized surfaces which have been abraded so that the base material is exposed, threaded portions of all fittings and fasteners and cut ends of bolts shall be protected in a manner as may be specified or directed.

The surfaces and sawed edges of untreated or salt-treated guardrail shall be painted with three coats of white paint to within 200 mm of the ground line. The first 200 mm of posts above the ground shall be painted with two coats of black paint. Each coat of paint shall be thoroughly dry before the next coat is applied. Paint shall be applied in heavy coats, completely covering every part of the surface and shall be worked well into the joints and open spaces. It shall be thoroughly and evenly spread that no excess paint collects at any point.

For beam type guardrails, metal works not galvanized shall be given one shop coat of red lead, zinc chromate paint or an approved fast-drying rust-inhibitive primer and two field coats of white or aluminum paint. Painting shall conform to the requirements of Item 411, Paint.

603.4 Method of Measurement

Guardrail shall be measured by linear meter from center to center of end posts, except where end connections are made on masonry or steel structures, in which case measurement will be to the face of such structures.

End anchorages and terminal sections will be measured as units of each kind shown in Bid Schedule. If no pay items for anchorages or terminal sections appear in the Bid Schedule, measurement therefore shall be included in the linear meter measurement for completed guardrail.

603.5 Basis of Payment

The accepted quantities of guardrail, determined in Subsection 603.4, Method of Measurement, shall be paid for at the contract unit price per linear meter for the type specified, complete in place, which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment, tools and incidentals necessary to complete the Item. When so specified, end anchorages and terminal sections will be paid for at the contract unit price for each of the kind specified and completed in place.

ITEM 605 – ROAD SIGN

605.1 Description

This Item shall consist of furnishing and installing road signs in accordance with this Specification and to the details shown on the Plans, or as required by the JHMC representative.

The road signs shall comply in all respects with the "Philippine International Road Signs Manual" published by the Department of Public Works and Highways, Manila. The categories of road signs are designated in the Manual, namely, danger warning signs, regulatory signs and informative signs, or guide signs. These are referred to in the Contract as warning signs and informatory signs, respectively.

Road signs shall be classified as standard or non-standard. Standard signs consist of all warning signs, regulatory signs and informatory signs with the exception of direction signs, place identification signs and the line. Non-standard signs consist of all informatory signs which are not classified as standard signs. The size of warning and regulatory signs is the length of the side of triangular signs (measured from the points of intersection of the extension of the edges), the horizontal width of octagonal signs and the diameter of circular signs.

605.2 Material Requirements

605.2.1 Sign Panels

Sign panels for warning, regulatory, and informatory signs shall be manufactured from aluminum sheeting at least 3 mm thick.

605.2.2 Reflective Sheeting

The reflective sheeting used on the road signs shall consist of spherical lens elements embedded within a transparent plastic having a smooth, flat surface with a protected pre-coat adhesive which shall be pressure sensitive for manual application, or tack free heat activated for mechanical vacuum-heat application.

The minimum reflective brightness values of the reflective sheeting as compared to a magnesium oxide (MgO) shall be as given in Table 605.1. The brightness of the reflective sheeting totally wet by rain, shall be not less than 90% of the given values. 5°

Table 605.1 – Reflective Brightness of Traffic Signs Surfaces

Color	Angle of Incidence	Angle of Divergence	Minimum Reflective Brightness Value Compared with MgO
Red	-4 ° 20 ° 50 °	0.5 ° 0.5 ° 0.5 °	15 10 3
White	-4 ° 20 ° 50 °	0.5 ° 0.5 ° 0.5 °	75 70 70

Yellow	-4 ° 20 ° 50 °	0.5 ° 0.5 ° 0.5 °	35 35 10
Blue	-4 ° 20 ° 50 °	0.5 ° 0.5 ° 0.5 °	6 4.5 0.5

The reflective sheeting shall be sufficiently flexible to permit application and adhesion to a moderately embossed surface. It shall show no damage when bent 90° over a 50 mm diameter mandrel.

The sheeting shall be solvent-resistant so as to be capable of withstanding cleaning with petrol, diesel fuel, mineral spirits, and turpentine methanol.

The sheeting shall show no cracking or reduction in reflectivity after being subjected to the dropping of a 25 mm diameter steel ball from a height of 2 m into its surface.

The adhesive shall permit the reflective sheeting to adhere accurately 48 hours after application of temperatures of up to 90°.

The reflective material shall be weather-resistant and, following cleaning in accordance with manufacturer's recommendations, shall show no discoloration, cracking, blistering, peeling or any dimensional change.

Samples of reflective sheeting shall be submitted to the JHMC representative for approval.

605.2.3 Posts and Frames

The Contractor shall use 3.00m x 50mm Ø G.I. pipe posts. All posts shall be thoroughly cleaned, free from grease, scale and rust and shall be given one coat of rust-inhibiting priming paint and two coats reflectorized sunshine yellow paint in accordance with Item 411, Paint.

605.2.4 Nuts and Bolts

Nuts, bolts, washers and other metal parts shall be hot-dip galvanized after fabrication in accordance with the requirements of AASHTO M 111.

605.2.5 Concrete Foundation Blocks

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

605.3 Construction Requirements

605.3.1 Excavation and Backfilling

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

Backfilling shall be carried out by using suitable material approved by the JHMC representative and shall be compacted in layers not exceeding 150 mm in depth. Surplus excavated material shall be disposed of by the Contractor as directed by the JHMC representative.

