PHILIPPINE BIDDING DOCUMENTS

(As Harmonized with Development Partners)

PROCUREMENT OF CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021 (CONSTRUCTION OF CONTROL TOWER BUILDING, ADMINISTRATION BUILDING, POWERHOUSE, TRANSFORMER YARD AND SITE DEVELOPMENT)

Government of the Republic of the Philippines

Bid No. 21-030-11 CHARLIE

Sixth Edition
July 2020

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Glossary of
Terms, Abbreviations, and Acronyms

ABC – Approved Budget for the Contract.

ARCC – Allowable Range of Contract Cost.

BAC – Bids and Awards Committee.

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

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

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

BIR – Bureau of Internal Revenue.

BSP – Bangko Sentral ng Pilipinas.

CDA – Cooperative Development Authority.

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

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

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

CPI – Consumer Price Index.

DOLE – Department of Labor and Employment.

DTI – Department of Trade and Industry.

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

GFI – Government Financial Institution.

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

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

GOP – Government of the Philippines.

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

LGUs – Local Government Units.

NFCC – Net Financial Contracting Capacity.

NGA – National Government Agency.

PCAB – Philippine Contractors Accreditation Board.

PhilGEPS - Philippine Government Electronic Procurement System.

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

PSA – Philippine Statistics Authority.

SEC – Securities and Exchange Commission.

SLCC – Single Largest Completed Contract.

UN – United Nations.

Section I. Invitation to Bid

Invitation to Bid for

CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021 (CONSTRUCTION OF CONTROL TOWER BUILDING, ADMINISTRATION BUILDING, POWERHOUSE, TRANSFORMER YARD AND SITE DEVELOPMENT) Bid No. 21-030-11 CHARLIE

1. The Civil Aviation Authority of the Philippines through the GAA CY 2021 DOTr Downloaded Projects intends to apply the sum of **ONE HUNDRED ONE MILLION ONE HUNDRED THIRTY THOUSAND FOUR HUNDRED THIRTY-EIGHT PESOS 50/100 (PHP101,130,438.50)** being the Approved Budget for the Contract (ABC) to payments under the contract for **CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021 (CONSTRUCTION OF CONTROL TOWER BUILDING, ADMINISTRATION BUILDING, POWERHOUSE, TRANSFORMER YARD AND SITE DEVELOPMENT) (Bid No. 21-030-11 CHARLIE).** Bids received in excess of the ABC shall be automatically rejected at bid opening.

2. The Civil Aviation Authority of the Philippines now invites bids for the above Procurement Project.

   Prospective Bidders should possess the following:

Technical Personnel	One (1) Project (Civil) Engineer One (1) Architect One (1) Mechanical Engineer One (1) Geodetic Engineer One (1) Materials Engineer One (1) Geotechnical Engineer One (1) Construction Safety & Health Officer One (1) Electrical Engineer One (1) Construction Foreman One (1) Master Electrician One (1) Master Plumber
Equipment	One (1) Unit Backhoe, 0.80 cu.m. One (1) Unit Payloader, 1.50 cu.m. Three (3) Dump Truck One (1) Tamping Rammer One (1) Truck Mounted Crane One (1) Unit Vibratory Single Smooth Drum Roller, 10MT One (1) Unit Diesel Pile Hammer, DSL - 10.5 ton One (1) Unit Drop Hammer One (1) Unit Jack Hammer

	One (1) Unit Air Compressor (355-450 cfm) One (1) Unit Concrete Batch Plant (Improvised) Two (2) Units Transit Mixer (5 cu.m.) Two (2) Units Concrete Vibrator One (1) Unit Water Truck, 4,000 gals One (1) Unit Pump Crete One (1) Unit Tower Crane Three (3) Units Bar Cutter/Shear, 42mm Three (3) Units Electric Bar Bender Four (4) Units One-bagger Concrete Mixer 1 cu.m. Two (2) Units Welding Machine, 200Amp One (1) Unit 51-100kw Generator Set, One (1) Unit Abrasive Cutting Machine Two (2) Units Oxy-Acetylene Cutting Torch/Welding Outfit One (1) Unit Motorized Road Grader, 140HP One (1) Unit Concrete Screeder, 5.5hp One (1) Unit Concrete Saw, self-propelled 10 3/4 in One (1) Unit Torch with regulator and gauge One (1) Unit Plate Compactor One (1) Portable Generator Set 10 kVA
PCAB License	**Medium A - License Category B** *(Building and Industrial Plant)*

Completion of the Works is required **Three Hundred Ninety (390) Calendar Days (inclusive of 10 rainy/unworkable 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 BAC Office, CAAP Compound, MIA Road corner Ninoy Aquino Avenue, 1300 Pasay City, Metro Manila on **November 24, 2021 until deadline of submission of bid** and inspect the Bidding Documents at the address given below from 08:00 AM to 05:00 PM from MONDAY to FRIDAY.

5. A complete set of Bidding Documents may be acquired by interested bidders on **November 24, 2021 until deadline of submission of bid** from given address and website/s below and upon payment of the applicable fee for the Bidding Documents, pursuant to the latest Guidelines issued by the GPPB, in the amount of **Php 56,000.00(inclusive of 12% VAT).** The Procuring Entity shall allow the bidder to present its proof of payment for the fees by presenting the official receipt in person.

6. The Civil Aviation Authority of the Philippines will hold a Pre-Bid Conference[1] on **2:00PM of December 01, 2021** at CAAP Conference Room, CAAP Compound, MIA Road Ninoy

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

Aquino Avenue, 1300 Pasay City, Metro and/or through videoconferencing/webcasting via Jitsi/Zoom/Google Meet, which shall be open to prospective bidders.

7. Bids must be duly received by the BAC Secretariat at the address below on or before **December 14, 2021 @ 2:00PM** at BAC Office, CAAP Compound, MIA Road corner Ninoy Aquino Avenue, 1300 Pasay City, Metro Manila. 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 on **December 14, 2021 @ 2:00PM** at the given address below and/or through Jitsi/Zoom/Google Meet. Bids will be opened in the presence of the bidders' representatives who choose to attend the activity.

10. The Civil Aviation Authority of the Philippines reserves the right to reject any and all bids, declare a failure of bidding, or not award the contract at any time prior to contract award in accordance with Sections 35.6 and 41 of the 2016 revised Implementing Rules and Regulations (IRR) of RA No. 9184, without thereby incurring any liability to the affected bidder or bidders.

11. For further information, please refer to:

    DR. ROLLY T. BAYABAN, M.D.
    Head, BAC-Alpha Secretariat
    Civil Aviation Authority of the Philippines
    MIA Road corner Ninoy Aquino Avenue
    1300 Pasay City, Metro Manila
    Telephone number – (02) 944-2358
    www.caap.gov.ph

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

November 24, 2021

_____
CAPTAIN DONALDO A. MENDOZA
Chairperson, BAC – Charlie/Delta

Section II. Instructions to Bidders

1. Scope of Bid

The Procuring Entity, Civil Aviation Authority of the Philippines invites Bids for the **CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021 (CONSTRUCTION OF CONTROL TOWER BUILDING, ADMINISTRATION BUILDING, POWERHOUSE, TRANSFORMER YARD AND SITE DEVELOPMENT)**, with Project Identification Number: **Bid No. _____**.

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 GAA CY 2021 DOTr Downloaded Projects in the amount of **ONE HUNDRED ONE MILLION ONE HUNDRED THIRTY THOUSAND FOUR HUNDRED THIRTY-EIGHT PESOS 50/100 (PHP101,130,438.50).**

2.2. The source of funding is:

a. GOCC and GFIs, the Corporate Operating Budget.

3. Bidding Requirements

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

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

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

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

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

5.1. 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.

5. 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.

6. Subcontracts

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

The Procuring Entity has prescribed that:

a. Subcontracting is not allowed.

7.1. *[If Procuring Entity has determined that subcontracting is allowed during the bidding, state:]* The Bidder must submit together with its Bid the documentary requirements of the subcontractor(s) complying with the eligibility criteria 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. *[If subcontracting is allowed during the contract implementation stage, state:]* 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.

7. 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.**

8. 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.

9. 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 X. 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**.

10. Documents Comprising the Bid: Financial Component

11.1. The second bid envelope shall contain the financial documents for the Bid as specified in **Section X. 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.

11. 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.

12. 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.

13. 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.

14. 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.

15. 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.

16. 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.**

17. 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.

18. 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.

19. 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**.

20. 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>3.0</td><td>Certificate of Site Inspection (Annex “B” Form 1) duly signed by Mr. Norman Nuñez, Officer-in-charge of Catbalogan Airport or his duly authorized representative, is required to be submitted.

This shall include all of the following documents as attachment to the Certificate of Site Inspection and shall form part of the bidder’s technical documents:

a) Copy of company ID of the person who conducted the site inspection;

b) Copy of the airport/facility visitor’s logbook; &

c) Picture of the proposed site including the personnel who conducted the site inspection together with the Airport Manager/Officer in Charge or his duly authorized representative.

Bids not complying with the above instruction shall be disqualified.</td></tr>
<tr><td>5.2</td><td>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.

For this purpose, contracts similar to the Project refer to contracts which have the same major categories of work, which shall be:

<table><tr><th>Category</th><th>ABC</th></tr><tr><td>1. Building Construction/ Improvement/ Rehabilitation/ Repair</td><td>101,130,438.45</td></tr></table></td></tr>
<tr><td>7.1</td><td>Subcontracting is not allowed.</td></tr>
<tr><td>10.1</td><td>Bidder shall submit all eligibility and technical documents as specified in Section X. Checklist of Technical and Financial Documents:

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</td></tr>
</table>

d. Tax clearance per E.O. No. 398, s. 2005, as finally reviewed and approved by the Bureau of Internal Revenue (BIR); and

In connection to GPPB Circular 07-2017 dated 31 July 2017, the bidder shall have the following options:

1. *Submit the Certificate of PhilGEPS Registration and Platinum Membership including its Annex "A" in lieu of the uploaded Class "A" Eligibility Documents identified in Section 8.5.2 of the Revised Implementing Rules and Regulations of Republic Act 9184 (Revised IRR of RA 9184), provided that all Class "A" Eligibility Documents listed under the aforesaid Annex "A" are all uploaded and maintained current and updated in the PhilGEPS Registry.*

2. *Submit a combination of the PhilGEPS Registration and Platinum Membership including its Annex "A" and Class "A" Eligibility Documents identified in Section 8.5.2 of the Revised IRR of RA 9184.*
   - *In the event that aforesaid Class "A" Eligibility Document(s) listed in the Annex "A" of the PhilGEPS Registration and Platinum Membership is/are reflected to be outdated, the bidder shall submit such current and updated Class "A" Eligibility Document(s).*

3. *Submit all the Class "A" Eligibility Documents only, provided that the PhilGEPS Registration and Platinum Membership shall be submitted as a Post-Qualification requirement in accordance with Section 34.2 of the Revised IRR of RA 9184.*

<u>Technical Documents</u>

e. 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. *(Annex "A" Form 1);* and

f. Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid, except under conditions provided under the rules. *(Annex "A" Form 2);* and

g. 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
Joint Resolution *(Annex "A" Form 3)*; and

h. 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 *(Annex "B" Form 2);* and

i. Project Requirements, which shall include the following:

1. Organizational chart for the contract to be bid *(Annex "B" Form 3)*; and

2. 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 *(Annex "B" Form 4, 5a, 5b & 5c)*; and

3. 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 *(Annex "B" Form 6)*; and

j. Original duly signed Omnibus Sworn Statement (OSS) *(Annex "B" Form 7)*; 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; and

   This shall include all of the following documents as attachment to the Omnibus Sworn Statement:

   1. Certification, under oath, attesting that they have no pending case(s) against the Government, in addition to the eligibility requirements as prescribe under the 2016 Revise Implementing Rules and Regulation (R-IRR) of RA No. 9184; and

   2. Legal Clearance to be issued by the CAAP Enforcement and Legal Service with respect to the non-pending cases of the prospective bidders against this Authority; and

   3. Bid Bulletins (if applicable); and

k. **Certificate of Site Inspection** *(Annex "B" Form 1)* duly signed by **Mr. Norman Nuñez, Officer-in-charge of Catbalogan Airport or his** duly authorized representative; and

   This shall include all of the following documents as attachment to the Certificate of Site Inspection:

   1. Copy of company ID of the person who conducted the site inspection; and

   2. Copy of the airport/facility visitor's logbook; and

   3. Picture of the proposed site including the personnel who conducted the site inspection together with the Airport Manager/Officer in Charge or his duly authorized representative: and

	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. Applicable CAAP BAC Standard Forms included in this PBD shall be complied in accordance with the prescribed forms under Section IX Bidding Forms – Annex "A" & "B". Bids not complying with the above instruction shall be disqualified.
10.3	Valid PCAB License or Special PCAB License in case of Joint Ventures, and Registration ***(Medium A Category B for vertical works - Building and Industrial Plant***) for the type and cost of the contract to be bid. Bids not complying with the above instruction shall be disqualified.
10.4	The key personnel must meet the required minimum years of experience set below: Key Personnel: Project (Civil) Engineer; Geodetic Engineer; Electrical Engineer; Mechanical Engineer; Materials Engineer; Geotechnical Engineer; Architect; Master Electrician; Master Plumber; Construction Foreman; Construction Safety & Health Officer General Experience: Five (5) years in General Engineering Relevant Experience: Three (3) years in Building Construction/Improvement/ Rehabilitation/ Repair Bids not complying with the above instruction shall be disqualified.
10.5	The minimum major equipment requirements are the following: Equipment: Backhoe — Capacity: 0.80 cu.m. — Number of Units: One (1) Unit Equipment: Payloader — Capacity: 1.50 cu.m. — Number of Units: One (1) Unit

	Dump Truck		Three (3) Units
	Tamping Rammer		One (1) Unit
	Truck Mounted Crane		One (1) Unit
	Vibratory Single Smooth Drum Roller	10MT	One (1) Unit
	Diesel Pile Hammer, DSL	10.5 ton	One (1) Unit
	Drop Hammer		One (1) Unit
	Jack Hammer		One (1) Unit
	Air Compressor	355-450 cfm	One (1) Unit
	Concrete batch plant (improvised)		One (1) Unit
	Transit Mixer	5 cu.m.	Two (2) Units
	Concrete Vibrator		Two (2) Units
	Water Truck	4,000 gals	One (1) Unit
	Pump Crete		One (1) Unit
	Tower Crane		One (1) Unit
	Bar cutter/shear	42 mm	Three (3) Units
	Electric bar bender		Three (3) Units
	One-bagger concrete mixer	1.0 cu.m.	Four (4) Units
	Welding Machine	200 Amp	Two (2) Units
	Generator set	51-100 kw	One (1) Unit
	Abrasive cutting machine		One (1) Unit
	Oxy-Acetylene cutting torch/Welding outfit		Two (2) Units
	Motorized Road Grader	140 hp	One (1) Unit
	Concrete screeder	5.5 hp	One (1) Unit
	Concrete Saw, self-propelled	10 ¾ in	One (1) Unit
	Plate Compactor		One (1) Unit
	Portable Generator Set	10kVA	One (1) Unit
	Bids not complying with the above instruction shall be disqualified.		
11.1.	The second bid envelope shall contain the financial documents for the Bid as specified in **Section X. Checklist of Technical and Financial Documents**. This shall include the complete accomplishment of all of the following documents as stated and required under Section VIII of this PBD and shall form part of the bidder's financial documents: a) Original of duly signed and accomplished Financial Bid Form; and b) Bill of Quantities *(Annex "C" Form 1)*; and c) Summary of Bid Proposal *(Annex "C" Form 2)*; and d) Bill of Materials & Cost Estimates *(Annex "C" Form 3)*; and e) Summary Sheet indicating the Unit Prices of Construction Materials, Labor Rates, and Equipment Rentals used in coming up with the Bid *(Annex "C" Form 4, 5 & 6)*; and f) Cash Flow by Quarter and Payment Schedule *(Annex "C" Form 7)* Modifications and/or alterations on the stated requirements in the financial		

	document forms (BOQ, Summary of Bid Proposal & Bill of Materials & Cost Estimates) shall not be allowed. Applicable CAAP BAC Standard Forms included in this PBD shall be complied in accordance with the prescribed forms under Section IX Bidding Forms – Annex "C". Bids not complying with the above instruction shall be disqualified. **The discounts stated in the Financial Bid Form shall be computer written with the same font style and size as of the whole text of the said Form.** **Discounts that are either handwritten, type written or computer written in other font style and size shall not be considered.**
11.2	Bid exceeding the ABC of the project shall be disqualified.
12	No further instructions.
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 two percent (2%) of ABC, 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 five percent (5%) of ABC if bid security is in Surety Bond.
16	1. Each and every page thereof shall be initialed/signed by the duly authorized representative/s of the Bidder. Submitted Eligibility, Technical and Financial documents shall be properly marked with index tabs (ear tab) and must be sequentially paginated in accurate order in the form i.e. "page 3 of 100". Page number of last page of the document (per envelope basis). Pagination should be sequential based on the entire span of the whole documents inside the envelope. 2. Each Bidder shall submit **one copy of the first and second components** of its bid. Bids not complying with the above instructions shall be automatically disqualified.
19.2	Partial bid is not allowed. The infrastructure project is packaged in a single lot and the lot shall not be divided into sub-lots for the purpose of bidding, evaluation, and contract award.
20	The Bidder with the Lowest Calculated Bid (LCB) that complies with and is responsive to all the requirements and conditions shall submit its a) Latest income and business tax returns filed through the Electronic Filing and Payment System (EFPS); b) Business licenses and permits required by law (Registration Certificate, Mayor's Permit, Tax Clearance & PCAB License);

	c) Latest Audited Financial Statements; and d) Key personnel licenses Failure to submit any of the post-qualification requirements on time, or a finding against the veracity thereof, shall disqualify the bidder for award. Provided, that in the event that a finding against the veracity of any of the documents submitted is made, it shall cause the forfeiture of the Bid Security in accordance with Section 69 of the IRR of RA 9184.
21	The following relevant project documents are required to be submitted by the successful bidder who submitted the LCRB as part of the Contract Agreement during its signing: a) Construction schedule b) Bar Chart & S-curve c) PERT/CPM Network Diagram d) Manpower schedule e) Construction methods f) Equipment utilization schedule Construction safety & health programs approved by the Department of Labor & Employment **(CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021 (CONSTRUCTION OF CONTROL TOWER BUILDING, ADMINISTRATION BUILDING, POWERHOUSE, TRANSFORMER YARD AND SITE DEVELOPMENT))**

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

3.1 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.

3.2 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	Not applicable.
3.1	The **CIVIL AVIATION AUTHORITY OF THE PHILIPPINES** shall give possession of all parts of the Site to the Contractor upon receipt of the Notice to Proceed.
6	None.
7.2	In case of permanent structures, such as buildings of types 4 and 5 as classified under the National Building Code of the Philippines and other structures made of steel, iron, or concrete which comply with relevant structural codes (e.g., DPWH Standard Specifications), such as, but not limited to, steel/concrete bridges, flyovers, aircraft movement areas, ports, dams, tunnels, filtration and treatment plants, sewerage systems, power plants, transmission and communication towers, railway system, and other similar permanent structures: Fifteen (15) years.
10	No dayworks are applicable to the contract.
11.1	Not applicable
11.2	Not applicable
13	The amount of the advance payment shall not exceed 15% of the total contract price. However, as per Department of Transportation (DOTr) Policy, Procuring Entity will not give advance payment to contractors.
14	No further instructions.
15.1	The date by which operating and maintenance manuals are required is upon completion of the project The date by which “as built” drawings are required is upon completion of the project. PDF/AutoCAD File of the “as built” plans shall include as attachment to the required hard copy of the same upon completion of the project.
15.2	The amount to be withheld for failing to produce “as built” drawings and/or operating and maintenance manuals by the date required is two percent (2.00%) of the Contract price.

Section VI. Specifications and Scope of Work

Name of Project	:	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021 (CONSTRUCTION OF CONTROL TOWER BUILDING, ADMINISTRATION BUILDING, POWERHOUSE, TRANSFORMER YARD AND SITE DEVELOPMENT)**
Location	:	Catbalogan Airport, Catbalogan
Duration	:	Three Hundred Ninety (390) Calendar Days (inclusive of 10 rainy/unworkable days)
Source of Funds	:	GAA CY 2021 DOTr Downloaded Projects

SCOPE OF WORK

The project covers the supply of labor, materials and equipment necessary for the CATBALOGAN AIRPORT DEVELOPMENT PROJECT. The details of work are best enumerated below, however, it is understood that the contract includes all works and services though not specifically mentioned herein, but are needed to fully complete the project shall be undertaken by the Contractor.

The following scopes of work shall be done in accordance with the approved plans, specifications and provisions of contract.

SPL-1 Mobilization/Demobilization

This work includes mobilization and demobilization of the contractor's personnel and equipment necessary for performing the work required under the contract.

Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and establishment of offices, and other necessary facilities for the contractor's operations at the site.

Demobilization shall include the disassembly of offices and other facilities on the site, as well as the removal and hauling of debris and rubbish materials.

I. CONSTRUCTION OF ADMINISTRATION BUILDING

1. CIVIL/ STRUCTURAL WORKS

1.01 Site Works

The work includes supply of materials, labor and equipment/tools for site works including excavation for foundation and backfill as well as gravel beading as indicated on the approved plans. (Excavation must be verified first by the Project in-Charge).

1.02 Pile Driving Works

The work includes supply of materials, labor and equipment/tools for to finish the 1,152 linear meter pile driving works, (0.35x0.35x18m driven pile – 5000psi) as indicated on the approved plans.

1.03 Concreting Works

The work includes supply of materials, labor and equipment/tools needed to complete the concreting components of the structure such as footings, footing tie beams, columns, beams and roof beams, slab on grade, suspended slab, stair as well as stair footing with a total volume of 125.51 m³, including fabrication and installation of reinforced steel bars and formworks as indicated on the approved plans.

1.04 Masonry Works

The work includes supply of materials, labor and equipment/tools for laying of concrete hollow blocks including zocalo, plastering (3/4" thk plaster), fabrication and installation of reinforced steel bars with a total coverage area of 508.62 m² as indicated on the approved plans.

1.05 Steel Works

The work includes supply of materials, labor and equipment/tools equipment needed to complete the steel works including fabrication, installation and painting of tubular steel, angle bars, tension rod and sag rod, framing for ACP and access ladders with a total weight of 4,388.48 kgs as indicated on the approved plans.

2. ARCHITECTURAL WORKS

2.01 Tile Works

The work includes supply of materials, labor, and equipment/tools for the installation of floor and wall tiles with a total coverage area of 516.01 m² as indicated on the approved plans.

2.02 Painting Works

The work includes supply of materials, labor, equipment/tools to complete the painting of exterior and interior walls with a total coverage area of 652.72 m² as indicated on the approved plan.

2.03 Ceiling Works

The work includes supply of materials, labor, and equipment/tools necessary for the installation of the following: ceiling boards (6mm thick fiber cement board) with complete accessories including painting having a total coverage area of 368.50 m² as indicated on the approved plans.

2.04 Carpentry Works

The work includes supply of materials, labor, equipment/tools to complete the installation of modular partitions and drywall partitions including painting with a total area of 221.42 m² as indicated on the approved plans.

2.05 Doors and Windows

The work includes supply of materials, labor and equipment/tools for installation of doors and windows including hardware accessories, door jamb and header as indicated on the approved plans.

2.06 Toilet Partition, Concrete Countertop and Accessories

The work includes supply of materials, labor and equipment/tools needed to complete the provision of Toilet Partition, Concrete Countertop and Accessories with an area of 11.18 sq.m as indicated on the approved plans.

2.07 Miscellaneous

The work includes supply of materials, labor and equipment/tools needed to complete the construction of receiving counters and installation of signage as indicated on the approved plans.

3. ELECTRICAL WORKS

The work includes all materials, labor, equipment and material testing for the installation of the following; Lighting Fixtures, Wiring Device and Boxes, Wires and Conduits, Panel Board and Circuit Breaker, Structured Cabling System and Termination Accessories as indicated on the approved plans. Electrical works should be tested and commissioned.

4. MECHANICAL WORKS

The work includes all materials, labor, equipment and tools necessary to complete the supply and installation of Split type, Wall mounted, Inverter Air conditioning Units; one (1) set 2.5hp, four (4) sets 2.0hp, two (2) sets 1.5hp and three (3) sets 1.0hp including the copper piping, fitting and insulations; Supply and installation of seven (7) sets ceiling mounted exhaust fan including ductworks, four (4) sets – 18in wall fan, hangers and all its accessories; Supply and installation of eighteen (18) sets smoke detector with built-in sounder and batteries, four (4) sets Fire Alarm Horn w/ Strobe, four (4) sets Manual Pull Station and eleven (11) sets 10 lbs. ABC Dry Chemical Portable Fire Extinguisher w/ wall hanger as indicated on the approved plans. Mechanical works should be tested and commissioned.

5. PLUMBING WORKS

5.01 Site Works

This item covers supply of materials and labor to finish the 111.21 m³ excavation, 98.84m³ backfill, 1.00 m³ gravel bedding and 1.00 m³ sand bedding. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

5.02 Sewer Line System

This item covers supply of materials and labor to finish the installation of 108.10 li.m. PVC pipe series 1000 including fittings for sewer line and vent system. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

5.03 Waterline System

This item covers supply of materials and labor to finish the installation of 133.65 li.m. PPR PN 20 pipe including fittings for water line system. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

5.04 Storm Drainage System

This item covers supply of materials and labor to finish the installation of 81.90 li.m. PVC pipe series 1000 including fittings for storm drain system. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

5.05Septic Tank, Catch Basin and Trench Drain

This item covers supply of materials, labor and equipment to finish the concreting of septic tank, catch basin and trench drain with a total capacity of 11.83 m³, including the installation/fabrication of rebar and formworks. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

5.06 Fixtures and Accessories

This item covers supply of materials and labor to finish the installation of fixtures and accessories and shall conform to lines, grades and dimensions as indicated on the approved plans.

6. FURNITURE

The work includes supply of all furniture as indicated on the approved plans.

II. CONSTRUCTION OF CONTROL TOWER BUILDING

2.01 CIVIL/ STRUCTURAL WORKS

2.01.01 Site Works

The work includes the supply of labor and equipment necessary to complete the excavation for the construction of matt footings, column footings, wall footings, footing tie beams, stair footing, septic tank/s, and catch basin/s. This also includes the demolition of existing pavement, backfilling works and provision of gravel bedding conforming to the required thickness as indicated on the approved plans. The Contractor must provide equipment for hauling and disposal of excavated materials and site cleanup.

- *Total Volume for Excavation* = **893.39 cu.m.**
- *Total Volume for Backfill* = **499.61 cu.m.**
- *Total Volume for Gravel Bedding* = **61 cu.m.** *(delivered on site)*

2.01.02 Pile Driving Works

The work includes the supply of materials, labor and equipment necessary to complete the pile driving works (0.40m x 0.40m x18m driven pile – 5000psi) as indicated on the approved plans.

- *Total length of Driven Pile – 3,402.00 li.m.*

2.01.03 Concrete Works

The work includes the supply of labor, materials and equipment necessary to complete the construction and cast-in place of matt, column and wall footings, columns, slab on fill, suspended slab (roof deck), concrete walls, shear wall, footing tie beams, beams, cantilever and roof beams, stairs and counter top; fabrication and installation of reinforcing steel bars; and fabrication and installation of formworks and scaffoldings as indicated on the approved plans.

- *Total Weight of Rebars = 144,338.00 kgs.*
- *Total Area of Formworks = 4,808.00 sq.m.*
- *Total Volume of Concrete = 967.00 cu.m.*

2.01.04 Masonry Works

The work includes materials, labor, equipment/tools for the laying of 100mm thick concrete hollow block (CHB) for interior walls and 150mm thick concrete hollow block (CHB) for exterior walls including mortar, ¾" thick plastering on both sides & installation of reinforcing steel bars as indicated on the approved plans. Materials to be used and workmanship must be approved by the Project In-Charge.

- *Total Area of Masonry Works = 1,396.52 sq.m.*

2.01.05 Steel Works

The work includes all materials, labor, and tools/equipment needed to complete the steel works including fabrication, installation and painting of I-beams, angular bars, MS plates, G.I. pipes, steel bars, and other materials as indicated on the approved plans. The Contractor must secure the scaffoldings and formworks prior to the installation and must conform to the specifications. Materials to be used and workmanship must be approved by the Project In-Charge assigned by CAAP.

- *Total Weight of Steel Works = 9,352.86 kgs.*

2.01.06 Moisture and Thermal Protection Works

The work includes the supply of labor, materials, and equipment and incidental items necessary for the application of moisture and thermal protection works. It includes the supply and installation of 12mm clear tempered glass with safety film roofing sheet on metal furring. Materials to be used and workmanship must be approved by the Project In-Charge assigned by CAAP.

- *Total Area Coverage = 109 sq.m.*

2.02 ARCHITECTURAL WORKS

2.02.01 Carpentry Works

1A. Ceiling Finishes

This covers the supply of labor, materials, and all incidental items necessary to complete the installation of 600mm x 1200mm perforated metal ceiling panel on clip-in system; ¼" thick fiber cement ceiling board on metal furring system; 600mm x 1200mm acoustic ceiling panel on clip-in system; 16mm thick gypsum board ceiling suspension system. Painting works of the ceiling panels and exposed concrete ceiling is also included under this item. Materials to be used and workmanship must be approved by the Project In-Charge assigned by CAAP.

- *Total Area Coverage = 817.20 sq.m.*

1B. Wall Finishes

This covers the supply of labor, materials, and all incidental items necessary to complete the installation of 12mm thick fiber cement on 0.6mm thick 35mm x 102mm metal studs; 4mm thick aluminum composite panel and 9mm thick compressed fiber cement board on metal studs with foil backed batt insulation on top hats framing and; 16mm thick gypsum board on 101mm metal studs. Materials to be used and workmanship must be approved by the Project In-Charge assigned by CAAP.

- *Total Area Coverage = 344.98 sq.m.*

2.02.02 Tile Works

This includes the supply of labor, materials and tools necessary to complete the laying of 600mm x 600mm synthetic granite floor tiles; 600mm x 600mm non-skid synthetic granite floor tiles; 600mm x 600mm homogeneous non-skid floor tiles; 300mm x 600mm homogeneous wall tiles; ¾" thk. Granite counter top; and 3mm thk. alloy temper mill finish grade aluminum stair nosing and the removal and cleaning of excess tile grout on all surfaces in accordance with the approved plans and specifications. Materials to be used and workmanship must be approved by the Project In-Charge assigned by CAAP.

- *Total Area Coverage = 1,031.87 sq.m.*

2.03.03 Raised Wall and Precast Wall Works

This item covers the provision of labor, materials and tools necessary for the installation of raised floor at specified area and all other related works as indicated on the approved plans.

- *Total Area Coverage = 31.00 sq.m.*

2.02.04 Painting Works

This item covers the provision of labor, materials and tools necessary to complete the painting of interior and exterior wall area, outside soffit slab, exposed columns and beams; application of chlorinated rubber paint finish (stair) as indicated on the approved plans.

- *Total Area Coverage* **= 4,940.04 sq.m.**

2.02.05 Doors & Windows

This covers the supply of labor, materials and equipment necessary to complete the installation of doors and windows with its accessories as indicated on the approved plans.

- *Total No. of Doors = 59 sets*
- *Total No. of Windows = 40 sets*

2.02.06 Toilet Partition, Concrete Countertop and Accessories

The work includes supply of materials, labor and equipment/tools needed to complete the provision of Toilet Partition, Concrete Countertop and Accessories with an area of 16.88 sq.m. as indicated on the approved plans.

2.03 ELECTRICAL WORKS

The work includes all materials, labor, equipment, material testing and performance of all operations to complete the Installation of lighting & power conduits and fittings, wires & cables,

electrical wiring devices, lighting fixtures, boxes & pull boxes, panel board/circuit breaker/circuit protection/gutter, feeder conductors, feeder conduits & fittings, Access Control System, CCTV System, back-up power supply, Lighting Protection and Grounding, Auxiliary Units, termination accessories and all other related works as indicated on the approved plans needed for the completion of the project. Testing and commissioning of Electrical works are the responsibility of the contractor. Materials to be used and Workmanship must be approved by the Project In-Charge assigned by CAAP.

- *Supply and Installation of Access Control System – 1 set*

- *Back-up Power Supply (Supply & Installation)*
  1 assy. – 50 KVA UPS Three phase 400V in 400 out, 60 Hz

- *Lighting Protection & Grounding (Supply & Installation)*
  1 assy. – Double action Early Streamer Emission (ESE) Lighting Protection a System

2.04 MECHANICAL WORKS

The work includes all materials, labor, equipment/tools and material testing to complete the supply and installation of Air Conditioning units with complete accessories including copper tubing, drain pipes, insulation; Ventilation Equipment, ducting, air grille, vent cap, accessories and fittings; and Fire Detection and Alarm System and Fire Extinguishers as indicated on the plans. Mechanical works should be tested and commissioned.

VRF Units:

1 unit – VRF Outdoor Unit, 45.0 kW

4 units – VRF Indoor FCU Wall Mounted 4.5 kW

2 units – VRF Indoor FCU Wall Mounted 5.6 kW

2 units – VRF Indoor FCU Ceiling Cassette 4-way, 7.1 kW

Inverter Spit-type Air-Conditioning Units w/ complete accessories and circuit breaker in NEMA-3R Enclosure:

1 set - Ceiling Cassette, 2.5 HP

4 sets - Wall Mounted, 1.5 HP

9 sets - Wall Mounted, 1.0 HP

Window Type Air-Conditioning Units:

3 sets - 2.5 HP, R-410A

1 set - 1.5 HP, R-410A

Ventilation Equipment:

11 units – 12" Ceiling Cassette Exhaust Fan

3 units – 14" Wall Type Exhaust Fan 1300 CFM

2 units – Inline Centrifugal Fan Exhaust 200 CFM

1 unit – Axial Flow Supply Fan 5000 CFM

Fire Detection and Alarm System:

38 sets – Stand-alone Smoke Detector w/ base, built-in sounder and batteries

13 sets – Fire Alarm Horn with Strobe, 15-110cd (candela) with complete accessories

13 sets – Manual Call Point, 24-30Vdc, 1.0A w/ complete accessories

Fire Extinguishers:

22 sets – 10lbs. ABS Dry Chemical Portable Fire Extinguisher w/ complete accessories

17 sets – 10lbs. Manual/Automatic HFC-236fa Fire Extinguisher (thermal Type) with sprinkler head and heat sensor, wall mounted with wall hanger

2.04.04 Supply and Installation of Passenger Elevator

The work includes all materials, labor, equipment/tools and material testing to complete the supply and installation of passenger elevator with necessary equipment support and standard accessories. Elevator works should be tested and commissioned.

1 unit – Passenger Elevator System, capacity of 630 kgs.

8 Person, 1mps speed, AC VVVF GL.

2.05 PLUMBING WORKS

2.04.05 Siteworks

This item covers supply of materials and labor to finish the 237.78 m³ excavation, 225 m³ backfill, 2.00 m³ gravel bedding and 37.00 m³ sand bedding. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

2.04.06 Sewer Line System

This item covers supply of materials and labor to finish the installation of 424.91 li.m. PVC pipe series 1000 including fittings for sewer line and vent system. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

2.04.07 Waterline System

This item covers supply of materials and labor to finish the installation of 246.06 li.m. PPR PN 20 pipe including fittings for water line system. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

2.04.08 Storm Drainage System

This item covers supply of materials and labor to finish the installation of 141.45 li.m. PVC pipe series 1000 including fittings for storm drain system. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

2.04.09 Septic Tank, Catch Basin and Trench Drain

This item covers supply of materials, labor and equipment to finish the concreting of septic tank, catch basin and trench drain with a total capacity of 15.39 m³, including the installation/fabrication of rebar and formworks. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

2.04.10 Fixtures and Accessories

This item covers supply of materials and labor to finish the installation of fixtures and accessories and shall conform to lines, grades and dimensions as indicated on the approved plans.

III. POWERHOUSE AND TRANSFORMER YARD

A. POWERHOUSE

3.01 CIVIL/STRUCTURAL WORKS

3.01.01 Site Works

This item covers supply of materials, labor and equipment to finish the 143.00 m³ excavation, 74.00 m³ backfilling, and 10.00 m³ laying of gravel bedding which conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

3.01.02 Concrete Works

This item covers supply of materials, labor and equipment to finish the concreting of columns, beams, footing, wall footing, slab on grade, suspended slab and electrical manhole with a total volume of 75.63 m³, including the fabrication/ installation/ dismantling of rebar and formworks. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

3.01.03 Masonry Works

This item covers supply of materials and labor to finish the laying of 151.03 m² concrete hollow blocks, including the fabrication/installation of reinforcing bars and plastering. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

3.01.04 Steel Works

This item covers supply of materials, labor and equipment to finish the fabrication and installation roof trusses, purlins and other steel works with a total weight of 702.78 kg including painting. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

3.01.05 Waterproofing Works

This item covers supply of materials and labor to finish the installation of 117.56 sq.m. waterproofing works and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.02 ARCHITECTURAL WORKS

3.02.01 Tile Works

This item covers supply of materials and labor to finish the tile and stone works with a total coverage area of 28.88 m². The work shall conform to lines, grades and dimensions as indicated on the approved plans.

3.02.02 Painting Works

This item covers supply of materials and labor to finish the painting works with a total coverage area of 295.11 m². The work shall conform to lines, grades and dimensions as indicated on the approved plans.

3.02.03 Celing Works

This item covers supply of materials and labor to finish the ceiling works with a total coverage area of 12 m². The work shall conform to lines, grades and dimensions as indicated on the approved plans.