605.3.2 Erection of Posts

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

605.3.3 Sign Panel Installation

Sign panels shall be installed in accordance with the details shown on the Plans. Any chipping or bending of the sign panels shall be considered as sufficient cause to require replacement of the panels at the Contractor's expense.

The exposed portion of the fastening hardware on the face of the signs shall be painted with enamels matching the background color.

All newly erected traffic road signs shall be covered until ordered removed by the JHMC representative.

605.4 Method of Measurement

The quantities of standard reflective warning and regulatory road signs shall be the number of such signs of the size specified, including the necessary posts and supports erected and accepted.

The quantities for standard reflective informatory signs and non-standard reflective informatory signs shall be the number of such, including the necessary posts and supports, erected and accepted.

605.5 Basis of Payment

The quantities measured as determined in Subsection 605.4, Method of Measurement, shall be paid for at the contract unit price for the Pay Items shown in the Bid Schedule which price and payment shall be full compensation for furnishing and installing road signs, for excavation, backfilling and construction of foundation blocks, and all labor, equipment, tools and incidentals necessary to complete the Item.

ITEM 612 – REFLECTIVE THERMOPLASTIC STRIPPING MATERIAL (SOLID FORM)

612.1 Description

This standard specifies the requirement for reflectorized thermoplastic pavement stripping material conforming to AASHTO M 249 that is applied to the road surface in a molten state by mechanical means with surface application of glass beads at a rate of not less than 350 g/L of glass beads having a size range of drop-in type and will produce an adherent reflectorized stripe of specified thickness and width capable of resisting deformation by traffic.

612.2 Materials Requirements

1. Reflectorized Thermoplastic Pavement Material shall be homogeneously composed of pigment, filler, resins and glass reflectorizing spheres.

The thermoplastic material shall be available to both white and yellow.

2. Glass Beads (Pre-Mix) shall be uncoated and shall comply with the following requirements:

Refractive Index, min. - 1.50 Spheres, Percent, min. - 90

Gradation:

Sieve, mm	Mass Passing Percent
0.850	100
0.600	75-95
0.425	-
0.300	15-35
0.180	-
0.150	0-5

612.3 General Requirements

612.3.1 Composition

The pigment, beads and filler shall be uniformly dispersed in the resin. The material shall be free from all skins, dirt and foreign objects and shall comply with the requirements as specified in Table 612.1

Table 612.1 - Composition Requirements

Component	White	Yellow
Binder, min.	18.0	18.0
Glass Beads:		
min.	30.0	30.0
max.	40.0	40.0
Titanium Dioxide, min.	10.0	
Chrome Yellow, Medium, min.		10.0
Calcium Carbonate And Inert Fillers, Max.	42.0	42.0

612.3.2 Qualitative

The material shall conform to the qualitative requirements as specified in Table 612.2.

Table 612.2 - Qualitative Requirements

Property	Requirements White	Yellow
Specific Gravity, max.	2.15	
Drying Time, minutes, max.	10.00	
Bond Strength to portland cement concrete after heating for four (4) hours ±5 min.@ 218°C, MPa, max.	1.24	
Cracking Resistance @ low temp. after heating for four (4) hours ±5 min.@ 218 ±2°C.	No cracks	
Impact Resistance after heating for four (4) hours ±5 min. @ 218 ±2°C and forming test specimens, mm/kg, min.	115.00	
Softening Point after heating for four (4) hours ±5 min. @ 218 ±2°C.	102.5 ± 9.5°C	
Daylight reflectant @ 45 Degrees - 0 degrees, % min.	75.00	45.00

612.4. Application Properties

The material shall readily extrude at a temperature of 211 ± 7°C, from approved equipment to produce a line 3.2 to 4.8 mm thick which shall be continuous and uniform in shape having clear and sharp dimensions.

The material shall not exude fumes which are toxic, obnoxious or injurious to persons or property when heated during applications.

The application of additional glass beads by drop-in methods shall be at a rate of not less than 350 g/L of glass beads having a size range for drop-in type. The typical size range of spheres of drop-in type paints is as follows. Passing 850 um (#20) sieve and retained on 250 um (#60) sieve, % 80 – 100

a) Preparation of Road Surface - the materials should be applied only on the surface which is clean and dry. It shall not be laid into loose detritus, mud or similar extraneous matter, or over an old paint markings, or over an old thermoplastic marking which is faulty. In the case of smooth, polished surface stones such as smooth concrete, old asphalt surfacing with smooth polished surface stones and/or where the method of application of the manufacturer of the thermoplastic materials shall be recommended, and with the approval of the Engineer.

b) Preparation of Thermoplastic Materials - The materials shall be melted in accordance with the manufacturer's instruction in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic and such the local overheating shall be avoided. The temperature of the mass shall be within the range specified by the manufacturer and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer. The molten material shall be used as expeditiously as possible and for thermoplastics which have natural resin binders or otherwise sensitive to prolonged heating, the materials shall not be maintained in a maiden condition for more than 4 hours .

c) Laying - Center lines, lane lines and edges lines shall be applied by approved mechanical means and shall be laid in regular alignment. Other markings may be applied

by hand - screed, hand propelled machine or by self-propelled machine approved or directed by the Engineer. After transfer to the laying apparatus the materials shall be maintained within the temperature range specified by the manufacturer and stirred to maintain the right consistency for laying.

In the case of screen application, the material shall be laid toa thickness of not less than 3 mm or more than 6 mm unless authorized by the Engineer when laid over an existing markings. In the case of sprayed application the material shall be laid to thickness of not less than 1.5 mm unless authorized by the Engineer.

In all cases the surface produced shall be uniform and appreciably free from bubbles and steaks. Where the Contract Documents require or the Engineer direct that ballotini shall be applied to the surface of the markings these shall be applied uniformly to the surface of hot thermoplastic immediately after laying such that the quality of ballotini firmly embedded and retained in the surface after completion complie with the requirements of Sub-section 606.2.2, Material Requirements.

Road markings of a repetitive nature, other center lines, lane lines etc., shall unless otherwise directed by the Engineer be set out with stencils which comply with the size and spacing requirements show n on the Plans.

d) Re-use of Thermoplastic Materials - At the end of day's work as much as possible the material remaining in the heater and/or laying apparatus shall be removed.

This may be broken and used ag a in provided that the maximum heating temperature has not been exceeded and that the total time during which ii is a molden condition does not exceed the requirements of Sub-section 606.2.3.Construction Requirements.

612.4.1 Defective Materials or Workmanship

Materials which are defective or have been applied in an unsatisfactory manner or to incorrect dimensions or in a wrong loca t ion shall be removed, the road pavement shall be made good and materials replaced , reconstructed and/or properly located Contractor's expenses and to the satisfaction of the Engnieer.

612.4.2 Protection of the Traffic

The Contractor shall protect pedestrians , vehicles and other traffic adjacent to the working area against damage or disfigurement by construction equipment , tools and materials or by spatters, splashes and smirches or paint or other construction materials and during the course of the work, provide and maintain adequate signs and signals for the warning and guidance of traffic.

612.5 Sampling

A minimum weight of 10 kg. of Reflectorized Thermoplastic paint shall be taken for every 100 bags or fraction thereof.

612.6 Testing

The material shall be tested in accordance with AASHTO T 250 or with the appropriate method in ASTM designation.

612.7 Packing and Marking

The material shall be packaged in a suitable containers to which it will not adhere during shipment and storage.The blocks of cast thermoplastic material shall be approximately 300 x 915 by 51 mm and shall weigh approximately 23 kg. Each container label shall designate the color, manufacturer 's name, batch number and date of manufacture Each batch manufactured shall have its own separate number. The label shall warn the user that the material shall be heated to 211 ± 7°C during application.

612.8 Method of Measurement

The quantity of pavement markings to be paid for shall be the area as shown on the Plans of painted traffic line of the stated width and the area as shown on the plans of symbols, lettering, hatching and the like, completed and accepted.

The quantity shown in the Bill of Quantities represents the approximate quantity in square meter of pavement markings, with width as shown applied at the centerline of the road pavements to which may be increased or decreased depending on the Engineer's decision whether to require additional markings or delete parts of it. Other markings representing symbols, lettering, hatching and others in locations where they maybe required by the Engineer shall, likewise, be implemented by the Contractor using reflectorized thermoplastic pavement markings as approved and directed.

612.9. Basis of Payment

for the Pay Items shown in the Bid Schedule which price and payment shall constitute full compensation for furnishing and placing all materials, sampling and packing, for the preparation of the surface, and for all labor, equipment, tools and incidentals necessary to complete the Item.

Item 807- Site Development

807.1 Description

This Item shall consist of furnishing and installation as per approved Plans of the complete site development work consisting of excavation, turfing, planting, mowing, carpentry works, plumbing, electrical works, delivery of materials and other labor necessary for the completion of the project.

807.2 Material and Construction Requirements

807.2.1 Softscape Specification

807.2.1.1 Turfing

807.2.1.1.1 Preparation

The areas to be turfed shall be completely cleared of all builders' debris, large stones and other obstructions.

The planting area shall be cultivated to an average depth of 150mm. Where the ground is clay, hardpan, sun baked earth or other impervious materials, it shall be ploughed or scarified to a minimum depth of 150 mm to reduce to granular material of sizes not exceeding 75 mm.

The ground shall be later finished by lightly rolling with roller not exceeding 136 kgs in weight. Rolling shall only be done when the formation is dry.

807.2.1.1.2 Trimming and Levelling

Before spreading the top soil the ground of filled earth must be trimmed and levelled. In case of banks, the edge must be trimmed off to a curve to allow the grass to be cut with a motor mower.

807.2.1.1.3 Turfing Existing Ground

Where existing ground is to be turfed, mounds shall be levelled and depressions, holes, channels, etc., shall be filled-in to the general level of the area or to the levels shown on the Plans.

807.2.1.1.4 Garden Soil (Top Soil)

The top soil is to be selected vegetable garden soil, free from roots, weeds and any unnecessary hard granular material. Top soil shall be spread and levelled over the whole area to be turfed to form an even layer of 50 mm (consolidated thickness). The Contractor shall submit a sample of the top soil to the Architect/ Engineer for approval before application.

801 .2.1.1.5 Ground to be Forked

Before turfing, the ground or filled earth shall be forked to a depth of 100 mm to 150 mm to thoroughly loosen the soil.

807.2.1.1.6 Turf

The turf for use in the work shall be of the best quality and shall be obtained from sources approved by the Architect/ Engineer. The turfs shall be very healthy, free from defects, decay, disfiguring of roots, sun or wind scaled injury, plant disease, insect or pest or any other form of infestation.