3.02.04 Doors and Windows

This item covers supply of materials and labor to finish the installation of 7 sets of doors and 6 sets of windows with complete hardware & accessories. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03 ELECTRICAL WORKS

3.03.01 Lighting and Power Conduits and Fittings

This item covers supply of materials, labor and equipment to finish the installation of 153 li.m. of lighting and power conduits and fittings works and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03.02 Electrical Wiring Devices

This item covers supply of materials, labor and equipment to finish the installation of 17 sets of electrical wiring devices and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03.03 Lighting Fixtures

This item covers supply of materials, labor and equipment to finish the installation of 28 sets of lighting fixtures and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03.04 Boxes

This item covers supply of materials, labor and equipment to finish the installation of 48 pcs of boxes and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03.05 ACU Power Supply Conduits & Fittings

This item covers supply of materials, labor and equipment to finish the installation 12 li.m. of ACU Power Supply Conduits & Fittings and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03.06 Lighting and Power Wires & Cable

This item covers supply of materials, labor and equipment to finish the installation of 4 rolls of Lighting and Power Wires & Cables and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03.07 Grounding System

This item covers supply of materials, labor and equipment to finish the installation of 70 li.m. of grounding system and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03.08 Panelboard/Circuit Breaker

This item covers supply of materials, labor and equipment to finish the installation of 3 assy for panelboard/circuit breaker and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03.09 Feeder/Sub Feeder Conductor

This item covers supply of materials, labor and equipment to finish the installation of 5,572 li.m. of feeder/sub feeder conductor and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03.10 Feeder/Sub Feeder Line Conduits and Fittings

This item covers supply of materials, labor and equipment to finish the installation of 1,236 li.m. of feeder/sub feeder line conduits & fittings and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.03.11 Emergency Power Supply

This item covers supply of materials, labor and equipment to finish the installation of 2 sets of brands new 500 kVA, three phase, 230V, 60Hz diesel engine generator set for emergency power supply and shall conform to lines, grades and dimensions as indicated on the approved plans. This item also covers the supply of materials such as fuel, oil and other consumables during the commissioning and load testing of the Generator set which will be based on Resistive load bank (dummy load) and incremental load (actual building load).

Note: The Contractor must secure the testing and commissioning of Electrical works.

3.04 MECHANICAL WORKS

3.04.01 Air-conditioning Unit and Piping System

This item covers supply of materials, labor and equipment to finish 1 set of air-conditioning unit and piping system and shall conform to lines, grades and dimensions as indicated on the approved plans. The Contractor must secure the testing and commissioning of Air-conditioning works.

3.04.02 Ventilation Equipment and Accessories

This item covers supply of materials and labor to finish ventilation equipment and accessories with a total coverage area of 56 m² and shall conform to lines, grades and dimensions as indicated on the approved plans. The Contractor must secure the testing and commissioning of Ventilation works.

3.04.03 Hangers and Support, Fire Extinguisher

This item covers supply of materials and labor to finish the hangers and support works and 2 sets Fire Extinguisher and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.05 PLUMBING WORKS

3.05.01 Fixtures

This item covers supply of materials and labor to finish the installation of 9 sets fixtures and shall conform to lines, grades and dimensions as indicated on the approved plans

3.05.02 Waste Waterline

This item covers supply of materials and labor to finish the installation of 9 li.m. PVC pipe series 1000 including fittings for sewer line & vent system. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

3.05.03 Cold Waterline

This item covers supply of materials and labor to finish the installation of 20 li.m. PPR PN 20 pipe including fittings for water line system. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

3.05.04 Storm Drainage Pipe

This item covers supply of materials and labor to finish the installation of 81 li.m. PVC pipe series 1000 including fittings for storm drain system. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

3.05.05 Catch Basin

This item covers supply of materials and labor to finish the installation of 9 sets of catch basin and shall conform to lines, grades and dimensions as indicated on the approved plans.

3.05.06 Septic Tank

This item covers supply of materials and labor to finish the construction of septic tank having a total coverage area of 5.52 m² and shall conform to lines, grades and dimensions as indicated on the approved plans.

B. TRANSFORMER YARD

3.06 CIVIL/STRUCTURAL WORKS

3.06.01 Site Works

This item covers supply of materials, labor and equipment to finish the 21.64 m³ excavation and 9.38 m³ backfilling. The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

3.06.02 Concrete Works

This item covers supply of materials, labor and equipment to finish the concreting work with a total volume of 19.05 m³. The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

3.06.03 Masonry Works

This item covers supply of materials, labor and equipment to finish the masonry works with a total area of 14.04 m². The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

3.06.04 Steel Works

This item covers supply of materials, labor and equipment to finish the steel works with a total weight of 701.53 kgs. The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

IV. SITE DEVELOPMENT

4.01 COVERED PATHWAY

4.01.01 Site Works

The work includes supply of materials, labor and equipment/tools for site works including demolition of the following: removal of existing covered walkway and existing concrete pavement,

also excavation, embankment and gravel bedding as indicated on the approved plans. (Demolition must be verified first by the Project in-Charge).

4.01.02 Concrete Works

The work includes the supply of labor, materials, tools and equipment needed to complete the concreting components of the structure such as pedestal footings, pedestals, concrete retainer strip, concrete bed & haunch, decorative stones, pavement blocks including formworks and fabrication and installation of reinforced steel bar as indicated on the approved plans.

4.01.03 Steel Works (including Painting Works)

This item covers supply of materials, labor and equipment to needed to complete the steel works with a total weight of 3,557.39 kgs. It also includes the painting of G.I. pipe trusses, base plate and purlins as indicated on the approved plan.

4.01.04 Pavement Blocks

This item covers supply of materials, labor and equipment to needed to complete the pavement block works with a total weight of 3,557.39 kgs. It also includes the painting of G.I. pipe trusses, base plate and purlins as indicated on the approved plan

4.01.05 Electrical Works

The work includes all materials, labor, equipment, material testing and performance of all operations to complete the Installation of lighting & power conduits and fittings, wires & cables, electrical wiring devices, lighting fixtures, boxes & pull boxes, hangers, supports and termination accessories and all other related works as indicated on the approved plans. Testing and commissioning of Electrical works are the responsibility of the contractor. Materials to be used and Workmanship must be approved by the Project In-Charge assigned by CAAP.

4.02 TYPE IV SECURITY FENCE WITH GATES

4.02.01 Site Works

This item covers supply of materials, labor and equipment to finish the demolition, excavation, embankment and disposal with a total volume of 50.52 m³. The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

4.02.02 Concrete Works

This item covers supply of materials, labor and equipment to finish the concreting work with a total volume of 28.67 m³. The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

4.02.03 Masonry Works (including plastering)

This item covers supply of materials, labor and equipment to finish the masonry works with a total area of 232.00 m². The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

4.02.04 Steel Works (including painting works)

This item covers supply of materials, labor and equipment to finish the steel works with a total length of 255.40 ln.m. The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

4.03 PERIMETER CHB FENCE

4.03.01 Site Works

This item covers the materials, labor and equipment for demolition, excavation and disposal as shown on the approved plans and in accordance with specifications and in conformity with the lines, grades and dimensions. The backfill shall be composed of selected common borrow (suitable) from the excavated materials. Hauling and disposal including any miscellaneous shall be the full responsibility of the contractor. This item covers the following:

1. Perimeter Fence (CHB) = 70.00 li.m.
2. Volume of Excavation = 33.16 cu.m.
3. Common Borrow = 0.11 cu.m.
4. Volume for disposal = 33.05 cu.m.

4.03.02 Concrete Works

This item covers the placement of reinforcing bars, forms, G.I. pipe embedded on concrete post and concrete pouring of lintel beams, column footings, columns and wall footings constructed on a prepared subbase in accordance with the specifications and shall conform to the lines, grades, thickness and cross section shown on the approved plans. This item also consists of furnishing all materials, tools, and equipment including labor required in undertaking the proper application. Materials to be used and workmanship must be approved by the Project In-Charge assigned by CAAP. (Note: Follow the existing Terrain/ Slope)

4.03.03 Masonry Works

This item includes materials, labor and equipment required for the laying of 150 mm. thick CHB of covered area including cut, bend and installation of reinforcing steel bars, formworks and scaffolding as specified on the approved plans. CHB wall shall have mortar plaster (Costura finish) on both sides. (Materials to be used and workmanship must be approved by the Project In-Charge assigned by CAAP)

150 mm. CHB Total Area of Fence = 164.50 sq.m.

Total Length of CHB Fence = 70.00 li.m.

4.03.04 Steel Works

This item includes materials, labor, equipment/tools and performance of all operations for steel works to complete the fabrication and installation of G.I. pipes with 6 strands of barbed wires as indicated on the approved plans. This item covers a total of 7 bays at 10.00 meters per bay. All G.I. pipes Sch. 40 shall be painted with epoxy primer before final coat is applied. The materials to be used must be approved by the CAAP Project-in-Charge. This item covers a total length of 420 linear meters.

4.04 VEHICULAR PARKING AREA CONCRETE PAVEMENT

105(1)a SUBGRADE PREPARATION

This item covers supply of labor and equipment to finish the subgrade preparation with a total of 1,008.75 sq.m. The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

P-154-5.1 AGGREGATE SUBBASE COURSE

This item covers the furnishing, placing and compacting of aggregate subbase coarse on a prepared subgrade in accordance with specifications and shall conform to the lines, grade and cross section shown on the approved plans. The aggregate subbase coarse shall be composed of crushed/uncrushed coarse aggregate bonded with either soil of fine aggregates or both.

P-501-8.1b.1 CEMENT CONCRETE PAVEMENT, 250MM THICK

This item covers the placement of rebars, steel forms and concrete paving constructed on a prepared subbase in accordance with the specifications and shall conform to the lines, grade, thickness and typical cross section shown on the approves plans.

4.05 LANDSCAPING WORKS

This item covers supply of materials, labor and equipment to finish the landscaping works with a total area of 2,112.30 m². The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

4.06 CONCRETE CURBS

4.06.01 Site Works

This item covers supply of materials, labor and equipment to finish the excavation and gravel bedding 104.82 cu.m. The work shall conform to lines, grades and dimensions as indicated on the approved plans. The work shall be directed by the CAAP Project in Charge.

4.06.02 Concrete Works

This item covers supply of materials, labor and equipment to finish the concrete works with a total volume of 80.76 m³, including the fabrication/ installation/ dismantling of rebar and formworks. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

4.07 VPA PAINTING WORKS

This item covers supply of materials and labor to finish the painting works with a total coverage area of 128.89 m². The work shall conform to lines, grades and dimensions as indicated on the approved plans.

4.08 EXTERIOR DRAINAGE SYSTEM

4.08.01 Site Works

This item covers supply of materials, labor, equipment and tools to finish the 392.67 m³ excavation, 209.14m³ backfill and 5.21 m³ gravel bedding. The work shall conform to lines, grades and dimensions as indicated on the approved plans.

4.08.02 Concrete Works (Manhole and Trench Drain)

The work includes supply of materials, labor and equipment/tools needed to complete the concreting components of the structure such as curb inlet manholes, double inlet manholes, surface inlet manholes and trench drains with a total volume of 23.72 m³, including fabrication and installation of reinforced steel bars and formworks as indicated on the approved plans.

4.08.03 Steel works (Manhole and Trench Drain)

The work includes supply of materials, labor and equipment/tools equipment needed to complete the steel works including fabrication and installation of steel grating with total weight of 3,737.96 kgs as indicated on the approved plans.

4.08.04 Masonry Works (Manhole and Trench Drain)

The work includes supply of materials, labor and equipment/tools for laying of concrete hollow blocks, plastering (16mm thk), fabrication and installation of reinforced steel bars with a total coverage area of 242.65 m² as indicated on the approved plans.

4.08.05 Steel Works

The work includes supply of materials, labor and equipment/tools needed to complete the laying and joining of reinforced concrete pipe and PVC pipe a total length of 207.50 li.m. as indicated on the approved plans.

SPL-2 TEMPORARY FACILITIES

The following provisions must be delivered within ten (10) days upon receipt of the Notice to Proceed (NTP).

1.0 STAFF HOUSE

This item covers the Contractor's provision of PMO Staff House on rental basis. The Facility shall be provided with air-con including the supply of kitchen utensils, gas and stove, beds and beddings, and dining sets for the exclusive use of CAAP-PMO in supervising the project. The Contractor shall be responsible for the payment of utility bills (water and electric) for the whole duration of the project.

2.0 SERVICE VEHICLE

This covers the provision of one lease/rent to own service vehicle, brand new latest model 4 x 2 pick-up with cab, air conditioned, automatic transmission, power window, diesel; for the exclusive use of CAAP Engineers supervising the project for the period of Three Hundred Ninety (390) Calendar Days. Land Transportation Office for the service vehicle will be provided by the Contractor. Moreover, driver, fuel and periodic maintenance for the service vehicle will also be provided by the contractor that are incorporated in the contractors overhead cost throughout the duration of the project, but will not be considered as per item.

The service vehicle including the Certificate of Registration and Official Receipt will be transferred and registered in the name of Civil Aviation Authority of the Philippines (CAAP) and will be turned over to the ADMS in good running condition after the completion of the project.

The ADMS will then transport the said service vehicle to the CAAP Central Office and will utilize the same as the Service's Official vehicle.

All scopes of work for this item must be in accordance with the approved plans and specifications. Quality and types of materials must conform to specifications and must be approved by the project in-charge of the CAAP prior to installation.

The contractor shall be responsible in providing safety fence, personal protective equipment (PPE) for staffs and workers, and Safety Inspectors or Safety Engineers on site while construction is ongoing. Regular safety reports should be accomplished.

The contractor shall be responsible for all laboratory, material testing, building and safety permits, survey instruments, energization of the building and tapping of waterline to main necessary in the project implementation. All expenses shall be incorporated in the contractor's overhead cost and shall not be considered as pay item.

GENERAL PROVISIONS

Provisions for staff house, service vehicles, laptops, printers, cameras, plotters, furniture and other materials, devices and equipment under Special Item or Temporary Facilities shall not include OCM & CP.

The contractor shall be responsible in providing safety perimeter fence or security fences, personal protective equipment (PPE) for staffs and workers on site while construction is ongoing. Safety reports should be prepared regularly.

The contractor shall be responsible for all laboratory, material testing, building and safety permits and survey instruments necessary in the project implementation. These expenses shall be incorporated in the contractor's overhead cost and shall not be considered as pay item.

SPECIFICATIONS

Section 105 Mobilization

105-1 Description. This item shall consist of work and operations, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project except as provided in the contract as separate pay items.

105-1.1 Posted notices. Prior to commencement of construction activities the Contractor must post the following documents in a prominent and accessible place where they may be easily viewed by all employees of the prime Contractor and by all employees of subcontractors engaged by the prime Contractor: Equal Employment Opportunity (EEO) Poster "Equal Employment Opportunity is the Law" in accordance with the Office of Federal Contract Compliance Programs Executive Order 11246, as amended; Davis Bacon Wage Poster (WH 1321) - DOL "Notice to All Employees" Poster; and Applicable Davis-Bacon Wage Rate Determination. These notices must remain posted until final acceptance of the work by the Owner.

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The Owner may include additional posted notices as required by local and State law.

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105-2 Basis of measurement and payment. Based upon the contract lump sum price for "Mobilization" partial payments will be allowed as follows:

a. With first pay request, 25%.

b. When 25% or more of the original contract is earned, an additional 25%.

c. When 50% or more of the original contract is earned, an additional 40%.

d. After Final Inspection, Staging area clean-up and delivery of all Project Closeout materials as required by 90-11, the final 10%.

****

Item Mobilization may be added to project at Owner's discretion. Rather than paying Contractor 100% of mobilization on first pay request, many Sponsors have found a payment schedule to be an effective way to reimburse Contractor for mobilization and demobilization. It is not required but it is recommended that the final 10% of this bid item not be paid until the Contractor has cleaned up the project staging area. The payment schedule can be altered, e.g., on small projects may not be appropriate to have more than two (2) payments.

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END OF SECTION 105

Item P-101 Preparation/Removal of Existing Pavements

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The Engineer may add or edit this item as necessary to address project requirements. Coordinate modifications in accordance with Order 5300.1.

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**** DESCRIPTION 101-1 This item shall consist of preparation of existing pavement surfaces for overlay, surface treatments, removal of existing pavement, and other miscellaneous items. The work shall be accomplished in accordance with these specifications and the applicable plans. EQUIPMENT AND MATERIALS 101-2 All equipment and materials shall be specified here and in the following paragraphs or approved by the Resident Project Representative (RPR). The equipment shall not cause damage to the pavement to remain in place. CONSTRUCTION 101-3.1 Removal of existing pavement. The Contractor's removal operation shall be controlled to not damage adjacent pavement structure, and base material, cables, utility ducts, pipelines, or drainage structures which are to remain under the pavement. a. Concrete pavement removal. Full depth saw cuts shall be made perpendicular to the slab surface. The Contractor shall saw through the full depth of the slab including any dowels at the joint, removing the pavement and installing new dowels as shown on the plans and per the specifications. Where the perimeter of the removal limits is not located on the joint and there are no dowels present, the perimeter shall be saw cut the full depth of the pavement. The pavement inside the saw cut shall be removed by methods which will not cause distress in the pavement which is to remain in place. If the material is to be wasted on the airport site, it shall be reduced to a maximum size of [ ]. Concrete slabs that are damaged by under breaking shall be repaired or removed and replaced as directed by the RPR. The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Spall and underbreak repair shall be in accordance with the plans. Any underlaying material that is to remain in place, shall be recompacted and/or replaced as shown on the plans. Adjacent areas damaged during repair shall be repaired or replaced at the Contractor's expense.

Item P-151 Clearing and Grubbing

DESCRIPTION

151-1.1 This item shall consist of clearing or clearing and grubbing, including the disposal of materials, for all areas within the limits designated on the plans or as required by the Resident Project Representative (RPR).

a. Clearing shall consist of the cutting and removal of all trees, stumps, brush, logs, hedges, the removal of fences and other loose or projecting material from the designated areas. The grubbing of stumps and roots will not be required.

b. Clearing and grubbing shall consist of clearing the surface of the ground of the designated areas of all trees, stumps, down timber, logs, snags, brush, undergrowth, hedges, heavy growth of grass

or weeds, fences, structures, debris, and rubbish of any nature, natural obstructions or such material which in the opinion of the RPR is unsuitable for the foundation of strips, pavements, or other required structures, including the grubbing of stumps, roots, matted roots, foundations, and the disposal from the project of all spoil materials resulting from clearing and grubbing.

c. Tree Removal. Tree Removal shall consist of the cutting and removal of isolated single trees or isolated groups of trees, and the grubbing of stumps and roots. The removal of all the trees of this classification shall be in accordance with the requirements for the particular area being cleared.

CONSTRUCTION METHODS

151-2.1 General. The areas denoted on the plans to be **[** cleared **] [** cleared and grubbed **]** shall be staked on the ground by the **[** RPR **] [** Contractor as indicated on the plans **]**.

The removal of existing structures and utilities required to permit orderly progress of work shall be accomplished by local agencies, unless otherwise shown on the plans. Whenever a telephone pole, pipeline, conduit, sewer, roadway, or other utility is encountered and must be removed or relocated, the Contractor shall advise the RPR who will notify the proper local authority or owner to secure prompt action.

151-2.1.1 Disposal. All materials removed by clearing or by clearing and grubbing shall be disposed of **[** in the designated waste disposal area **] [** outside the Airport's limits at the Contractor's responsibility **] [** by burning **]**, except when otherwise directed by the RPR. **[** When burning of material is permitted, it shall be burned under the constant overseeing of a watchman to assure the surrounding vegetation and other adjacent property is not jeopardized. Burning shall be done in accordance with all applicable federal, state and local laws, ordinances, and regulations. The Contractor shall notify the agency having jurisdiction and obtain all approvals in writing before starting any burning operations. **]** As far as practicable, waste concrete and masonry shall be placed on slopes of embankments or channels. When embankments are constructed of such material, this material shall be placed in accordance with requirements for formation of embankments. Any broken concrete or masonry that cannot be used in construction and all other materials not considered suitable for use elsewhere, shall be disposed of by the Contractor. In no case, shall any discarded materials be left in windrows or piles adjacent to or within the airport limits. The manner and location of disposal of materials shall be subject to the approval of the RPR and shall not create an unsightly or objectionable view. When the Contractor is required to locate a disposal area outside the airport property limits, the Contractor shall obtain and file with the RPR permission in writing from the property owner for the use of private property for this purpose.

151-2.1.2 Blasting. **[** Blasting shall not be allowed. **] [** Blasting and explosive storage shall be in accordance with Section 70, paragraph 70-09 and all federal, state, and local safety regulations. Submit notice 15 days prior to starting work. Submit a Blasting Plan, prepared and sealed by a registered professional Engineer, that includes calculations for overpressure and debris hazard. Obtain written approval prior to performing any blasting and notify the RPR 24 hours prior to blasting. Include provisions for storing, handling and transporting explosives as well as for the blasting operations in the plan. The Contractor is responsible for damage caused by blasting operations. **]**

151-2.2 Clearing. The Contractor shall clear the staked or indicated area of all materials as indicated on the plans. Trees unavoidably falling outside the specified clearing limits must be cut up, removed, and disposed of in a satisfactory manner. To minimize damage to trees that are to be left standing, trees shall be felled toward the center of the area being cleared. The Contractor shall preserve and protect from injury all trees not to be removed. The trees, stumps, and brush shall be cut flush with the original ground surface. The grubbing of stumps and roots will not be required.

Fences shall be removed and disposed of as directed by the RPR. Fence wire shall be neatly rolled and the wire and posts stored on the airport if they are to be used again, or stored at a location designated by the RPR if the fence is to remain the property of a local owner or authority.

151-2.3 Clearing and grubbing. In areas designated to be cleared and grubbed, all stumps, roots, buried logs, brush, grass, and other unsatisfactory materials as indicated on the plans, shall be removed, except where embankments exceeding 3-1/2 feet (105 cm) in depth will be constructed outside of paved areas. For embankments constructed outside of paved areas, all unsatisfactory materials shall be removed, but sound trees, stumps, and brush can be cut off flush with the original ground and allowed to remain. Tap roots and other projections over 1-1/2 inches (38 mm) in diameter shall be grubbed out to a depth of at least 18 inches (0.5 m) below the finished subgrade or slope elevation.

Any buildings and miscellaneous structures that are shown on the plans to be removed shall be demolished or removed, and all materials shall be disposed of by removal from the site. The cost of removal is incidental to this item. The remaining or existing foundations, wells, cesspools, and like structures shall be destroyed by breaking down the materials of which the foundations, wells, cesspools, etc., are built to a depth at least 2 feet (60 cm) below the existing surrounding ground. Any broken concrete, blocks, or other objectionable material that cannot be used in backfill shall be removed and disposed of at the Contractor's expense. The holes or openings shall be backfilled with acceptable material and properly compacted.

All holes in embankment areas remaining after the grubbing operation shall have the sides of the holes flattened to facilitate filling with acceptable material and compacting as required in Item P-152. The same procedure shall be applied to all holes remaining after grubbing in areas where the depth of holes exceeds the depth of the proposed excavation.

****

Indicate extent of grading required after clearing, or clearing and grubbing, on the plans including any required surface tolerances.

****

METHOD OF MEASUREMENT

151-3.1 The quantities of clearing as shown by the limits on the plans shall be **[** the number of acres (square meters) or fractions thereof, **] [** per lump sum **]** of land specifically cleared.

151-3.2 The quantities of clearing and grubbing as shown by the limits on the plans shall be **[** the number of acres (square meters) or fractions thereof **] [** per lump sum **]** of land specifically cleared and grubbed.

151-3.3 The quantity of tree removal as shown on the plans shall be the **[** number of individual trees **] [** number of acres (square meters) or fractions thereof **] [** per lump sum **]** of land specifically cleared.

BASIS OF PAYMENT

151-4.1 Payment shall be made at the contract unit price **[** per acre (square meter) or fractions thereof **] [** per lump sum **]** for clearing. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

151-4.2 Payment shall be made at the contract unit price **[** per acre (square meter) **] [** per lump sum **]** for clearing and grubbing. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

151-4.3 Payment shall be made at the contract unit price **[** per number of individual trees **] [** per acre (square meter) **] [** per lump sum **]** for tree removal. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-151-4.1	Clearing – **[** per acre (square meter) or fractions thereof **] [** per lump sum **]**
Item P-151-4.2	Clearing and grubbing - **[** per acre (square meter) or fractions thereof **] [** per lump sum **]**
Item P-152-4.3	Tree Removal – **[** per number of individual trees **] [** per acre (square meter) or fractions thereof **] [** per lump sum **]**

Item P-152 Excavation, Subgrade, and Embankment

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct safety areas, runways, taxiways, aprons, and intermediate areas as well as other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

152-1.2 Classification. All material excavated shall be classified as defined below:

a. Unclassified excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature **[** which is not otherwise classified and paid for under one of the following items **]**.

[b. [___]

[Rock excavation. Rock excavation shall include all solid rock in ledges, in bedded deposits, in unstratified masses, and conglomerate deposits which are so firmly cemented they cannot be removed without blasting or using rippers. All boulders containing a volume of more than 1/2 cubic yard (0.4 m^3) will be classified as "rock excavation." **]**

[Muck excavation. Muck excavation shall consist of the removal and disposal of deposits or mixtures of soils and organic matter not suitable for foundation material. Muck shall include materials that will decay or produce subsidence in the embankment. It may consist of decaying stumps, roots, logs, humus, or other material not satisfactory for incorporation in the embankment. **]**

[Drainage excavation. Drainage excavation shall consist of all excavation made for the primary purpose of drainage and includes drainage ditches, such as intercepting, inlet or outlet ditches; temporary levee construction; or any other type as shown on the plans. **]**

[Borrow excavation. Borrow excavation shall consist of approved material required for the construction of embankments or for other portions of the work in excess of the quantity of usable material available from required excavations. Borrow material shall be obtained from areas designated by the Resident Project Representative (RPR) within the limits of the airport property but outside the normal limits of necessary grading, or from areas outside the airport boundaries. **]**

[Other.]]

****

All material excavated shall be considered "unclassified" unless the Engineer specifies other classifications in the project specifications.

Add or delete the classifications not applicable for the project.

****

152-1.3 Unsuitable excavation. Unsuitable material shall be disposed in designated waste areas as shown on the plans. Materials containing vegetable or organic matter, such as muck, peat, organic silt,

or sod shall be considered unsuitable for use in embankment construction. Material suitable for topsoil may be used on the embankment slope when approved by the RPR.

CONSTRUCTION METHODS

152-2.1 General. Before beginning excavation, grading, and embankment operations in any area, the area shall be cleared or cleared and grubbed in accordance with Item P-151.

The suitability of material to be placed in embankments shall be subject to approval by the RPR. All unsuitable material shall be disposed of in waste areas as shown on the plans. All waste areas shall be graded to allow positive drainage of the area and adjacent areas. The surface elevation of waste areas shall be specified on the plans or approved by the RPR.

When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the RPR notified per Section 70, paragraph 70-20. At the direction of the RPR, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Areas outside the limits of the pavement areas where the top layer of soil has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches (100 mm), to loosen and pulverize the soil. Stones or rock fragments larger than 4 inches (100 mm) in their greatest dimension will not be permitted in the top 6 inches (150 mm) of the subgrade.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the RPR, who shall arrange for their removal if necessary. The Contractor, at their own expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

a. Blasting. [Blasting shall not be allowed. **] [** Blasting will be permitted as directed by the RPR and in accordance with the following:

Blasting will be permitted only when proper precautions are taken for the safety of all persons, work, and property. All damage done to the work or property shall be repaired by the Contractor. The cost of repair is incidental to this item. All operations of the Contractor in connection with the transportation, storage, and use of explosives shall conform to all federal, state and local regulations and explosive manufacturers' instructions, with applicable approved permits reviewed by the RPR. Any approval will not relieve the Contractor of their responsibility in blasting operations.

Where blasting is approved, the Contractor shall employ a vibration consultant, approved by the RPR, to advise on explosive charge weights per delay and to analyze records from seismograph recordings. The seismograph shall be capable of producing a permanent record of the three components of the motion in terms of particle velocity, and in addition shall be capable of internal dynamic calibration.

In each distinct blasting area, where pertinent factors affecting blast vibrations and their effects in the area remain the same, the Contractor shall submit a blasting plan of the initial blasts to the RPR for approval. This plan must consist of hole size, depth, spacing, burden, type of explosives, type of delay sequence, maximum amount of explosive on any one delay period, depth of rock, and depth of overburden if any. The maximum explosive charge weights per delay included in the plan shall not be increased without the approval of the RPR.

The Contractor shall keep a record of each blast: its date, time and location; the amount of explosives used, maximum explosive charge weight per delay period, and, where necessary, seismograph records identified by instrument number and location.

Blasting and explosive storage shall be in accordance with Section 70, paragraph 70-09 and all federal, state, and local safety regulations.

These records shall be made available to the RPR on a monthly basis or in tabulated form at other times as required. **]**

152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Contractor and the RPR has obtained from the Contractor, the survey notes of the elevations and measurements of the ground surface. The Contractor and RPR shall agree that the original ground lines shown on the original topographic mapping are accurate, or agree to any adjustments made to the original ground lines.

[Digital terrain model (DTM) files of the existing surfaces, finished surfaces and other various surfaces were used to develop the design plans.

[Volumetric quantities were calculated by comparing DTM files of the applicable design surfaces and generating Triangle Volume Reports. Electronic copies of DTM files and a paper copy of the original topographic map will be issued to the successful bidder. **]**

[Volumetric quantities were calculated using design cross sections which were created for this project using the DTM files of the applicable design surfaces and generating End Area Volume Reports. Paper copies of design cross sections and a paper copy of the original topographic map will be issued to the successful bidder. **]**

Existing grades on the design cross sections or DTM's, where they do not match the locations of actual spot elevations shown on the topographic map, were developed by computer interpolation from those spot elevations. Prior to disturbing original grade, Contractor shall verify the accuracy of the existing ground surface by verifying spot elevations at the same locations where original field survey data was obtained as indicated on the topographic map. Contractor shall recognize that, due to the interpolation process, the actual ground surface at any particular location may differ somewhat from the interpolated surface shown on the design cross sections or obtained from the DTM's. Contractor's verification of original ground surface, however, shall be limited to verification of spot elevations as indicated herein, and no adjustments will be made to the original ground surface unless the Contractor demonstrates that spot elevations shown are incorrect. For this purpose, spot elevations which are within **[** 0.1 foot (30 mm) **]** of the stated elevations for ground surfaces, or within **[** 0.04 foot (12 mm) **]** for hard surfaces (pavements, buildings, foundations, structures, etc.) shall be considered "no change". Only deviations in excess of these will be considered for adjustment of the original ground surface. If Contractor's

verification identifies discrepancies in the topographic map, Contractor shall notify the RPR in writing at least **[** two weeks **]** before disturbance of existing grade to allow sufficient time to verify the submitted information and make adjustments to the design cross sections or DTM's. Disturbance of existing grade in any area shall constitute acceptance by the Contractor of the accuracy of the original elevations shown on the topographic map for that area. **]**

****

Delete bracketed DTM paragraphs if DTM not used.

**********All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans or by the RPR. All suitable excavated material shall be used in the formation of embankment, subgrade, or other purposes **as** shown on the plans. All unsuitable material shall be disposed of as shown on the plans.

The grade shall be maintained so that the surface is well drained at all times.

When the volume of the excavation exceeds that required to construct the embankments to the grades as indicated on the plans, the excess shall be used to grade the areas of ultimate development or disposed as directed by the RPR. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from borrow areas.

****

During the design phase, perform subsurface investigations to identify existing subsurface conditions to minimize the potential for unforeseen conditions arising during excavation such as the need for dewatering or removal of unsuitable materials.

****

a. Selective grading. When selective grading is indicated on the plans, the more suitable material designated by the RPR shall be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas until it can be placed. The more suitable material shall then be placed and compacted as specified. Selective grading shall be considered incidental to the work involved. The cost of stockpiling and placing the material shall be included in the various pay items of work involved.

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches (300 mm) below the subgrade or to the depth specified by the RPR. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be **[** disposed of at locations shown on the plans. **]** **[** disposed off the airport. The cost is incidental to this item. **]** This excavated material shall be paid for at the contract unit price per cubic yard (per cubic meter) for **[___]**. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts

are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans. Undercutting will be paid as **[** unclassified excavation **] [** rock excavation **]**.

****

The Engineer shall specify the appropriate class of excavation. If rock or muck excavation is not included under paragraph 152-1.2, unclassified excavation should be specified.

The plans shall show details for draining pockets created in rock cuts.

****

c. Over-break. Over-break, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the RPR. All over-break shall be graded or removed by the Contractor and disposed of as directed by the RPR. The RPR shall determine if the displacement of such material was unavoidable and their own decision shall be final. Payment will not be made for the removal and disposal of over-break that the RPR determines as avoidable. Unavoidable over-break will be classified as "Unclassified Excavation."

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished **[** by someone other than the Contractor **] [** by the Contractor as indicated on the plans **]**. All existing foundations shall be excavated at least 2 feet (60 cm) below the top of subgrade or as indicated on the plans, and the material disposed of as directed by the RPR. All foundations thus excavated shall be backfilled with suitable material and compacted as specified for embankment or as shown on the plans.

152-2.3 Borrow excavation. [Borrow areas are not required. **] [** Borrow areas within the airport property are indicated on the plans. Borrow excavation shall be made only at these designated locations and within the horizontal and vertical limits as staked or as directed by the RPR. All unsuitable material shall be disposed of by the Contractor as shown on the plans. All borrow pits shall be opened to expose the various strata of acceptable material to allow obtaining a uniform product. Borrow areas shall be drained and left in a neat, presentable condition with all slopes dressed uniformly. Borrow areas shall not create a hazardous wildlife attractant. **[___]]**

[There are no borrow sources within the boundaries of the airport property. The Contractor shall locate and obtain borrow sources, subject to the approval of the RPR. The Contractor shall notify the RPR at least **[** 15 **]** days prior to beginning the excavation so necessary measurements and tests can be made by the RPR. All borrow pits shall be opened to expose the various strata of acceptable material to allow obtaining a uniform product. Borrow areas shall be drained and left in a neat, presentable condition with all slopes dressed uniformly. Borrow areas shall not create a hazardous wildlife attractant. **[___]]**

****

For on-site borrow areas, the Engineer must determine the acceptability of the borrow material before identifying the area on the plans.

For off-site borrow areas obtained by the Contractor, the RPR must determine the acceptability of the borrow material before its use on the project.

Address hazardous wildlife attractants when opening borrow sites on or near an airport. Add references and sources addressing standing water, permitting, approvals, and zoning. Reference AC 150/5200-33, Hazardous Wildlife Attractants on or near Airports.

****

152-2.4 Drainage excavation. Drainage excavation shall consist of excavating drainage ditches including intercepting, inlet, or outlet ditches; or other types as shown on the plans. The work shall be performed in sequence with the other construction. Ditches shall be constructed prior to starting adjacent excavation operations. All satisfactory material shall be placed in embankment fills; unsuitable material shall be placed in designated waste areas or as directed by the RPR. All necessary work shall be performed true to final line, elevation, and cross-section. The Contractor shall maintain ditches constructed on the project to the required cross-section and shall keep them free of debris or obstructions until the project is accepted.

152-2.5 Preparation of cut areas or areas where existing pavement has been removed. In those areas on which a subbase or base course is to be placed, the top **[** 12 inches (300 mm) **]** of subgrade shall be compacted to not less than **[** 100 % **]** of maximum density for non-cohesive soils, and **[** 95% **]** of maximum density for cohesive soils as determined by ASTM **[___]**. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

****

For subgrade under flexible and rigid pavements, the Engineer shall specify the required compaction depth and density as determined from the geotechnical report and the FAARFIELD Airport Pavement Design compaction recommendations. The current version of FAARFIELD is available at: www.faa.gov/airports/engineering/design_software/

Specify ASTM D698 for areas designated for aircraft with gross weights of 60,000 pounds (27200 kg) or less and ASTM D1557 for areas designated for aircraft with gross weights greater than 60,000 pounds (27200 kg).

For soils with expansive characteristics, the maximum density should be determined in accordance with ASTM D698 regardless of aircraft weight.

****

152-2.6 Preparation of embankment area. All sod and vegetative matter shall be removed from the surface upon which the embankment is to be placed. The cleared surface shall be broken up by plowing or scarifying to a minimum depth of 6 inches (150 mm) and shall then be compacted per paragraph 152-2.10.

Sloped surfaces steeper than one (1) vertical to four (4) horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches (300 mm) and compacted as specified for the adjacent fill.

****

The Engineer shall include benching details on the plans based on the type of material, degree of consolidation of the material, and the degree of homogeneity of the material. The minimum width of the bench shall be sufficient to accommodate construction equipment.

The Engineer should consider the consolidation of embankments over 4 feet (1.2 m) and consider installation of monitoring equipment such as settlement plates and inclinometers for deep fills.

****

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-2.7 Control Strip. The first half-day of construction of subgrade and/or embankment shall be considered as a control strip for the Contractor to demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of this specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches (300 mm) upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor's expense. Full operations shall not begin until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the RPR.

152-2.8 Formation of embankments. The material shall be constructed in lifts as established in the control strip, but not less than 6 inches (150 mm) nor more than 12 inches (300 mm) of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications.

The lifts shall be placed, to produce a soil structure as shown on the typical cross-section or as directed by the RPR. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained due to rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

The material in each lift shall be within ±2% of optimum moisture content before rolling to obtain the prescribed compaction. The material shall be moistened or aerated as necessary to achieve a uniform moisture content throughout the lift. Natural drying may be accelerated by blending in dry material or manipulation alone to increase the rate of evaporation.

The Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content to achieve the specified embankment density.

The [RPR][contractor] will take samples of excavated materials which will be used in embankment for testing and develop a Moisture-Density Relations of Soils Report (Proctor) in accordance with **[** ASTM D698 **] [** D 1557 **]**. A new Proctor shall be developed for each soil type based on visual classification.

Density tests will be taken by the [RPR][contractor] for every **[** 3,000 **]** square yards of compacted embankment for each lift which is required to be compacted, or other appropriate frequencies as determined by the RPR.

If the material has greater than 30% retained on the 3/4-inch (19.0 mm) sieve, follow AASHTO T-180 Annex Correction of maximum dry density and optimum moisture for oversized particles.

****

It is recommended that density tests be made for each 3,000 square yards (2500 square meters) of material placed per lift. Testing frequency should be determined by the Geotechnical Engineer. The Engineer may specify other frequencies as appropriate to the job size. If necessary to apply special controls to the moisture content of the soil during or after compaction to ensure strength because of the presence of expansive soils or other unusually sensitive soils), the Engineer must specify the appropriate moisture content. The moisture limitations shall be specified using acceptable moisture ranges as determined by ASTM D698 or ASTM D1557. Refer to FAA RD-76-66, Design and Construction of Airport Pavements on Expansive Soils, for additional guidance.