The Contractor shall furnish the Architect/ Engineer of approved samples of the turf before planting. The Architect/ Engineer shall visit and inspect the nursery from where the turfs are obtained.

The turfs for use in the Contract shall be of the following type:

a) Cow Grass

The turf shall be cut into approximately 225 mm square and lifted carefully with proper cutting tools and shall be flat, square or rectangular, with even thickness, but shall be as thick as possible. The minimum thickness of turf shall be 40 mm. The root formation shall be moist and the grass shall not exceed 20 mm long and shall be dense green with vigorous roots and healthy.

The grass shall be stacked on site, and the Architect/ Engineer shall inspect the grass for weeds before laying. The grass shall always be kept moist by spraying with water and covering with wet sacks.

b) Grass Planting

Cow grass shall be planted within 24 hours after being cut or stripped off. Dry turf shall be rejected.

i) Spot Turfing - Spot shall be at 450 mm at centers.

ii) Close Turfing - The turf shall be laid on top of vegetable garden soil and shall be laid accurately to level and full with close butt joints. Immediately after laying, the turfs shall be lightly beaten with wooden beater until they are firmly bedded to the ground. Any depression produced by the beatings shall be leveled by packing the depression with additional top soil from underneath the turf. The turf shall be beaten again. Laying and beating shall continue until all the turfs are firmly bedded and a continuous turfing area is obtained.

The minimum total thickness of the turf and the top soil shall be 75 mm and shall be measured after the turf has been laid and beaten. For this purpose, small trial holes shall be dug as directed by the Architect/ Engineer. If the thickness between the top of the grass and the formation level is less than 75 mm, the Contractor shall, without additional cost, relay the turfs to the approval of the Architect/ Engineer. Turfing to banks shall be firmly cured by 150 mm long wooden pegs driven each piece.

807.2.1.1.7 Top Dressing

The material used for the top dressing shall be between 80/20 and 90/10 sand/soil mixes. organic matter shall be included in the mixture. Fertilizers, soil ameliorants such as lime, and pesticides shall also be included for special purposes. The Contractor shall apply top dressing to the turfed area immediately after they are laid and thereafter until the turfs survive independently.

The top dressing shall be deposited and spread evenly over the turfed area at the rate of 11.2 grams per m^2

807.2.1.1.8 Commencement of Turfing

Turfing shall be carried out at least well in advance three (3) months before the completion of the whole works.

807.2.1.1.9 Watering

The Contractor shall immediately after laying, water the turf adequately. The Contractor shall water the turf throughout the planting and maintenance periods until the turfs survive independently.

The Contractor shall water the turfs by spraying so that no turf or soil will be disturbed. The rate of application shall be not less than 0.47 ml/ m^2•

807.2.1.1 Softscape Maintenance
807.2.1.1.1 Nursing and Watering

It is the Contractor's responsibility to ensure that the grass is properly nursed and tended until fully established, including watering as necessary during dry periods. Any grass which fails to flourish shall be replaced at the Contractor's expense until the grasses survive independently.

807.2.1.1.2 Cutting and Rolling

The Contractor shall cut the grass at least once a month throughout the planting and maintenance periods or at any time instructed by the Architect/ Engineer. Grass cutting shall be carried out with hand or mechanical tools with sharp and well-adjusted blade, so that the turf shall be cleanly cut and no tearing will take place.

The Contractor shall take reasonable care not to cut or damage the stolons or rhizones of the spreading grass when cutting spot turfing. No cutting shall be carried out when the grass is wet or when it is raining.

Where and when instructed by the Architect/ Engineer, the Contractor shall roll the turf with a roller weighing not exceeding 360 kgs to press the roots firmly into the soil and to produce a close well knitted turfing.

807.2.1.2 Lawn Maintenance
807.2.1.2.1 Watering

During drought periods, the only way to maintain a desirable greenness is to give the lawn a thorough soaking once or twice a week. Light daily sprinkling does more harm than good. It requires from 1900 to 2840 liters of water for every 93 m^2 of lawn for each application to give an equivalent 20 mm to 38 mm of rain. This will moisten the soil from 65 mm to 125 mm deep.

Continuous heavy watering favors diseases.

The surface layer of soil must be kept damp by frequent light watering with a fine spray during the germination period after seeding or vegetative planting and until the young plants are rooted firmly. It is often necessary to water three (3) or four (4) times daily in hot windy periods. After the grass is established, water should be used sparingly and with maximum intervals between applications.

Water should be applied to new seeding and vegetative plantings in a fine spray that will not wash that soil away from the base of young plants. It must be applied slowly so that the surface will not puddle and crust.

807.2.1.3.2 Weeding

Keep all planting areas free from weeds and undesirable grasses, by a method and by materials approved/ permitted by the Architect/ Engineer.

807.2.1.3.3 Mowing

All grass area shall be mowed at regular intervals which will keep grass height from exceeding 80 mm. Mower blades shall be set at 40 mm unless otherwise directed by the Engineer. All for season beyond

the Contractor's control, the height of the grass has exceeded 80 mm, the mower blades shall be raised so that at no time will more than ½ of the grass leaf surface be removed.

807.2.1.3 Planting

Plant holes shall be excavated at a minimum of twice the size of the volume of the pot size specified in the Plans.

Plants shall be provided with the following characteristics:

a) Large healthy root systems, with no evidence of root curl, restriction or damage;
b) Vigorous, well established, free from disease and pests, of good form consistent with the species or variety; and
c) Hardened off, not soft or forced, and suitable for planting in the natural climatic conditions prevailing at the site.