If the material has greater than 30% retained on the 3/4-inch (19.0 mm) sieve, follow the methods in the ASTM D698 or D1557; or AASHTO T180 Annex for correction of maximum dry density and optimum moisture for oversized particles.

If nuclear density machines are to be used for density determination, the machines shall be calibrated in accordance with ASTM D6938.

Include testing frequencies per square yard for density and moisture acceptance tests.

****

Rolling operations shall be continued until the embankment is compacted to not less than **[** 100% **]** of maximum density for non-cohesive soils, and **[** 95% **]** of maximum density for cohesive soils as determined by ASTM **[___]**. Under all areas to be paved, the embankments shall be compacted to a depth of **[___]** and to a density of not less than **[___]** percent of the maximum density as determined by ASTM **[___]**. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

****

For subgrade under flexible and rigid pavements, the Engineer shall specify the required compaction depth and density as determined from the geotechnical report and the FAARFIELD Airport Pavement Design compaction recommendations. The current version of FAARFIELD is available at: www.faa.gov/airports/engineering/design_software/

Specify ASTM D698 for areas designated for aircraft with gross weights of 60,000 pounds (27200 kg) or less and ASTM D1557 for areas designated for aircraft with gross weights greater than 60,000 pounds (27200 kg).

For soils with expansive characteristics, the maximum density should be determined in accordance with ASTM D698 regardless of aircraft weight.

****

On all areas outside of the pavement areas, no compaction will be required on the top **[** 4 inches (100 mm) **]** which shall be prepared for a seedbed in accordance with **[** Item T-901 **] [** T-906 **]**.

The in-place field density shall be determined in accordance with [ASTM D1556] [ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938.]. The [RPR shall perform all density tests] [Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the RPR for acceptance]. If the specified density is not attained, the area represented by the test or as designated by the RPR shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

Compaction areas shall be kept separate, and no lift shall be covered by another lift until the proper density is obtained.

During construction of the embankment, the Contractor shall route all construction equipment evenly over the entire width of the embankment as each lift is placed. Lift placement shall begin in the deepest

portion of the embankment fill. As placement progresses, the lifts shall be constructed approximately parallel to the finished pavement grade line.

When rock, concrete pavement, asphalt pavement, and other embankment material are excavated at approximately the same time as the subgrade, the material shall be incorporated into the outer portion of the embankment and the subgrade material shall be incorporated under the future paved areas. Stones, fragmentary rock, and recycled pavement larger than 4 inches (100 mm) in their greatest dimensions will not be allowed in the top 12 inches (300 mm) of the subgrade. Rockfill shall be brought up in lifts as specified or as directed by the RPR and the finer material shall be used to fill the voids forming a dense, compact mass. Rock, cement concrete pavement, asphalt pavement, and other embankment material shall not be disposed of except at places and in the manner designated on the plans or by the RPR.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in lifts of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in lifts not exceeding 2 feet (60 cm) in thickness. Each lift shall be leveled and smoothed with suitable equipment by distribution of spalls and finer fragments of rock. The lift shall not be constructed above an elevation 4 feet (1.2 m) below the finished subgrade.

[There will be no separate measurement of payment for compacted embankment. All costs incidental to placing in lifts, compacting, discing, watering, mixing, sloping, and other operations necessary for construction of embankments will be included in the contract price for excavation, borrow, or other items. **] [** Payment for compacted embankment will be made under embankment in-place and no payment will be made for excavation, borrow, or other items. **]**

152-2.9 Proof rolling. **[** Not Used **]** The purpose of proof rolling the subgrade is to identify any weak areas in the subgrade and not for compaction of the subgrade. **[** Before start of embankment, **] [** and **] [** After compaction is completed, **]** the subgrade area shall be proof rolled with a **[[** 20 ton (18.1 metric ton) **]** Tandem axle Dual Wheel Dump Truck loaded to the legal limit with tires inflated to **[** 80/100/150 psi (0.551 MPa/0.689 MPa/1.034 MPa) **]] [[**___**]** ton Proof Roller with tires spaced not more than 32 inches (0.8 m) on-center with tires inflated to **[** 100/125/150 psi (0.689 MPa/0.861 MPa/1.034 MPa) **]]** in the presence of the RPR. Apply a minimum of **[**___**]** coverage, or as specified by the RPR, under pavement areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch (25 mm) or show permanent deformation greater than 1 inch (25 mm) shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications. Removal and replacement of soft areas is incidental to this item.

****

The Engineer shall select the proof-rolling method and number of coverages.

Drawings should be checked to ensure that any supplementary information required by this paragraph has been shown and that there is no conflict between the drawings and the specifications.

When proof rolling not used, delete all text from Paragraph 152-2.9 and insert Not Used.

****

152-2.10 Compaction requirements. The subgrade under areas to be paved shall be compacted to a depth of **[** 12 inches (300 mm) **]** and to a density of not less than **[** 100 **]** percent of the maximum dry density as determined by ASTM **[** D1557 **] [** D698 **]**. The subgrade in areas outside the limits of the pavement areas shall be compacted to a depth of **[** 12 inches (300 mm) **]** and to a density of not less than **[** 95 **]** percent of the maximum density as determined by ASTM **[** D698 **]**.

The material to be compacted shall be within ±2% of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils). When the material has greater than 30 percent retained on the ¾ inch (19.0 mm) sieve, follow the **[** methods in **[** ASTM D698 **] [** ASTM D1557 **]] [** procedures in AASHTO T180 Annex for correction of maximum dry density and optimum moisture for oversized particles. **]** Tests for moisture content and compaction will be taken at a minimum of **[**___**]** S.Y. of subgrade. All quality assurance testing shall be done by **[** the RPR. **] [** the Contractor's laboratory in the presence of the RPR, and density test results shall be furnished upon completion to the RPR for acceptance determination. **]**

****

The Engineer shall specify the required compaction depths and densities as determined from FAARFIELD Airport Pavement Design Report. The current version of FAARFIELD is available at: https://www.faa.gov/airports/engineering/design_software/

The Engineer shall specify ASTM D698 for areas designated for aircraft with gross weights of 60,000 pounds (27200 kg) or less, and ASTM D1557 for areas designated for aircraft with gross weights greater than 60,000 pounds (27200 kg).

If the material has greater than 30% retained on the 3/4-inch (19.0 mm) sieve, follow the methods in the ASTM D698 or D1557; or AASHTO T180 Annex for correction of maximum dry density and optimum moisture for oversized particles.

Include testing frequencies per square yard (square meter) for density and moisture acceptance tests.

****

The in-place field density shall be determined in accordance with **[** ASTM D1556 **] [** ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938 within 12 months prior to its use on this contract. The gage shall be field standardized daily. **]**

Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

If the specified density is not attained, the entire lot shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the RPR and the finished subgrade shall be maintained.

152-2.11 Finishing and protection of subgrade. Finishing and protection of the subgrade is incidental to this item. Grading and compacting of the subgrade shall be performed so that it will drain readily. All low areas, holes or depressions in the subgrade shall be brought to grade. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans. All ruts or rough places that develop in the completed subgrade shall be graded, re-compacted, and retested. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes.

The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been accepted by the RPR.

152-2.12 Haul. All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

The Contractor's equipment shall not cause damage to any excavated surface, compacted lift or to the subgrade as a result of hauling operations. Any damage caused as a result of the Contractor's hauling operations shall be repaired at the Contractor's expense.

The Contractor shall be responsible for providing, maintaining and removing any haul roads or routes within or outside of the work area, and shall return the affected areas to their former condition, unless otherwise authorized in writing by the Owner. No separate payment will be made for any work or materials associated with providing, maintaining and removing haul roads or routes.

152-2.13 Surface Tolerances. In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

a. **Smoothness.** The finished surface shall not vary more than +/- ½ inch (12 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.

b. Grade. The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within +/-0.05 feet (15 mm) of the specified grade.

On safety areas, turfed areas and other designated areas within the grading limits where no subbase or base is to placed, grade shall not vary more than 0.10 feet (30 mm) from specified grade. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-2.14 Topsoil. When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall be located as shown on the plans and the approved CSPP, and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the RPR, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further re-handling.

****

Refer to AC 150/5370-2, Operational Safety on Airports During Construction when developing the Construction Safety and Phasing Plan (CSPP).

****

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as shown on the plans and as required in Item T-905. Topsoil shall be paid for as provided in Item T-905. No direct payment will be made for topsoil under Item P-152.

METHOD OF MEASUREMENT

152-3.1 Measurement for payment specified by the cubic yard (cubic meter) shall be computed by the **[** average end areas of design cross sections **] [** the comparison of digital terrain model (DTM) surfaces **]** for computation of neat line design quantities **]**. The end area is that bound by the original ground line established by field cross-sections and the final theoretical pay line established by cross-sections shown on the plans, subject to verification by the RPR.

****

The Engineer may edit method of volume calculations. The method of calculating volumes must meet or exceed the accuracy of the average end area method. The method of field verification should be described and must meet or exceed what is currently specified for the average end area method.

****

152-3.1 [The quantity of **[** unclassified **] [** rock **] [** muck **] [** drainage **]** excavation to be paid for shall be the number of cubic yards (cubic meters) measured in its original position. Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed. **]**

[152-3.2 The quantity of embankment in place shall be the number of cubic yards (cubic meters) measured in its final position. **]**

[152-3.3 [Stockpiled material shall be paid for on the basis of the number of cubic yards (cubic meters) measured in the stockpiled position. **] [** Stockpiled material shall not be measured for payment in the stockpiled position. **]]**

BASIS OF PAYMENT

152-4.1 [Unclassified excavation **] [** Rock Excavation **] [** Muck Excavation **] [** Drainage Excavation **] [** Stockpiled Material **]** payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

[152-4.2 For embankment in place, payment shall be made at the contract unit price per cubic yard (cubic meter). This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item. **]**

[152-4.3 Stockpiled material shall be paid for on the basis of the number of cubic yards (cubic meters) measured in the stockpiled position. **]**

Payment will be made under:

[Item P-152-4.1 **[[** Unclassified **] [** Rock **] [** Muck **] [** Drainage **] [** Excavation **] [** Stockpiled material **]]** - per cubic yard (cubic meter) **]**

[Item P-152-4.2 Embankment in place - per cubic yard (cubic meter) **]**

[Item P-152-4.3 Stockpiled material – per cubic yard (cubic meter) **]**

Item P-154 Subbase Course

DESCRIPTION

154-1.1 This item shall consist of a subbase course composed of granular materials constructed on a prepared subgrade or underlying course in accordance with these specifications, and in conformity with the dimensions and typical cross-section shown on the plans.

MATERIALS

154-2.1 Materials. The subbase material shall consist of hard durable particles or fragments of granular aggregates. This material will be mixed or blended with fine sand, clay, stone dust, or other similar binding or filler materials produced from approved sources. This mixture must be uniform and shall comply with the requirements of these specifications as to gradation, soil constants, and shall be capable of being compacted into a dense and stable subbase. The material shall be free from vegetative matter, lumps or excessive amounts of clay, and other objectionable or foreign substances. Pit-run material may be used, provided the material meets the gradation requirements specified.

****

Where environmental conditions (temperature and availability of free moisture) indicate non-frost susceptible material is not required to prevent potential damage from frost action, the paragraph regarding the 0.02 mm and maximum passing 5% passing the No. 200 sieve should be deleted. The Engineer should reference the geotechnical report.

****

Gradation Requirements

Sieve designation (square openings) as per ASTM C136 and ASTM D422	Percentage by weight passing sieves
3 inch (75 mm)	100
No. 10 (2.0 mm)	20-100
No. 40 (0.450 mm)	5-60
No. 200 (0.075 mm)	0-8

The portion of the material passing the No. 40 (0.450 mm) sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than six (6) when tested in accordance with ASTM D4318.

[The material finer than 0.02 mm shall be limited to a maximum of 3% and the maximum allowable material passing the No. 200 sieve shall be reduced from 0-8% to 0-5%. Testing per ASTM D422 will be required for the percentage passing the 0.02 mm particle size once per lot. **]**

154-2.2 Sampling and testing. Material used on the project shall be sampled per ASTM D75 and tested per ASTM C136 and ASTM C117. Results shall be furnished to the Engineer by the Contractor prior to the start of construction and once per day during construction.

****

Include testing frequencies for the particle size distribution for preliminary and minimum of one per day during construction.

****

CONSTRUCTION METHODS

154-3.1 General. The subbase course shall be placed where designated on the plans or as directed by the Engineer. The material shall be shaped and thoroughly compacted within the tolerances specified.

Granular subbases which, due to grain sizes or shapes, are not sufficiently stable to support the construction equipment without movement, shall be mechanically stabilized to the depth necessary to provide stability as directed by the Engineer. The mechanical stabilization shall include the addition of a fine-grained medium to bind the particles of the subbase material sufficiently to furnish a bearing strength, so the course will not deform under construction equipment traffic. The addition of the binding medium to the subbase material shall not increase the soil constants of that material above the specified limits.

154-3.2 Operation in pits. The subbase material shall be obtained from pits or sources that have been approved by the Engineer. The material in the pits shall be excavated and handled to produce a uniform and satisfactory product. All work involved in clearing and stripping pits and handling unsuitable material encountered shall be performed by the Contractor. The cost of this work is incidental to this item.

154-3.3 Preparing underlying course. Prior to constructing the subbase course, clean the underlying course or subgrade of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Correct ruts, or soft yielding spots, in the underlying courses and subgrade areas having inadequate compaction and deviations of the surface from the specified requirements by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D2487, the surface shall be stabilized prior to placement of the overlying course. Accomplish stabilization by mixing the overlying course material into the underlying course, and compacting by approved methods. **[** The stabilized material shall be considered as part of the underlying course and shall meet all requirements for the underlying course. **]** The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until the overlying course is placed. The course shall be checked and accepted by the Engineer before placing and spreading operations are started.

To protect the subgrade and to ensure proper drainage, the spreading of the subbase shall begin along the centerline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

154-3.4 Materials acceptance in existing condition. When the entire subbase material is in a uniform and satisfactory condition at approximately the required moisture content, the approved material may be moved directly to the spreading equipment for placing. The material may be obtained from gravel pits, stockpiles, or may be produced from a crushing and screening plant with proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. The intent of the specifications is to secure materials that will not require further mixing. The moisture content of the material shall be approximately that required to obtain maximum density. Any minor deficiency or excess in moisture content may be corrected by surface sprinkling or by aeration. Some mixing or aeration may be required prior to rolling to obtain the required moisture content. Blading or dragging, if necessary, shall be performed to obtain a smooth uniform surface true to line and grade.

154-3.5 Plant mixing. When materials from several sources will be blended and mixed, the subbase material shall be processed in a **[** central **] [** travel **]** mixing plant. The subbase material, together with any blended material, shall be thoroughly mixed with the required amount of water. After the mixing is complete, the material shall be transported to and spread on the underlying course without undue loss of moisture content.

[154-3.5.1 Mixed in place. When materials from different sources are to be proportioned and mixed or blended in place, the relative proportions of the components of the mixture shall be as designated by the Engineer.

The subbase material shall be deposited and spread evenly to a uniform thickness and width. Then the binder, filler or other material shall be deposited and spread evenly over the first layer. There shall be as many layers of materials added as the Engineer may direct to obtain the required subbase mixture.

When the required amount of materials have been placed, they shall be thoroughly mixed and blended by means of graders, discs, harrows, rotary tillers, supplemented by other suitable equipment if necessary. The mixing shall continue until the mixture is uniformly blended. Areas of segregated material shall be corrected by the addition of binder or filler material and by thorough remixing. Water shall be uniformly applied prior to and during the mixing operations, if necessary, to maintain the material at its required moisture content. When the mixing and blending has been completed, the material shall be spread in a uniform layer which, when compacted, will meet the requirements of thickness and typical cross-section. **]**

****

If mixing in place will not provide a consistent subbase material, delete paragraph 154-3.5.1.

****

154-3.6 General methods for placing. The subbase course shall be constructed in layers of not less than inches (75 mm) nor more than 8 inches (200 mm) of compacted thickness. The subbase material shall be deposited and spread evenly to a uniform thickness and width. The material, as spread, shall be of uniform gradation with no pockets of fine or coarse materials. The subbase, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square yards (1700 sq m) in advance of

the rolling. Any necessary sprinkling shall be kept within this limit. No material shall be placed in snow or on a soft, muddy, or frozen course.

When more than one layer is required, the construction procedure described here shall apply similarly to each layer.

During the placing and spreading, sufficient caution shall be exercised to prevent the incorporation of subgrade, shoulder, or foreign material in the subbase course mixture.

154-3.7 Finishing and compacting. After spreading or mixing, the subbase material shall be thoroughly compacted by rolling and sprinkling, when necessary. Sufficient rollers shall be furnished to adequately handle the rate of placing and spreading of the subbase course.

The field density of the compacted material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the subbase material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with **[___]**. The in-place field density shall be determined in accordance with **[** ASTM D1556. Test in accordance with ASTM D4718 if greater than 30% is retained on the 3/4" sieve. **] [** or **] [** ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. **]**. The moisture content of the material at the start of compaction shall be within ±2% of the optimum moisture content. All testing shall be done by **[** the Engineer. **] [** the Contractor's laboratory in the presence of the Engineer, and density test results shall be furnished upon completion to the Engineer for acceptance determination. **]**

****

The Engineer shall specify ASTM D698 for areas designated for aircraft with gross weights of 60,000 pounds (27200 kg) or less and ASTM D1557 for areas designated for aircraft with gross weights greater than 60,000 pounds (27200 kg).

Include testing frequencies per square yard or cubic yard for density and moisture acceptance tests.

Material meeting the requirements of Item P-154 may be free-draining which may prevent the material from retaining sufficient moisture to meet the compaction moisture requirements of this paragraph. If this situation occurs during field operations, minimum moisture content should be established for placement of the material.

****

The course shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the subbase. When the rolling develops irregularities that exceed 3/8 inch (9 mm) when tested with a 12 feet (3.7 m) straightedge, the irregular surface shall be loosened and then refilled with the same kind of material as that used in constructing the course and again rolled as required above.

Along places inaccessible to rollers, the subbase material shall be tamped thoroughly with mechanical or hand tampers.

Sprinkling during rolling, if necessary, shall be by equipment approved by the Engineer. Water shall not be added in manner or quantity that allows free water to reach the underlying layer and cause it to become soft.

154-3.8 Surface tolerance. The surface of the top layer shall show no deviations in excess of 3/8 inch (9 mm) when tested with a 12-foot (3.7-m) straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at **[** 50 **] [**___**]** foot **[** 15 **] [**___**]** meter intervals. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

154-3.9 Thickness control. The completed thickness of the course(s) shall be in accordance with the thickness and grade indicated on the drawings. The completed course shall not be more than 1/2 inch (12 mm) deficient in thickness nor more than 1/2 inch (12 mm) above or below the established grade. Where any of these tolerances are exceeded, correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness is 1/2 inch (12 mm) or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 1/2 inch (12 mm). The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch (6 mm) of the thickness shown. The thickness of the completed subbase course shall be determined by **[** depth tests or sample holes taken at intervals so each test shall represent no more than 500 square yards (420 sq m) **] [** by survey **]**.