Trees which, unless required to be multi-stemmed, have a single leading shoot shall be provided.

At least one plant shall be labelled of each species or variety in a batch using a durable, readable tag.
Planting shall be carried out on the same day that plants are delivered to the site. Plants shall not be planted in unsuitable weather conditions such as extreme heat, cold, wind or rain. In other than sandy soils, excavation shall be suspended when the soil is wet.

Plants shall be watered thoroughly before planting and immediately after planting.

807 .2.1.4.1 Mulching

Mulch shall be free from deleterious and extraneous matter such as stones, soil, weeds and sticks.

Mulch shall be placed clear of plant stems, and rake to an even surface flush with the surrounding finished levels.

Depth shall be at 75 mm. maximum.
Mulch types hays shall be from seasonal grasses and free from noxious weeds etc. Laterite gravel shall be uniform in color and size or graded from 5 to 25 mm.
Brush Chippings shall be approved "Forest Blend" vegetative material processed to pieces not larger than 75 x SO x 15 mm and aged from 6 to 12 weeks.

Washed River Pebble shall be uniform in size or graded from 10 to 25 mm.

807 .2.1.4.2 Stakes

Stakes material shall be hardwood, straight, free from knots or twists, pointed at one end.

807 .2.1.4.2.1 Installation

Stakes shall be driven into the ground at least one third of their length, avoiding damage to the root system. Those no longer required at the end of the establishment period shall be removed.

Stake sizes shall conform to the following:

a) For plants 1 to 2.5 m high: Two SO mm x SO mm x 1800 mm stakes per plant.
b) For plants smaller than 1 m high: One 38 mm x 38 mm x 1200 mm stake per plant.

807.2.1.4.2.2 Ties

Ties fixed securely to the stakes, one tie at half the height of the main stem, shall be provided whenever necessary to stabilize the plant. Ties shall be attached loosely and SO mm hessian webbing stapled to the stake shall be likewise provided.

807.2.1.4 Irrigation

807.2.1.4.1 Installation

Pipework shall be installed in straight lines and uniform grades. Unions, flanges and isolating valves shall be provided for the satisfactory removal of piping and fittings for maintenance or replacement of plant. Pipework shall be arranged and supported so that it remains free from vibration while permitting necessary movements such as thermal expansion and contraction. Pipework shall conform to the applicable requirements of Item 1201- Water Pumping System.

807.2.1.s.2 **Accesslbllity Location**

Fittings requiring maintenance or servicing, including control valves, joints designed to enable removal of pipes, and the like, shall be located in accessible positions, with adequate clearance. The pipework shall be arranged so that it does not interfere with the removal or servicing of associated equipment or valves.

Fixed location type with automatically or manually operated sprinklers, sprays, microsprays and drippers shall be used.

807.2.1.s.3 **Irrigation Controller**

The controller shall be mounted in a weatherproof lockable cabinet. The following features shall be included:

a) Variable timer for each station with a range from 1 minute to not less than 30 minutes.
b) Manual cycle and individual station operation.
c) Manual on-off operation of irrigation without loss of program.
d) 240 V input and 24 V output capable of operating 2 control valves simultaneously.
e) 24-hour battery program backup (if possible).

Micro irrigation system Polyethylene irrigation pipe shall conform to Item 1201 - Water Piping System with barbed fittings of similar pressure rating fastened with ratchet type clamps. Lay pipe on finished ground surface under planting bed mulch and anchor at minimum 1.5 m intervals with U-shaped stakes. Connect micro-tube laterals with proprietary push-in or screw in-fittings.

Microsprays shall be mounted on stakes 300 mm above ground and connected to the pipework with microtubes.

807.2.1.5.4 Drippers

Use drippers which are turbulent flow types, easily dismantled for cleaning. Connect directly into the pipework or with microtubes. Micro irrigation valve box: Use micro irrigation valve boxes which are of high impact plastic with snap lock covers at finished ground level, each housing a stop cock, filter (200 mm for microsprays, 100 mm for drippers), pressure reducing valve (170 kPa outlet pressure) and automatic control valve. Use vandal resistant controls in public areas.

807.2.1.5.5 Completion of Planting

Maintenance manual shall be provided which includes notes and specifications of all landscape and irrigation work and recommendations for on-going maintenance work.

807.2.1.5.6 Plant Establishment

The planted areas shall be maintained for a minimum of 13 weeks from the time of practical completion. Damaged, stolen or vandalized stock shall be replaced as required and at the expense of the Contractor. For all other work including irrigation and hardworks, the contractual provisions for defects liability period shall apply.

807.2.1.5 Trees and Shrubs

Specifications for the trees and shrubs to be used in the project shall be specified in detail in the Plans. The Architect/ Engineer shall inspect whether the delivered trees and shrubs are approved based on physical features and the capacity of the trees and shrubs to survive after planting.

Specifications and procedures for establishing trees and shrubs shall be submitted by the Contractor prior to planting. Fertilization, mulching, staking, establishment and irrigation shall be indicated on the procedures.