****

When subbase or rigid pavement base courses are constructed less than 6 inches (150 mm) in total thickness, a deficiency of 1/2 inch (12 mm) in the thickness of any area of such paving is considered excessive. Applicable to job conditions, the thickness tolerance provisions will be modified as required, restricting all deficiencies to less than 1/4 inch (6 mm).

****

154-3.10 Protection. Work on subbase course shall not be conducted during freezing temperatures nor when the subgrade is wet. When the subbase material contains frozen material or when the underlying course is frozen, the construction shall be stopped. The Contractor shall protect and maintain the subgrade from yielding until the subbase is accepted.

154-3.11 Maintenance. The Contractor shall maintain the completed course in a satisfactory condition until accepted by the Engineer.

METHOD OF MEASUREMENT

154-4.1 Subbase course shall be measured by the number of **[** square yards (meters) **] [** cubic yards (cubic meters) **]** of subbase course material placed, compacted, and accepted in the completed course. The quantity of subbase course material shall be measured in final position based upon **[** depth tests or cores taken as directed by the Engineer, at the rate of one (1) depth test for each 500 square yard (420 sq m) of subbase course **] [** by means of average end areas on the complete work computed from elevations to the nearest 0.01 foot (3 mm) **]**. On individual depth measurements, thicknesses more than 1/2 inch (12 mm)

in excess of that shown on the plans shall be considered as the specified thickness plus 1/2 inch (12 mm) in computing the yardage for payment. Subbase materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

154-5.1 Payment shall be made at the contract unit price per **[** square yard (meter) **] [** cubic yard (cubic meter) **]** for subbase course. This price shall be full compensation for furnishing all materials; for all preparation, hauling, and placing of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-154-5.1	Subbase Course - per **[** square yard (meter) **] [** cubic yard (cubic meter) **]**

TESTING REQUIREMENTS

ASTM C117	Standard Test Method for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-154

Item P-208 Aggregate Base Course

208-1.1 This item shall consist of a base course composed of course aggregate bonded with fine aggregate base. It shall be constructed on a prepared subgrade or subbase course per these specifications and shall conform to the dimensions and typical cross-section shown on the plans.

MATERIALS

208-2.1 Aggregate base. The aggregate base material shall consist of both fine and coarse aggregate. Material shall be clean, sound, durable particles and fragments of stone or gravel, crushed stone, **[** crushed slag, **]** or crushed gravel mixed or blended with sand, screenings, or other similar materials produced from approved sources. The aggregate shall be free from lumps of clay, organic matter, and other objectionable materials or coatings.

[Crushed slag shall be air-cooled, blast furnace product consisting of angular fragments reasonably uniform in density and quality and shall be reasonably free from thin, elongated, or soft pieces, dirt, and other objectionable matter. It shall weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter) as determined by ASTM C29. **]**

Crushed aggregate shall consist of clean, sound, durable stones and rock crushed to specified size and shall be free from excess soft or disintegrated pieces, dirt, or other objectionable matter. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as nearly constant and uniform as practicable.

The coarse aggregate portion, defined as the portion retained on the No. 4 sieve, shall not have a loss of greater than 50% when tested per ASTM C131. The sodium sulfate soundness loss shall not exceed 12%, or the magnesium sulfate soundness loss shall not exceed 18%, after five cycles, when tested in accordance with ASTM C88. The aggregate shall have at least 60% by weight of particles with at least two fractured faces and 75% with at least one fractured face per ASTM D5821. The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces. The aggregate shall contain no more than 15%, by weight, of flat, elongated, or flat and elongated particles per ASTM D4791. A flat particle is one having a ratio of width to thickness greater than three (3); an elongated particle is one having a ratio of length to width greater than three (3).

The fine aggregate portion, defined as the portion passing the No. 4 sieve, produced in crushing operations shall be incorporated in the base material to the extent permitted by the gradation requirements.

a. Sampling and testing for initial aggregate base requirements. Samples shall be taken by the Contractor in the presence of the Engineer. Material shall meet the requirements in paragraph 208-2.1 and 208-2.2. This sampling and testing will be the basis for approval of the aggregate base quality requirements. **[___]**

****

The Engineer may require additional sampling points for quality requirements. The Engineer shall define when additional sampling points are needed in the above paragraph.

****

208-2.2 Gradation requirement. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine as defined by ASTM D2487 and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa. The fraction of material passing the No. 200 (0.075 mm) sieve shall not exceed one-half the fraction passing the No. 40 (0.45 mm) sieve. The portion of the filler and binder, including any blended material, passing the No. 40 (0.45 mm) sieve shall have a liquid limit not more than 25 and a plasticity index not more than five (5) when tested per ASTM D4318.

[The material finer than 0.02 mm shall be limited to a maximum of 3% and the maximum allowable material passing the No. 200 sieve shall be reduced from 0-8% to 0-5%. Testing per ASTM D422 will be required for the percentage passing the 0.02 mm particle size once per lot. **]**

Requirements for Gradation of Aggregate Base

Sieve Size	**Design Range Percentage by Weight**	**Contractor's Final Gradation**	**Job Control Grading Band Tolerances for Contractor's Final Gradation Percent**
2 inch (50 mm)	*		0
1-1/2 inch (38 mm)	*		±5
1 inch (25 mm)	*		±8
3/4 inch (19 mm)	*		±8
No. 4 (4.75 mm)	*		±8
No. 40 (0.45 mm)	*		±5
No. 200 (0.075 mm)	*		±3

****

For areas subject to frost, the Engineer shall include the bracketed statement above.

The Engineer shall select the required gradation from the following table and replace the asterisks in the column titled "Design Range Percentage by Weight." Leave the column titled "Contractor's Final Gradation" blank. The Contractor's Final Gradation approved by the Engineer will be used to populate this column and the "Job Control Grading Band Tolerances for Contractor's Final Gradation" will apply to this column for the project duration.

Requirements for Gradation of Aggregate Base

Sieve Designation	Percentage by weight passing sieves		
	2″ maximum	**1-1/2″ maximum**	**1″ maximum**
2 inch (50 mm)	100	--	--
1-1/2 inch (38 mm)	70-100	100	--
1 inch (25 mm)	55-85	70-100	100
3/4 inch (19 mm)	50-80	55-85	70-100
No. 4 (4.75 mm)	30-60	30-60	35-65
No. 40 (0.45 mm)	10-30	10-30	10-25
No. 200 (0.075 mm)	5-15	5-15	5-15

****

The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

a. Sampling and testing for gradation. The Contractor shall take at least [two] aggregate base samples per lot to check the final gradation. Sampling shall be per ASTM D75. The lot will be consistent with the lot size used for density. The samples shall be taken from the in-place, un-compacted material in the presence of the Engineer. Sampling points and intervals will be designated by the Engineer.

CONSTRUCTION METHODS

208-3.1 Operations in pits and quarries. All work involved in clearing and stripping pits and quarries, including handling of unsuitable material, shall be performed by the Contractor. All material shall be handled in a manner that shall secure a uniform and satisfactory base product. The base course material shall be obtained from sources that have been approved by the Engineer.

208-3.2 Preparing underlying subgrade and/or subbase. The underlying subgrade and/or subbase shall be checked and accepted by the Engineer before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with P-152, at the Contractor's expense, may be required by the Engineer if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

208-3.3 Production. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 208-3.5, the approved material may be transported directly to the spreading equipment.

208-3.4 Placing. The aggregate base material shall be placed and spread on the prepared underlying subgrade and/or subbase and compacted in layers to the thickness shown on the plans. Work shall progress without interruption. The material shall be deposited and spread in lanes in a uniform layer without segregation to such loose depth that, when compacted, the layer shall have the specified thickness. The aggregate base course shall be constructed in layers of uniform thickness of not less than 3 inches (75 mm) nor more than 6 inches (150 mm) of compacted thickness. The aggregate as spread shall be of uniform grading with no pockets of fine or coarse materials. The aggregate, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square yards (1700 sq m) in advance of the rolling. Any necessary sprinkling shall be kept within these limits. Care shall be taken to prevent cutting into the underlying layer during spreading. No material shall be placed in snow or on a soft, muddy, or frozen course. The aggregate base material shall be spread by spreader boxes or other approved devices. This equipment shall have positive thickness controls that spread the aggregate in the required amount to avoid or minimize the need for hand manipulation. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

When more than one layer is required, the construction procedure described here shall apply similarly to each layer.

208-3.5 Compaction. Immediately upon completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density. The moisture content of the material during placing operations shall be within ±2 percentage points of the optimum moisture content as determined by ASTM **[___]**.

****

If nuclear density machines are to be used for density determination, the field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated per ASTM D6938.

****

208-3.6 Acceptance sampling and testing for density. Aggregate base course shall be accepted for density on a lot basis. A lot will consist of one day's production if it does not exceed 2400 square yards (2000 sq m). A lot will consist of one-half day's production if a day's production is between 2400 and 4800 square yards (2000 and 4000 sq m). The **[** Engineer shall perform all density tests **]** **[** Contractor's laboratory shall perform all density tests in the Engineer's presence and provide the test results upon completion to the Engineer for acceptance **]**.

Each lot shall be divided into two equal sublots. One test shall be made for each sublot and shall consist of the average of two random locations for density determination. Sampling locations will be determined by the Engineer on a random basis per ASTM D3665.

Each lot shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM **[___]**. The in-place field density shall be determined per **[** ASTM D1556. Test in accordance with ASTM D4718 if greater than 30% is retained on the 3/4" sieve. **] [** ASTM D2167 **] [** ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. **]**. If the specified density is not attained, the entire lot shall be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached.

****

The Engineer may specify ASTM D698 for areas designated for aircraft with gross weights of less than 60,000 pounds (27200 kg). The Engineer shall specify ASTM D1557 for areas designated for aircraft with gross weights of 60,000 pounds (27200 kg) or greater.

****

208-3.7 Surface tolerances. After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and recompacted to grade until the required smoothness and accuracy are obtained and approved by the Engineer. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8 inch (9 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.

b. Accuracy. The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within +0 and -1/2 inch (12 mm) of the specified grade.

208-3.8 Thickness control. The thickness of the base course shall be within +0 and -1/2 inch (12 mm) of the specified thickness as determined by depth tests taken by the Contractor in the presence of the

Engineer. Tests shall be taken at intervals representing no more than 300 square yards (250 sq m) per test. Where the thickness is deficient by more than 1/2 inch (12 mm), the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches (75 mm), adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

****

The Engineer may modify the above thickness control paragraph to permit the thickness determination by survey. Survey shall be required before and after placement of the base. The survey interval should be specified based on the size of the project.

****

208-3.9 Protection. Perform construction when the atmospheric temperature is above 35°F (2°C). When the temperature falls below 35°F (2°C), protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements. When the aggregates contain frozen materials or when the underlying course is frozen or wet, the construction shall be stopped. Hauling equipment may be routed over completed portions of the base course, provided no damage results. Equipment shall be routed over the full width of the base course to avoid rutting or uneven compaction. The Engineer will stop all hauling over completed or partially completed base course when, in the Engineer's opinion, such hauling is causing damage. Any damage to the base course shall be repaired by the Contractor at the Contractor's expense.

208-3.10 Maintenance. The Contractor shall maintain the base course in a satisfactory condition until the full pavement section is completed and accepted by the Engineer. The surface shall be kept clean and free from foreign material and properly drained at all times. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any base course that is not paved over prior to the onset of winter shall be retested to verify that it still complies with the requirements of this specification. Any area of base course that is damaged shall be reworked or replaced as necessary to comply with this specification.

Equipment used in the construction of an adjoining section may be routed over completed base course, if no damage results and the equipment is routed over the full width of the base course to avoid rutting or uneven compaction.

THE CONTRACTOR SHALL REMOVE ALL SURVEY AND GRADE HUBS FROM THE BASE COURSES PRIOR TO PLACING ANY BITUMINOUS SURFACE COURSE.

METHOD OF MEASUREMENT

208-4.1 The quantity of aggregate base course shall be measured by the number of **[** square yards (square meters) **] [** cubic yards (cubic meters) **]** of material actually constructed and accepted by the

Engineer as complying with the plans and specifications. Base materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

208-5.1 Payment shall be made at the contract unit price per **[** square yards (square meters) **] [** cubic yard (cubic meter) **]** for aggregate base course. This price shall be full compensation for furnishing all materials and for all operations, hauling, placing, and compacting of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-208-5.1	Aggregate Base Course - per **[** square yards (square meters) **]** **[** cubic yard (cubic meter) **]**

TESTING REQUIREMENTS

ASTM C29	Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2700 kN-m/m^3))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D3665	Standard Practice for Random Sampling of Construction Materials

ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-208

Item P-209 Crushed Aggregate Base Course

DESCRIPTION

209-1.1 This item consists of a base course composed of crushed aggregate base constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross-sections shown on the plans.

MATERIALS

209-2.1 Crushed aggregate base. Crushed aggregate shall consist of clean, sound, durable particles of crushed stone, crushed gravel, **[** or crushed slag **]** and shall be free from coatings of clay, silt, organic material, clay lumps or balls or other deleterious materials or coatings. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable. Fine aggregate portion, defined as the portion passing the No. 4 (4.75 mm) sieve shall consist of fines from the coarse aggregate crushing operation. The fine aggregate shall be produced by crushing stone, gravel, **[** or slag **]** that meet the coarse aggregate requirements for wear and soundness. Aggregate base material requirements are listed in the following table.

Crushed Aggregate Base Material Requirements

Material Test	Requirement	Standard
Coarse Aggregate		
Resistance to Degradation	Loss: 45% maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate **or** Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Percentage of Fractured Particles	Minimum 90% by weight of particles with at least two fractured faces and 98% with at least one fractured face[1]	ASTM D5821
Flat Particles, Elongated Particles, or Flat and Elongated Particles	10% maximum, by weight, of flat, elongated, or flat and elongated particles [2]	ASTM D4791
[Bulk density of slag	Weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter)	ASTM C29 **]**
[Clay lumps and friable particles	Less than or equal to 3 percent	ASTM C142 **]**
Fine Aggregate		
Liquid limit	Less than or equal to 25	ASTM D4318
Plasticity Index	Not more than five (5)	ASTM D4318

[1] The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

[2] A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

****

Delete bracketed reference to crushed slag in above paragraph and table if slag will not be used in the project.

****

209-2.2 Gradation requirements. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa.

Gradation of Aggregate Base

Sieve Size	Design Range Percentage by Weight passing	Contractor's Final Gradation	Job Control Grading Band Tolerances[1] (Percent)
2 inch (50 mm)	100		0
1-1/2 inch (37.5 mm)	95-100		±5
1 inch (25.0 mm)	70-95		±8
3/4 inch (19.0 mm)	55-85		±8
No. 4 (4.75 mm)	30-60		±8
No. 40[2] (425 µm)	10-30		±5
No. 200[2] (75 µm)	[0-10]		±3

[1] The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

[2] The fraction of material passing the No 200 (75 µm) sieve shall not exceed two-thirds the fraction passing the No 40 (425 µm) sieve.

****

When non frost susceptible material is required, the maximum material passing the No. 200 (75 µm) sieve shall be reduced to 0-5%. For areas subject to substantial frost penetration into base and subgrade layers, a separation filter layer or geosynthetic separation layer is recommended.

Leave the column titled "Contractor's Final Gradation" blank in the above table. The Contractor's Final Gradation approved by the Engineer/RPR will be used to populate this column and the "Job Control Grading Band Tolerances for Contractor's Final Gradation" will apply to this column for the project duration, and these limits establish quality control action limits for the Contractor.

****

209-2.3 Sampling and Testing.

a. Aggregate base materials. The Contractor shall take samples of the aggregate base in accordance with ASTM D75 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in paragraph 209-2.1. This sampling and testing will be the basis for approval of the aggregate base quality requirements. **[___]**

b. Gradation requirements. The Contractor shall take at least **[** two **]** aggregate base samples per day in the presence of the Resident Project Representative (RPR) to check the final gradation. Sampling shall be per ASTM D75. Material shall meet the requirements in paragraph 209-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the RPR.

****

The Engineer may require additional sampling points for quality requirements. The Engineer shall define when additional sampling points are needed in the above paragraph.

On large projects and/or projects that span multiple construction seasons, additional aggregate tests may be necessary to validate consistency of aggregate produced and delivered for the project.

****

209-2.4 Separation Geotextile. **[** Not used. **] [** Separation geotextile shall be **[** Class 2 **]**, **[** 0.02 sec^{-1} **]** permittivity per ASTM D4491, Apparent opening size per ASTM D4751 with **[** 0.60 mm **]** maximum average roll value. **]**

****

The use of a geotextile to prevent mixing of a subgrade soil and an aggregate subbase/base is appropriate for pavement structures constructed over soils with a California Bearing Ratio greater than 3.

Generally, on airport projects, a Class 2 geotextile with a permittivity of 0.02 and AOS of 0.6 mm will be sufficient.

See AASHTO M288 for additional notes regarding separation geotextiles.

****

CONSTRUCTION METHODS

209-3.1 Control strip. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches (300 mm) upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted or removed and replaced at the Contractor's expense. Full operations shall not continue until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved by the RPR.

209-3.2 Preparing underlying subgrade and/or subbase. The underlying subgrade and/or subbase shall be checked and accepted by the RPR before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with Item P-152, at the Contractor's expense, may be required by the RPR if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

209-3.3 Production. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 209-3.5, the approved material may be transported directly to the placement.

209-3.4 Placement. The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

The aggregate shall meet gradation and moisture requirements prior to compaction. The base course shall be constructed in lifts as established in the control strip, but not less than 4 inches (100 mm) nor more than 12 inches (300 mm) of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications at the Contractor's expense.

209-3.5 Compaction. Immediately after completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade.

The field density of each compacted lift of material shall be at least **[** 100% **]** of the maximum density of laboratory specimens prepared from samples of the base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with **[** ASTM D1557 **]**. The moisture content of the material during placing operations shall be within ±2 percentage points of the optimum moisture content as determined by ASTM **[___]**. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

****

Material meeting the requirements of P-209 may be free-draining and to achieve compaction may need to be compacted on the wet-side of optimum.

The Engineer may specify ASTM D698 for areas designated for aircraft with gross weights of 60,000 pounds (27200 kg) or less and ASTM D1557 for areas designated for aircraft with gross weights greater than 60,000 pounds (27200 kg).

If the material has greater than 30% retained on the 3/4-inch (19.0 mm) sieve, ASTM D1557 or D698 has suggested procedures for dealing with oversize material.

****

209-3.6 Weather limitations. Material shall not be placed unless the ambient air temperature is at least 40°F (4°C) and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

209-3.7 Maintenance. The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at the Contractor's expense.

209-3.8 Surface tolerances. After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches (75 mm), reshaped and recompacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8-inch (9 mm) when tested with a 12-foot (3.7-m) straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot (3.7-m) straightedge for the full length of each line on a 50-foot (15-m) grid.

b. Grade. The grade and crown shall be measured on a 50-foot (15-m) grid and shall be within +0 and -1/2 inch (12 mm) of the specified grade.

209-3.9 Acceptance sampling and testing. Crushed aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each **[** 1200 square yds (1000 m^2) **]**. Sampling locations will be determined on a random basis per ASTM D3665

a. Density. The **[** RPR shall perform all density tests **] [** Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the RPR for acceptance **]**.