807.2.1 Hardscapes Specifications

807.2.1.1 Fountains

Work of this Section includes all labor, materials, equipment, tools, incidentals, and services necessary to design, engineer, manufacture, supply, and install the Fountain with related mechanical and electrical systems complete including all components, hardware, and accessories as indicated on the Plans and specified herein:

1. Discharge and suction piping systems
2. Electrical conduit and wiring systems
3. Subterranean vaults
4. Collector Tank
5. Mechanical and electrical equipment with components and accessories
6. Manufacture of primary fountain equipment and components is a "Basis of Design"
7. Include fountain system testing, adjustment, and operational training for Owner
8. Fountain Electrical Control Panel

Related Fountain System Work shall be as follows:

1. Paving systems
2. Cast-In-Place Concrete
3. Earthwork including trench excavation and backfill
4. Waterproofing

The material to be used in the project shall be, as much as possible, cast aluminum with mounting pit to house plumbing, curvilinear blade. Dimensions, height, sizes, and thickness shall be indicated in the Plans.

Installation shall be based on manufacturer's specification and relevant standards and codes.

The fountain to be installed shall be inspected by the Contractor prior to gathering. Defects in installation shall be replaced at the expense of the Contractor.

807.2.1.1.1 Quality Control Submittals

Test Reports: Fountain manufacturer's test report must be included in the control panel information package. This report shall include results of the test on both motors and all lighting circuits. Field Reports: The manufacturer shall provide a field test report in the controls package. This report, which includes information on the field voltage, current, and resistance at all components, must be filled out by the installing electrical contractor and submitted to the manufacturer and the Architect/ Engineer for approval.

807.2.1.1.2 Contract Closeout, Operations and Maintenance

Manuals shall be submitted pertaining to the operations and maintenance of the fountain system prior to final approval of system installation. The manuals shall include specification sheets, operations and maintenance data, copies of field and test reports, exploded diagrams, preventative maintenance schedule, water quality information, cleaning instructions, and warranty information.

807.2.1.1.3 Quality Assurance

Insofar as possible, all materials and equipment used in the installation of this work shall be of the same brand or manufacturer throughout for each class of material or equipment.

Piping materials shall bear Department of Trade and Industry (DTI) approved ICC sticker, and or other markings of specified testing agency.

807.2.1.1.4 Maintenance and Extra Materials

The Contractor shall supply chemical treatment materials of sufficient quantity, in addition to materials needed for system testing and adjustment, in maintenance of the system for a period of at least one month after Substantial Completion.

The Contractor shall supply any other special tools or parts that would be needed for maintenance of the fountain system.

Extra Material - Contractor shall be the one to provide one spare element for each cartridge filter, an extra solenoid valve for water make-up, and one replacement bulb for each U.V.

807.2.1.2 Benches

Raw materials for steel benches shall conform to the applicable requirements of PNS 49 - Steel bars for concrete reinforcement and ASTM A 36 - Standard Specification for carbon Structural Steel.

Wooden benches shall conform to the specie indicated in the Plans and shall conform to the applicable requirements of Item 1003 - Carpentry and Joinery Works.

Other materials to be used on the projects shall submit certificates of conformance to ASTM and/or PNS.

807.2.1.3 Gazebos

Wooden gazebos shall conform to the specie indicated in the Plans and shall conform to the applicable requirements of Item 1003 - Carpentry and Joinery Works.

Vinyl gazebos shall conform to the specifications indicated in the Plans.

Roofing tiles/ shingles shall be as indicated in the Plans and shall conform to the applicable requirements of Item 1015 - Clay Roof Tile and Item 1015A - Asphalt Roofing Shingles.

807.2.3 Aquatic Plants

807.2.3.1 Plant Materials

Provide select quality of root stocks, tubers, rhizomes or container grown plugs/ quarts of moisture-favoring plants, trees and shrubs. All referenced seeding rates are bulk. All seeds and container grown stock will be subject to standards for such material. All plant materials are subject to review and approval by the Architect/ Engineer. Inferior or substandard material will be rejected and must be replaced with acceptable material at the Contractor's expense.

807.2.3.2 Installation

Woody and herbaceous plants associated with the wetland shall be installed in the arrangements shown on the Plans. The limits of each planting area indicated on the plan (whether for individual species or groups of species) shall be staked with survey lath by the contractor and checked by the designer prior to planting. Stakes shall be repositioned as directed by the designer.

Plant in masses of a single species, if so indicated on the Plans, shall be spaced at 600 mm on center for wetlands. Plants may be hand planted (push manually into soil with growing ends exposed) in soft substrates or planted using a planting bar, if necessary, in firmer substrates.

Planting of plugs in wetlands shall follow all specifications for other container grown, terrestrial, herbaceous material.

Sedges and other wetland species provided as seed, shall be hand seeded at the specified rates, and then lightly raked into the top 6.35 mm to 1.27 mm of soil and mulched lightly with straw.

807.2.3.3 Maintenance

Wetland Plantings: During the first growing season, restore eroded wetland soils with organic soil, fertilize and replace dead plants as directed by the Architect/ Engineer.

Sedimentation Basin: Accumulated sediments shall be removed periodically. If dredging is required, the root stock of installed rhizomatous material shall be removed prior to dredging. Following removal of dredging spoil, reinstall root stock in same relative topographic and hydrologic positions from which it was removed. If root stock is not salvageable, replace emergent and wetland vegetation with original species and in original quantities. Following dredge spoil removal, re-seed basin as required with original mix at original rates and cover with coconut-straw erosion control blanket to stabilize immediately.

807.2.4 Aquatic Animals

It may be salt water or fresh water fishes, molluscs, or crustaceans, depending on the request of the Architect/ Engineer or if specified in the Plans.