Each area shall be accepted for density when the field density is at least **[** 100% **]** of the maximum density of laboratory specimens compacted and tested per ASTM **[** 1557 **] [** D698 **]**. The in-place field density shall be determined per **[** ASTM D1556. **] [** or **] [** ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. **]**. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

****

The Engineer may specify ASTM D698 or ASTM D1557 for areas designated for aircraft with gross weights of less than 60,000 pounds (27200 kg). The Engineer shall specify ASTM D1557 for areas designated for aircraft with gross weights of 60,000 pounds (27200 kg) or greater.

****

b. Thickness. Depth tests shall be made by test holes at least 3 inches (75 mm) in diameter that extend through the base. The thickness of the base course shall be within +0 and -1/2 inch (12 mm) of the specified thickness as determined by depth tests taken by the Contractor in the presence of the RPR for each area. Where the thickness is deficient by more than 1/2-inch (12 mm), the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches (75 mm), adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

****

The Engineer may modify the above thickness control paragraph to permit the thickness determination by survey. Survey shall be required before and after placement of the base. The survey interval should be specified based on the size of the project.

****

METHOD OF MEASUREMENT

209-4.1 The quantity of crushed aggregate base course will be determined by measurement of the number of **[** square yards (square meters) **] [** cubic yards (cubic meters) **]** of material actually constructed and accepted by the RPR as complying with the plans and specifications. Base materials shall not be included in any other excavation quantities.

[209-4.2 Separation geotextile shall be measured by the number of **[** square yards **] [** square meters **]** of materials placed and accepted by the RPR as complying with the plans and specifications excluding seam overlaps and edge anchoring. **]**

BASIS OF PAYMENT

209-5.1 Payment shall be made at the contract unit price per **[** square yard (square meter) **] [** cubic yard (cubic meter) **]** for crushed aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item.

[209-5.2 Payment shall be made at the contract unit price per **[** square yard **] [** square meter **]** for separation geotextile. The price shall be full compensation for furnishing all labor, equipment, material, anchors, and incidentals necessary. **]**

Payment will be made under:

Item P-209-5.1	Crushed Aggregate Base Course - per **[** square yard (square meter **] [** cubic yard (cubic meter) **]**
[Item P-209-5.2	Separation geotextile per **[** square yard **] [** square meter **]]**

Item P-501 Cement Concrete Pavement

DESCRIPTION

501-1.1 This work shall consist of pavement composed of cement concrete **[** with reinforcement **]** **[** without reinforcement **]** constructed on a prepared underlying surface in accordance with these specifications and shall conform to the lines, grades, thickness, and typical cross-sections shown on the plans. The terms cement concrete, hydraulic cement concrete, and concrete are interchangeable in this specification.

****

The Engineer shall specify with or without reinforcement. Item P-610, Cement Concrete shall be used for sign bases and other formed concrete structures.

The dimensions and depth of the concrete shall be as defined by the Engineer's pavement design performed in accordance with advisory circular (AC) 150/5320-6, Airport Pavement Design and Evaluation and FAARFIELD. The current version of FAARFIELD is available at: www.faa.gov/airports/engineering/design_software/

****

MATERIALS

501-2.1 Aggregates.

a. Reactivity. Fine and Coarse aggregates to be used in PCC on this project shall be tested and evaluated by the Contractor for alkali-aggregate reactivity in accordance with both ASTM C1260 and ASTM C1567. Tests must be representative of aggregate sources which will be providing material for production. ASTM C1260 and ASTM C1567 tests may be run concurrently.

(1) Coarse aggregate and fine aggregate shall be tested separately in accordance with ASTM C1260, however, the length of test shall be extended to 28 days (30 days from casting). Tests must have been completed within 6 months of the date of the concrete mix submittal.

(2) The combined coarse and fine aggregate shall be tested in accordance with ASTM C1567, modified for combined aggregates, using the proposed mixture design proportions of aggregates, cementitious materials, and/or specific reactivity reducing chemicals. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

(3) If lithium nitrate is proposed for use with or without supplementary cementitious materials, the aggregates shall be tested in accordance with Corps of Engineers (COE) Concrete Research Division (CRD) C662 in lieu of ASTM C1567. If lithium nitrate admixture is used, it shall be nominal 30% ±0.5% weight lithium nitrate in water. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion is greater than 0.10% at 28 days, the

aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

b. Fine aggregate. Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of ASTM C33 and the parameters identified in the fine aggregate material requirements below. Fine aggregate material requirements and deleterious limits are shown in the table below.

Fine Aggregate Material Requirements		
Soundness of Aggregates by Use of Sodium Sulfate **or** Magnesium Sulfate	Loss after 5 cycles: 10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate	ASTM C88
Sand Equivalent	**[45]** minimum	ASTM D2419
Fineness Modulus (FM)	$2.50 \leq FM \leq 3.40$	ASTM C136
Limits for Deleterious Substances in Fine Aggregate for Concrete		
Clay lumps and friable particles	1.0% maximum	ASTM C142
Coal and lignite	0.5% using a medium with a density of Sp. Gr. of 2.0	ASTM C123
Total Deleterious Material	1.0% maximum	

c. Coarse aggregate. The maximum size coarse aggregate shall be **[___]**.

Aggregates delivered to the mixer shall be clean, hard, uncoated aggregates consisting of crushed stone, crushed or uncrushed gravel, air-cooled iron blast furnace slag, crushed recycled concrete pavement, or a combination. The aggregates shall have no known history of detrimental pavement staining. Steel blast furnace slag shall not be permitted. Coarse aggregate material requirements and deleterious limits are shown in the table below; washing may be required to meet aggregate requirements.

****

Select maximum aggregate size (typically 1-1/2-inch, 1-inch, or 3/4-inch) based on what is locally available and considering freeze-thaw vulnerability.

Dust and other coatings may need to be removed from the aggregate by washing in order to meet material requirements.

On large projects and/or projects that span multiple construction seasons, additional aggregate tests may be necessary to validate consistency of aggregate produced and delivered for the project.

Some aggregates may contain ferrous sulfides and iron oxides which can cause stains on exposed concrete surfaces. In areas where staining has been a problem

or is suspected, the Engineer should verify that producers and aggregate suppliers have taken steps to minimize the inclusion of any ferrous sulfides or iron oxides in aggregate to be used in the project.

If there is a concern that these may exist, a known indicator to identify staining particles is to immerse the aggregate in a lime slurry. If staining particles are present, a blue-green gelatinous precipitate will form within five (5) to 10 minutes, rapidly changing to a brown color on exposure to air and light. The reaction should be complete in 30 minutes. If no brown gelatinous precipitate forms, there is little chance of reaction in concrete. (Portland Concrete Association, Design and Control of Concrete Mixtures)

****

Coarse Aggregate Material Requirements

Material Test	**Requirement**	**Standard**
Resistance to Degradation	Loss: 40% maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate **or** Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles at 5:1 for any size group coarser than 3/8 (9.5 mm) sieve [1]	ASTM D4791
Bulk density of slag [2]	Weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter)	ASTM C29
[D-cracking (Freeze-Thaw)[3]	Durability factor ≥ 95	ASTM C666 **]**

[1] A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

[2] Only required if slag is specified.

[[3] Coarse aggregate may only be accepted from sources that have a 20-year service history for the same gradation to be supplied with no history of D-Cracking. Aggregates that do not have a 20-year record of service free from major repairs (less than 5% of slabs replaced) in similar conditions without D-cracking shall not be used unless the material currently being produced has a durability factor greater than or equal to 95 per ASTM C666. The Contractor shall submit a current certification and test results to verify the aggregate acceptability. Test results will only be accepted from a State Department of Transportation (DOT) materials laboratory or an accredited laboratory. Certification and test results which are not dated or which are over one (1) year old or which are for different gradations will not be accepted. **]**

****

In areas where D-cracking is not a concern, delete the D-cracking (ASTM C666) and corresponding footnote in the above table.

Crushed granite, calcite cemented sandstone, quartzite, basalt, diabase, rhyolite or trap rock are considered to meet the D-cracking test requirements but must meet all other quality tests specified in Item P-501.

In areas of freeze-thaw that have had problems with Chert popouts,prior to reducing the limit on Chert verify that aggregate sources are available that can meet specification. Very rare for sedimentary deposits to meet requirements less than 1%. Elimination of Chert may require that contractor utilize non sedimentary aggregates.

****

The amount of deleterious material in the coarse aggregate shall not exceed the following limits:

Limits for Deleterious Substances in Coarse Aggregate

Deleterious material	**ASTM**	**Percentage by Mass**
Clay Lumps and friable particles	ASTM C142	1.0
Material finer than No. 200 sieve (75 µm)	ASTM C117	1.0[1]
Lightweight particles	ASTM C123 using a medium with a density of Sp. Gr. of 2.0	0.5
Chert[2] (less than 2.40 Sp Gr.)	ASTM C123 using a medium with a density of Sp. Gr. of 2.40)	[0.1][3]

[1] The limit for material finer than 75-µm is allowed to be increased to 1.5% for crushed aggregates consisting of dust of fracture that is essentially free from clay or shale. Test results supporting acceptance of increasing limit to 1.5% with statement indicating material is dust of fracture must be submitted with Concrete mix. Acceptable techniques to characterizing these fines include methylene blue adsorption or X-ray diffraction analysis.

[2] Chert and aggregates with less than 2.4 specific gravity.

[3] The limit for chert may be increased to 1.0 percent by mass in areas not subject to severe freeze and thaw.

d. Combined aggregate gradation. This specification is targeted for a combined aggregate gradation developed following the guidance presented in United States Air Force Engineering Technical Letter (ETL) 97-5: Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements. Base the aggregate grading upon a combination of all the aggregates (coarse and fine) to be used for the mixture proportioning. Three aggregate sizes may be required to achieve an optimized combined gradation that will produce a workable concrete mixture for its intended use. Use aggregate gradations that produce concrete mixtures with well-graded or optimized aggregate

combinations. The Contractor shall submit complete mixture information necessary to calculate the volumetric components of the mixture. The combined aggregate grading shall meet the following requirements:

(1) The materials selected and the proportions used shall be such that when the Coarseness Factor (CF) and the Workability Factor (WF) are plotted on a diagram as described in paragraph 501-2.1d(4) below, the point thus determined shall fall within the parallelogram described therein.

(2) The CF shall be determined from the following equation:

CF = (cumulative percent retained on the 3/8 in. (9.5 mm) sieve)(100) / (cumulative percent retained on the No. 8 (2.36 mm) sieve)

(3) The WF is defined as the percent passing the No. 8 (2.36 mm) sieve based on the combined gradation. However, WF shall be adjusted, upwards only, by 2.5 percentage points for each 94 pounds (42 kg) of cementitious material per cubic meter yard greater than 564 pounds per cubic yard (335 kg per cubic meter).

(4) A diagram shall be plotted using a rectangular scale with WF on the Y-axis with units from 20 (bottom) to 45 (top), and with CF on the X-axis with units from 80 (left side) to 30 (right side). On this diagram a parallelogram shall be plotted with corners at the following coordinates (CF-75, WF-28), (CF-75, WF-40), (CF-45, WF-32.5), and (CF-45, WF-44.5). If the point determined by the intersection of the computed CF and WF does not fall within the above parallelogram, the grading of each size of aggregate used and the proportions selected shall be changed as necessary. The point determined by the plotting of the CF and WF may be adjusted during production ±3 WF and ±5 CF. Adjustments to gradation may not take the point outside of the parallelogram.

e. Contractors combined aggregate gradation. The Contractor shall submit their combined aggregate gradation using the following format:

Contractor's Combined Aggregate Gradation

Sieve Size	**Contractor's Concrete mix Gradation (Percent passing by weight)**
2 inch (50 mm)	*
1-1/2 inch (37.5 mm)	*
1 inch (25.0 mm)	*
3/4 inch (19.0 mm)	*
1/2 inch (12.5 mm)	*
3/8 inch (9.5 mm)	*
No. 4 (4.75 mm)	*
No. 8 (2.36 mm)	*
No. 16 (1.18 mm)	*
No. 30 (600 µm)	*
No. 50 (300 µm)	*
No. 100 (150 µm)	*

****

Table remains blank until the Contractor submits the concrete mix.

Reference United States Air Force Engineering Technical Letter (ETL) 97-5: Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements. The ETL is available at the following website:

https://www.wbdg.org/ffc/dod/supplemental-technical-criteria/tspwg-m-3-250-04-97-05

****

501-2.2 Cement. Cement shall conform to the requirements of ASTM **[___]** Type **[___]**.

****

The Engineer shall specify all of the following that are acceptable for use on the project:

ASTM C150 - Type I, II, or V.

ASTM C595 - Type IP, IS, IL.

ASTM C1157 – Types GU, HS, MH.

Other cements may be specified with concurrence of the FAA.

Low alkali cements (less than 0.6% equivalent alkali, the low reactivity option in ASTM C595, or Option R in ASTM C1157) shall be specified.

****

501-2.3 Cementitious materials.

a. Fly ash. Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than 15% and a total alkali content less than 3% per ASTM C311. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix, and shall furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the Resident Project Representative (RPR).

b. Slag cement (ground granulated blast furnace (GGBF)). Slag cement shall conform to ASTM C989, Grade 100 or Grade 120. Slag cement shall be used only at a rate between 25% and 55% of the total cementitious material by mass.

c. Raw or calcined natural pozzolan. Natural pozzolan shall be raw or calcined and conform to ASTM C618, Class N, including the optional requirements for uniformity and effectiveness in controlling Alkali-Silica reaction and shall have a loss on ignition not exceeding 6%. Class N pozzolan for use in mitigating Alkali-Silica Reactivity shall have a total available alkali content less than 3%.

[d. Ultrafine fly ash and ultrafine pozzolan. UltraFine Fly Ash (UFFA) and UltraFine Pozzolan (UFP) shall conform to ASTM C618, Class F or N, and the following additional requirements:

(1) The strength activity index at 28 days of age shall be at least 95% of the control specimens.

(2) The average particle size shall not exceed 6 microns. **]**

501-2.4 Joint seal. The joint seal for the joints in the concrete pavement shall meet the requirements of **[** Item P-604 **] [** Item P-605 **]** and shall be of the type specified in the plans.

501-2.5 Isolation joint filler. Premolded joint filler for isolation joints shall conform to the requirements of ASTM D1751 or ASTM D1752 and shall be where shown on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the RPR. When the use of more than one piece is required for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the RPR.

501-2.6 Steel reinforcement. Reinforcing shall consist of **[___]** conforming to the requirements of ASTM **[___]**.

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The Engineer shall designate one of the following:

ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A706 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A775 Standard Specification for Epoxy-Coated Steel Reinforcing Bars

ASTM A934 Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars

ASTM A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

ASTM A184 or A704 Bar mats

ASTM A1035 Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement

ASTM A884 Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement

Welded wire fabric shall be furnished in flat sheets only.

Delete this paragraph when not applicable to the project.

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501-2.7 Dowel and tie bars. Dowel bars shall be plain steel bars conforming to ASTM A615 and shall be free from burring or other deformation restricting slippage in the concrete.

a. Dowel Bars. Before delivery to the construction site each dowel bar shall be epoxy coated per ASTM A1078, Type 1, with a coating thickness after curing greater than 10 mils. Patched ends are not required for Type 1 coated dowels. The dowels shall be coated with a bond-breaker recommended by the manufacturer. Dowel sleeves or inserts are not permitted. Grout retention rings shall be fully circular metal or plastic devices capable of supporting the dowel until the grout hardens.

b. Tie Bars. Tie bars shall be deformed steel bars and conform to the requirements of ASTM A615. Tie bars designated as Grade 60 in ASTM A615 or ASTM A706 shall be used for construction requiring bent bars.

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After coordination with the FAA regarding need and eligibility of additional corrosion protection, the Engineer may require additional corrosion protection or resistance such as chromium dowel and tie bars meeting ASTM A1035; or stainless steel dowel and tie bars meeting ASTM A955.

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501-2.8 Water. Water used in mixing or curing shall be potable. If water is taken from other sources considered non-potable, it shall meet the requirements of ASTM C1602.

501-2.9 Material for curing concrete. Curing materials shall conform to one of the following specifications:

a. Liquid membrane-forming compounds for curing concrete shall conform to the requirements of ASTM C309, Type 2, Class A, or Class B.

b. White polyethylene film for curing concrete shall conform to the requirements of ASTM C171.

c. White burlap-polyethylene sheeting for curing concrete shall conform to the requirements of ASTM C171.

d. Waterproof paper for curing concrete shall conform to the requirements of ASTM C171.

501-2.10 Admixtures. Admixtures shall conform to the following specifications:

a. Air-entraining admixtures. Air-entraining admixtures shall meet the requirements of ASTM C260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entraining agent and any water reducer admixture shall be compatible.

b. Water-reducing admixtures. Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D.

c. Other admixtures. The use of set retarding and set-accelerating admixtures shall be approved by the RPR prior to developing the concrete mix. Retarding admixtures shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating admixtures shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

d. Lithium Nitrate. The lithium admixture shall be a nominal 30% aqueous solution of Lithium Nitrate, with a density of 10 pounds/gallon (1.2 kg/L), and shall have the approximate chemical form as shown below:

Lithium Admixture

Constituent	**Limit (Percent by Mass)**
LiNO3 (Lithium Nitrate)	30 ±0.5
SO4 (Sulfate Ion)	0.1 (max)
Cl (Chloride Ion)	0.2 (max)
Na (Sodium Ion)	0.1 (max)
K (Potassium Ion)	0.1 (max)

The lithium nitrate admixture dispensing and mixing operations shall be verified and certified by the lithium manufacturer's representative.

501-2.11 Epoxy-resin. All epoxy-resin materials shall be two-component materials conforming to the requirements of ASTM C881, Class as appropriate for each application temperature to be encountered, except that in addition, the materials shall meet the following requirements:

a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.

b. Material for use as patching materials for complete filling of spalls and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.

c. Material for use for injecting cracks shall be Type IV, Grade 1.

d. Material for bonding freshly mixed Portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.

501-2.12 Bond Breaker. [Choke stone shall be an ASTM C33 Number 89 stone. **] [** Fabric shall meet the requirements of AASHTO M 288 Class I fabric with elongation not less than 50% at the specified strengths, with a weight not less than 14.5 oz/sy. A certificate of compliance (COC) shall be provided by the fabric manufacturer that the material may be used as a bond breaker. **] [** Liquid membrane forming compound shall be in accordance with paragraph 501-2.7. **]] [** Not required. **]**

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The Engineer must select the bond breaker when concrete pavement will be placed directly above the lean concrete base. Coordinate with paragraph 501-.

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CONCRETE MIX

501-3.1. General. No concrete shall be placed until an acceptable concrete mix has been submitted to the RPR for review and the RPR has taken appropriate action. The RPR's review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

501-3.2 Concrete Mix Laboratory. The laboratory used to develop the concrete mix shall be accredited in accordance with ASTM C1077. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for developing the concrete mix must be included in the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the RPR prior to start of construction.

501-3.3 Concrete Mix Proportions. Develop the mix using the procedures contained in Portland Cement Association (PCA) publication, "Design and Control of Concrete Mixtures." Concrete shall be proportioned to achieve a 28-day flexural strength that meets or exceeds the acceptance criteria contained in paragraph 501-6.6 for a flexural strength of **[___]** psi per ASTM C78.