The aquatic animals to be transported shall be free from any diseases (such as Epizootic haematopoietic necrosis, Oncorhynchus masou virus disease, Viral haemorrhagic septicaemia, and others), The animals shall be checked-up and approved by licensed veterinarian prior to delivery to the site.

16. 807.2.4.1 Water Parameters for Salt Water Anlmals

The following table shall be the general guideline of acceptable water parameter ranges for different types of tropical marine aquariums.

Parameter	**Suggested Level: Reef Aquarium**	**Suggested Level: FOWLR Aquarium**	**Average Level: Coral Reefs**	**Test Requirements**
Specific Gravity	1.023 • 1.025	1.020· 1.025	1.025	A5TM D1429 -Standard Test Methods for Specific Gravity of Water and Brine
Temperature	22 - 26°C	22 - 26°C	28°C	
pH	8.1 - 8.4	8.1 - 8.4	8.0 - **8.5**	A5TM D1293 -Standard Test Methods for pH of Water
Alkalinity	8 - 12 dKH	8 - 12 dKH	6- 8 dKH	A5TM D1067 -Standard Test Methods for Acidity or Alkalinity of Water
Ammonia (NH3)	Undetectable	Undetectable	Near Zero	A5TM D1426 -Standard Test Methods for Ammonia Nitrogen In Water
Nitrite (NO2)	Undetectable	Undetectable	Near Zero	A5TM D3867 ·Standard Test Methods for Nitrite-Nitrate in Water
Nitrate - Nitrogen(NO3)	< 1.0 ppm	< 30 ppm	0.25 ppm	
Phosphate (P04)	< 0.2 ppm	< 1.0 ppm	0.13 ppm	A5TM D4327 -Standard Test Method for Anions In Water by Suppressed Ion Chromatography
calcium	350 - 450 ppm	350 - 450 ppm	380 - 420 ppm	ASTM D511 -Standard Test Methods for calcium and Magnesium In Water
Magnesium	1250 • 1350 ppm	1150 • 1350 ppm	1300 ppm	
Iodine	0.06 - 0.10 ppm	0.04 - 0.10 ppm	0.06 ppm	
Strontium	8 -14 ppm	4- 10 ppm	8-10 ppm	A5TM D3920 ·Standard Test Method for Strontium In Water

807.2.4.2 Water Parameters for Fresh Water Animals

The following table shall be the general guideline of acceptable water parameter ranges for different types of freshwater aquariums, brackish water aquariums, and ponds. The water parameters listed are a general guideline for maintaining each specific type of aquarium or pond.

Parameter	Freshwater Community	African Cichlid	Freshwater Plants& Discus	Brackish	Test Requirements
Temperature	22-28°C	22 - 28°C	22 - 28°C	22 - 28°C	
pH	6.5 - 7.5	7.8 - 8.5	6.0 - 7.5	7.5 - 8.4	ASTM D1293
Ammonia	0.0	0.0	0.0	0.0	ASTM D1426
Nitrite	0.0	0.0	0.0	0.0	ASTM D3867
Nitrate	< 50 ppm	< 50 ppm	< 30 ppm	< 50 ppm	
Alkalinity (Carbonate Hardness)	4 - 8 KH	10-18KH	3-8 KH	10 - 18 KH	ASTM D1067
General Hardness	4 - 12 GH	12 - 20 GH	3-8GH	12-20GH	ASTM D1126 - Standard Test Method for Hardness in Water

807.2.5 Concrete Masonry Unit

Concrete masonry units (also called pavers, concrete pavers, paving stones, paving block, and brick pavers) included in the design for vehicles (such as driveways, access lanes and parking areas), floors (such as floors on grade and patios) and walking paths (including sideways) shall conform to the applicable requirements of Item 741 - Interlocking Precast Concrete Blocks.

807.2.6 Curbs

Curbs shall conform to the requirements of Item 600 - Curb and/or Gutter.

807.2.7 Column Guards

The cover for column guards shall be extruded high impact vinyl, with nominal thickness of 2.2 mm. For retainer, it shall be extruded recycled high impact vinyl, with nominal thickness of 1.8 mm. Injection molded thermoplastic shall be the material for closure caps.

807.2.7.1 Impact Resistance

Extruded profiles shall resist damage from impact at apex of 90° corner when tested in accordance with applicable sections of ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies.

Izod impact strength shall conform to ASTM D256 • Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics method A notched, 130 kg-cm/cm average with no break.

Charpy impact strength shall conform to ASTM D6110 Standard Test Method for Determining the Charpy Impact Resistance of Notched Specimens of Plastics notched, 142 kg-cm/cm average with no break.

807.2.7.2 Installation

The substrate shall be cleaned to remove dust and debris prior to installation of the column guards.

The materials shall be acclimatized to building conditions for at least 24 hours prior to installation.

Install wall protection products in accordance with manufacturer's installation instructions provided by the manufacturer.

807.2.8 Wheel Guard

Wheel guard shall conform to the applicable requirements of Item 900 - Reinforced Concrete, or as specified in the Plans.

807.2.9 Fences

807.2.9.1 Concrete Fences

Concrete fences shall conform to the applicable requirements of Item 1046 - Masonry Works and Item 1027 - Cement Plaster Finish. The Bars and Grills at the top of fences shall conform to PNS 49 - Steel Bars for Concrete Reinforcement.

807.2.9.2 Steel Fences

Steel fence materials (such as angular, tubular and rod/ rectangular steel bars) shall conform to the applicable requirements of PNS 49 and ASTM A 36 • Standard Specification for Carbon Structural Steel.

807.2.10 Gates

807.2.10.1 Wood Gates

Wooden gates shall conform to the specie indicated in the Plans and shall conform to the applicable requirements of Item 1003 - Carpentry and Joinery Works.

807.2.10.2 Metal Gates

The aluminum to be used for the gate shall conform to the applicable requirements of ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

The stainless steel plate to be used for the gate shall conform to the applicable requirements of ASTM A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

The framing for the gate shall conform to the applicable requirements of Sub-section 807.2.9.2 - Steel Fences.

Gates shall be constructed to match the fencing and in the locations shown on the Plans or as directed by the Architect/Engineer.

807.3 Method of Measurements

All the units installed shall be measured and determined by the number of units approved by and ready for service as provided in the Bill of Materials and Quantities accepted to the satisfaction of the Architect/ Engineer.

807.4 Basis of Payment

The items measured and determined as provided in subsection 807.3 - Method of Measurements shall be paid for at the unit bid price which payment constitute full compensation of materials, labor, and incidentals necessary to complete this Item.

Payment shall be made under:

Pay Item (Number)	Description	Unit Of Measure
807 (1)	Site Development	Lump Sum
807 (2)	Softscape	Lump Sum
807 (2)	Softscape (Trees)	Each
807 (2)	Softscape (Shrubs)	Each
807 (2)	Softscape (Grass)	Square Meter
807 (3)	Hardscape	Lump Sum
807 (3)	Hardscape (Fountains)	Each
807 (3)	Hardscape (Benches)	Each
807 (3)	Hardscape (Gazebos)	Each
807 (4)	Garden Soil	Cubic Meter
807 (5)	Aquatic Plants	Each
807 (5)	Aquatic Animals	Each
807 (6)	Paver Blocks	Square Meter
807 (7)	Curbs	Linear Meter
807 (8)	Column Guards	Pieces
807 (8)	Wheel Guards	Pieces
807 (9)	Fence	Square Meter
807 (10)	Gate	Lump Sum

Section VII. Drawings

Section VIII. Bill of Quantities

Item No.	Item Description	Unit	Quantity
A.1.1	Offices and Laboratory for the Engineer	l.s.	1.00
B.4(10)	Miscellaneous Survey and Staking	l.s.	1.00
B.5	Project Billboard/Signboard	Each	2.00
B.7(1)	Occupational Safety and Health	Month	5.90
B.8(1)	Road Works Safety and Traffic Management	Month	5.90
B.9	Mobilization/Demobilization	l.s.	1.00
B.12	Removal and Relocation of	l.s.	1.00
B.14	Environmental Management and Monitoring	Month	5.90
101(1)	Removal of Actual Structures/Obstruction (Grouted Riprap)	cu.m.	373.35
101(3)b6	Removal of Actual Structures/Obstruction (PCCP, Unreinforced)	sq.m.	81.60
101(3)d	Removal of Actual Structures/Obstruction (0.1m Thick, Sidewalk)	sq.m.	799.40
101(4)b	Removal of Actual Structures/Obstruction (Curb and Gutter)	l.m.	3,353.00
102(2)	Surplus Common Excavation	cu.m.	1,018.00
104(2)	Embankment	cu.m.	388.08
201(1)	Aggregate Base Course	cu.m.	186.70
302(2)	Bituminous Tack Coat (Emulsified Asphalt: Csb-3)	sq.m.	27,582.00
310(1)c	Bituminous Concrete Surface Wearing Course, Hot-Laid 50mm thick.	sq.m.	27,582.00
311(1)e2	Portland Cement Concrete Pavement (Unreinforced, 0.28mm Thick, 7 Day)	sq.m.	3,653.00
401(1)	Metal Railing	l.m.	385.00
404(1)a	Reinforcing Steel (Grade 40)	kg	13,780.56
405(1)a3	Structural Concrete (Class A, 20.68mpa, 30 Days)	cu.m.	176.48

500(1)	Pipe Culverts (610mmø RCPC,	l.m.	422.00
502(1)a1	Manholes (610mmø, Concrete)	Each	20.00
502(2)a1	Inlet, Type (610mmø)	Each	20.00
502(4)a1	Concrete Cover (610mmø)	Each	26.00
503(2)	Drainage Steel Grating with Frame	kg	544.43
505(2)	Grouted Riprap	cu.m.	1,332.52
508(1)	Hand-Laid Rock Embankment	cu.m.	123.90
600(4)	Curb and Gutter (Cast-in-Place)	l.m.	4,287.00
601(1)	Sidewalk	sq.m.	2,630.00
603(6)a	Guardrail (Metal Guardrail, W-Beam, Including Post)	l.m.	1,133.80
605(1)	Road Sign (Warning Signs)	l.s.	1.00
605(2)	Road Sign (Regulatory Signs)	l.s.	1.00
605(3)	Road Sign (Guide or Informative Signs)	l.s.	1.00
605(6)	Road Sign (Hazard Markers)	l.s.	1.00
612(1)	Reflectorized Thermoplastic Pavement Markings White	sq.m.	1,191.00
612(2)	Reflectorized Thermoplastic Pavement Markings Yellow	sq.m.	636.00
807(1)	Site Development	l.s.	1.00
807(9)	Paver Blocks	sq.m.	2,301.04

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.


Republic of the Philippines
gppb
Government Procurement Policy Board