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The Engineer shall specify a minimum contractual acceptance flexural strength for airport pavements sufficient to assure that the pavement achieves the design flexural strength prior to being placed in service. Note the design strength used in FAARFIELD structural analysis is approximately 5% higher than the construction acceptance strength e.g. if structural design strength is 650 psi (4482 kPA), then the construction acceptance strength would be approximately 620 psi (4275 kPa).

If local materials utilized consistently produce above the design strength limit with the minimum amount of cementitious material, the Engineer may allow a reduction in the minimum amount of cementitious material with approval of the FAA.

Due to variations in materials, operations, and testing, the average strength of concrete furnished by a supplier should be higher than the specified strength to ensure a good statistical chance of meeting the acceptance criteria throughout the duration of the job. The strength necessary to meet specification requirements depends on the producer's standard deviation of flexural test results and the accuracy that the value can be estimated from historic data for the same or similar materials.

For pavements designed to accommodate aircraft gross weights of 60,000 pounds (27215 kg) or less, this section may be modified to indicate that concrete shall be designed to achieve a 28-day compressive strength that meets or exceeds the acceptance criteria for a compressive strength of 4,400 psi (30337 kPa) per ASTM C39.

The use of materials that meet state highway specifications for airfield pavement construction materials is permitted at non-primary airports serving aircraft that do not exceed 60,000 pounds gross weight.

The use of State highway specifications for materials requires a Modification of Standards in accordance with FAA Order 5300.1. The project specification must include a copy of all referenced state specifications.

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The minimum cementitious material shall be adequate to ensure a workable, durable mix. The minimum cementitious material (cement plus fly ash, or slag cement) shall be **[___]** pounds per cubic yard (**[___]** kg per cubic meter). The ratio of water to cementitious material, including free surface moisture on the aggregates but not including moisture absorbed by the aggregates shall be between 0.38 – 0.45 by weight.

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A minimum total cementitious material content of 470 pounds per cubic yard (280 kg per cubic meter) should be specified. A higher minimum may be necessary to meet the specified strength when other cementitious materials are substituted or to meet durability requirements for severe freeze/thaw, deicer, or sulfate exposure.

The minimum total cementitious requirement should not be less than 517 pounds per cubic yard (310 kg per cubic meter) where severe freeze-thaw, deicer, or sulfate exposure is expected. The Engineer shall specify a maximum water/cementitious ratio of 0.45 unless a lower water/cementitious ratio is necessary for severe freeze/thaw, deicer, sulfate exposure, or other local conditions. A

water/cementitious ratio of less than 0.38 shall be subject to approval by the Engineer and the FAA.

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Flexural strength test specimens shall be prepared in accordance with ASTM C192 and tested in accordance with ASTM C78. At the start of the project, the Contractor shall determine an allowable slump as determined by ASTM C143 not to exceed 2 inches (50 mm) for slip-form placement. For fixed-form placement, the slump shall not exceed 3 inches (75 mm). For hand placement, the slump shall not exceed 4 inches (100 mm).

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When the flexural design strength in paragraph 501-3.3 is to be accepted on the basis of compressive strength, the following procedure establishes the correlation between compressive and flexural strength for the concrete mix. Each concrete mix will require a separate correlation.

Cylinders/Beams

a. Fabricate all beams and cylinders for each mixture from the same batch or blend of batches. Fabricate and cure all beams and cylinders in accordance with ASTM C192, using 6 × 6-inch (150 × 150 mm) steel beam forms and 6 × 12-inch (150 × 300 mm) single-use cylinder forms.

b. Cure test beams from each mixture for 3, 7, 14, [28 **] and [** 90 **]-day flexural tests; three (3) beams to be tested per age.**

c. Cure test cylinders from each mixture for 3, 7, 14, [28 **] and [** 90 **]-day compressive strength tests; three (3) cylinders to be tested per age.**

d. Test beams in accordance with ASTM C78, cylinders in accordance with ASTM C39.

e. Using the average strength for each age, plot all results on separate graphs for each w/c versus:

- **3-day flexural strength**
- **7-day flexural strength**
- **14-day flexural strength**
- **[** 28-day flexural strength **]**
- **[** 90-day flexural strength **]**
- **3-day compressive strength**
- **7-day compressive strength**
- **14-day compressive strength**
- **[** 28-day compressive strength **]**

- **[** 90-day compressive strength **]**

f. From the above expected strengths for the selected mixture determine the following Correlation Ratios:

(1) Ratio of the 14-day compressive strength of the selected mixture to the [28 **] [** 90 **]-day flexural strength of the mixture (for acceptance).**

(2) Ratio of the 7-day compressive strength of the selected mixture to the [28 **] [** 90 **]-day flexural strength of the mixture (for Contractor QC control).**

g. If there is a change in materials, additional mixture design studies shall be made using the new materials and new Correlation Ratios shall be determined.

h. No concrete pavement shall be placed until the Engineer has approved the Contractor's mixture proportions. The approved water-cementitious materials ratio shall not exceed the maximum value specified.

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The results of the concrete mix shall include a statement giving the maximum nominal coarse aggregate size and the weights and volumes of each ingredient proportioned on a one cubic yard (meter) basis. Aggregate quantities shall be based on the mass in a saturated surface dry condition.

If a change in source(s) is made, or admixtures added or deleted from the mix, a new concrete mix must be submitted to the RPR for approval.

The RPR may request samples at any time for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

501-3.4 Concrete Mix submittal. The concrete mix shall be submitted to the RPR at least **[** 30 **]** days prior to the start of operations. The submitted concrete mix shall not be more than 180 days old and must use the materials to be used for production for the project. Production shall not begin until the concrete mix is approved in writing by the RPR.

Each of the submitted concrete mixes (i.e, slip form, side form machine finish and side form hand finish) shall be stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items and quantities as a minimum:

- Certified material test reports for aggregate in accordance with paragraph 501-2.1. Certified reports must include all tests required; reporting each test, test method, test result, and requirement specified (criteria).
- Combined aggregate gradations and analysis; and including plots of the fine aggregate fineness modulus.
- Reactivity Test Results.

- Coarse aggregate quality test results, including deleterious materials.
- Fine aggregate quality test results, including deleterious materials.
- Mill certificates for cement and supplemental cementitious materials.
- Certified test results for all admixtures, including Lithium Nitrate if applicable.
- Specified flexural strength, slump, and air content.
- Recommended proportions/volumes for proposed mixture and trial water-cementitious materials ratio, including actual slump and air content.
- Flexural and compressive strength summaries and plots, including all individual beam and cylinder breaks.
- Correlation ratios for acceptance testing and Contractor QC testing, when applicable.
- Historical record of test results documenting production standard deviation, when applicable.

501-3.5 Cementitious materials.

a. Fly ash. When fly ash is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 20 and 30% by weight of the total cementitious material. If fly ash is used in conjunction with slag cement the maximum replacement rate shall not exceed 10% by weight of total cementitious material.

b. Slag cement (ground granulated blast furnace (GGBF)). Slag cement may be used. The slag cement, or slag cement plus fly ash if both are used, may constitute between 25 to 55% of the total cementitious material by weight.

c. Raw or calcined natural pozzolan. Natural pozzolan may be used in the concrete mix. When pozzolan is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 20 and 30% by weight of the total cementitious material. If pozzolan is used in conjunction with slag cement the maximum replacement rate shall not exceed 10% by weight of total cementitious material.

[d. Ultrafine fly ash (UFFA) and ultrafine pozzolan (UFP). UFFA and UFP may be used in the concrete mix with the RPR's approval. When UFFA and UFP is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall be between 7% and 16% by weight of the total cementitious material. **]**

501-3.6 Admixtures.

a. Air-entraining admixtures. Air-entraining admixture are to be added in such a manner that will ensure uniform distribution of the agent throughout the batch. The air content of freshly mixed air-entrained concrete shall be based upon trial mixes with the materials to be used in the work adjusted to produce concrete of the required plasticity and workability. The percentage of air in the mix shall be **[___]**. Air content shall be determined by testing in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag and other highly porous coarse aggregate.

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The Engineer must specify the appropriate air content for the exposure level for the project location at the maximum aggregate size specified in paragraph 501-2.1(c).

Recommended Air Content (Percent)

Exposure Level	Maximum Size Aggregate inch (mm)				
	2 inch (50 mm)	**1-1/2 inch (37.5 mm)**	**1 inch (25.0 mm)**	**3/4 inch (19.0 mm)**	**1/2 inch (12.5 mm)**
Mild	2.0%	2.5%	3.0%	3.5%	4.0%
Moderate	4.0%	4.5%	4.5%	5.0%	5.5%
Severe	5.0%	5.5%	6.0%	6.0%	7.0%

1. Mild exposure - When desired for other than durability, such as to improve workability. Used where pavement will not be exposed to freezing or to deicing agents.
2. Moderate exposure - Service in a climate where freezing is expected but where the concrete will not be continually exposed to moisture or free water for long periods prior to freezing and will not be exposed to deicing agents or other aggressive chemicals.
3. Severe exposure - Concrete which is exposed to deicing chemicals or other aggressive agents or where the concrete may become highly saturated by continual contact with moisture or free water prior to freezing.

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b. Water-reducing admixtures. Water-reducing admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted with the materials to be used in the work, in accordance with ASTM C494.

c. Other admixtures. Set controlling, and other approved admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted with the materials to be used in the work, in accordance with ASTM C494.

d. Lithium nitrate. Lithium nitrate shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements in accordance with paragraph 501-2.10d.

CONSTRUCTION METHODS

501-4.1 Control Strip. The control strip(s) shall be to the next planned joint after the initial 250 feet (75 m) of each type of pavement construction (slip-form pilot lane, slip-form fill-in lane, or fixed form). The Contractor shall demonstrate, in the presence of the RPR, that the materials, concrete mix,

equipment, construction processes, and quality control processes meet the requirements of the specifications. The concrete mixture shall be extruded from the paver meeting the edge slump tolerance and with little or no finishing. Pilot, fill-in, and fixed-form control strips will be accepted separately. Minor adjustments to the mix design may be required to place an acceptable control strip. The production mix will be the adjusted mix design used to place the acceptable control strip. Upon acceptance of the control strip by the RPR, the Contractor must use the same equipment, materials, and construction methods for the remainder of concrete paving. Any adjustments to processes or materials must be approved in advance by the RPR. Acceptable control strips will meet edge slump tolerance and surface acceptable with little or no finishing, air content within action limits, strength equal or greater than requirements of P501-3.3. The control strip will be considered one lot for payment (no sublots required for control strip). Payment will only be made for an acceptable control strip in accordance with paragraph 501-8.1 using a lot pay factor equal to 100.

501-4.2 Equipment. The Contractor is responsible for the proper operation and maintenance of all equipment necessary for handling materials and performing all parts of the work to meet this specification.

a. Plant and equipment. The plant and mixing equipment shall conform to the requirements of ASTM C94 and/or ASTM C685. Each truck mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades. The truck mixers shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be replaced when they have worn down 3/4 inch (19 mm) or more. The Contractor shall have a copy of the manufacturer's design on hand showing dimensions and arrangement of blades in reference to original height and depth.

Equipment for transferring and spreading concrete from the transporting equipment to the paving lane in front of the finishing equipment shall be provided. The equipment shall be specially manufactured, self-propelled transfer equipment which will accept the concrete outside the paving lane and will spread it evenly across the paving lane in front of the paver and strike off the surface evenly to a depth which permits the paver to operate efficiently.

b. Finishing equipment.

(1) Slip-form. The standard method of constructing concrete pavements shall be with an approved slip-form paving equipment designed and operated to spread, consolidate, screed, and finish the freshly placed concrete in one complete pass of the machine so that the end result is a dense and homogeneous pavement which is achieved with a minimum of hand finishing. The paver-finisher shall be a heavy duty, self-propelled machine designed specifically for paving and finishing high quality concrete pavements.

(2) Fixed-form. On projects requiring less than **[** 10,000 cubic yards (7650 cubic meters) **]** of concrete pavement or irregular areas at locations inaccessible to slip-form paving equipment, concrete pavement may be placed with equipment specifically designed for placement and finishing using stationary side forms. Methods and equipment shall be reviewed and accepted by the RPR. Hand screeding and float finishing may only be used on small irregular areas as allowed by the RPR.

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The Engineer may reduce the quantity of concrete when fixed forms are allowed.

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c. Vibrators. Vibrator shall be the internal type. The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation or voids. The number, spacing, and frequency shall be as necessary to provide a dense and homogeneous pavement and meet the recommendations of American Concrete Institute (ACI) 309R, Guide for Consolidation of Concrete. Adequate power to operate all vibrators shall be available on the paver. The vibrators shall be automatically controlled so that they shall be stopped as forward motion ceases. The Contractor shall provide an electronic or mechanical means to monitor vibrator status. The checks on vibrator status shall occur a minimum of two times per day or when requested by the RPR.

Hand held vibrators may only be used in irregular areas and shall meet the recommendations of ACI 309R, Guide for Consolidation of Concrete.

d. Concrete saws. The Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions. The Contractor shall provide at least one standby saw in good working order and a supply of saw blades at the site of the work at all times during sawing operations.

e. Fixed forms. Straight side fixed forms shall be made of steel and shall be furnished in sections not less than 10 feet (3 m) in length. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms with battered top surfaces and bent, twisted or broken forms shall not be used. Built-up forms shall not be used, except as approved by the RPR. The top face of the form shall not vary from a true plane more than 1/8 inch (3 mm) in 10 feet (3 m), and the upstanding leg shall not vary more than 1/4 inch (6 mm). The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting. Wood forms may be used under special conditions, when approved by the RPR. The forms shall extend the full depth of the pavement section.

501-4.3 Form setting. Forms shall be set to line and grade as shown on the plans, sufficiently in advance of the concrete placement, to ensure continuous paving operation. Forms shall be set to withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the concrete placement.

501-4.4 Base surface preparation prior to placement. Any damage to the prepared base, subbase, and subgrade shall be corrected full depth by the Contractor prior to concrete placement. The underlying surface shall be entirely free of frost when concrete is placed. The prepared grade shall be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from concrete. **[** Bond breaker shall be applied in accordance with 501-2.12. **]**

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The Engineer should ensure the plans show that the appropriate prepared base, subbase, and subgrade extend a width sufficient to support the paving machine

track without any noticeable displacement of the paver. Typical widths up to 3 feet (1 m) are required to support the paver track.

The Engineer will determine if a bond breaker is required and insert the appropriate P-specification for the project.

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501-4.5 Handling, measuring, and batching material. Aggregate stockpiles shall be constructed and managed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the concrete batch plant. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Store and maintain all aggregates at a uniform moisture content prior to use. A continuous supply of materials shall be provided to the work to ensure continuous placement.

501-4.6 Mixing concrete. The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials are placed into the drum until the drum is emptied into the truck. All concrete shall be mixed and delivered to the site in accordance with the requirements of ASTM C94 or ASTM C685.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or non-agitating trucks. The elapsed time from the addition of cementitious material to the mix until the concrete is discharged from the truck should not exceed **[** 30 **]** minutes when the concrete is hauled in non-agitating trucks, nor 90 minutes when the concrete is hauled in truck mixers or truck agitators. In no case shall the temperature of the concrete when placed exceed 90°F (32°C). Retempering concrete by adding water or by other means will not be permitted. With transit mixers additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements provided the addition of water is performed within 45 minutes after the initial mixing operations and provided the water/cementitious ratio specified is not exceeded.

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Depending on the location of the batch plant, this time can be adjusted. Batch plant location must be provided to ensure that the time limit is reasonable to allow for delivery and placement of concrete within the allotted time.

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501-4.7 Weather Limitations on mixing and placing. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

a. Cold weather. Unless authorized in writing by the RPR, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches

40°F (4°C) and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35°F (2°C).

The aggregate shall be free of ice, snow, and frozen lumps before entering the mixer. The temperature of the mixed concrete shall not be less than 50°F (10°C) at the time of placement. Concrete shall not be placed on frozen material nor shall frozen aggregates be used in the concrete.

When concreting is authorized during cold weather, water and/or the aggregates may be heated to not more than 150°F (66°C). The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials.

Curing during cold weather shall be in accordance with paragraph 501-4.13d.

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Information regarding cold weather concreting practices may be found in ACI 306R, Cold Weather Concreting.

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b. Hot weather. During periods of hot weather when the maximum daily air temperature exceeds 85°F (30°C), the following precautions shall be taken.

The forms and/or the underlying surface shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90°F (32°C). The aggregates and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

The concrete placement shall be protected from exceeding an evaporation rate of 0.2 psf (0.98 kg/m^2 per hour) per hour. When conditions are such that problems with plastic cracking can be expected, and particularly if any plastic cracking begins to occur, the Contractor shall immediately take such additional measures as necessary to protect the concrete surface. If the Contractor's measures are not effective in preventing plastic cracking, paving operations shall be immediately stopped.

Curing during hot weather shall be in accordance with paragraph 501-4.13e.

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Information regarding hot weather concreting practices may be found in ACI 305R, Hot Weather Concreting.

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c. Temperature management program. Prior to the start of paving operation for each day of paving, the Contractor shall provide the RPR with a Temperature Management Program for the concrete to be placed to assure that uncontrolled cracking is avoided. (Federal Highway Administration HIPERPAV 3 is one example of a temperature management program.) As a minimum, the program shall address the following items:

(1) Anticipated tensile strains in the fresh concrete as related to heating and cooling of the concrete material.

(2) Anticipated weather conditions such as ambient temperatures, wind velocity, and relative humidity; and anticipated evaporation rate using Figure 19-9, PCA, Design and Control of Concrete Mixtures.

(3) Anticipated timing of initial sawing of joint.

(4) Anticipated number and type of saws to be used.

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Federal Highway Administration HIPERPAV 3 is one example of a temperature management program. The software is available at http://www.hiperpav.com/

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d. **Rain.** The Contractor shall have available materials for the protection of the concrete during inclement weather. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils (0.1 mm) thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.

501-4.8 Concrete Placement. At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface shall not exceed 3 feet (1 m). The finished concrete product must be dense and homogeneous, without segregation and conforming to the standards in this specification. Backhoes and grading equipment shall not be used to distribute the concrete in front of the paver. Front end loaders will not be used. All concrete shall be consolidated without voids or segregation, including under and around all load-transfer devices, joint assembly units, and other features embedded in the pavement. Hauling equipment or other mechanical equipment can be permitted on adjoining previously constructed pavement when the concrete strength reaches **[** a flexural strength of 550 psi (3.8 MPa) **] [** a compressive strength of 3,100 psi (21.4 MPa) **]**, based on the average of four field cured specimens per 2,000 cubic yards (1,530 cubic meters) of concrete placed. The Contractor must determine that the above minimum strengths are adequate to protection the pavement from overloads due to the construction equipment proposed for the project.

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The Engineer shall choose flexural or compressive strength based on concrete mix requirement. The strength needed for construction traffic is dependent upon the loads it will be exposed to. The strength needed for a thin pavement at a small airport may be more than is needed for a thick pavement at a large airport. Coordinate the strength in 501-4.8, 501-4.17 and 501-4.18. Engineer must determine strength required to accommodate construction loads (e.g. hauling, placing, etc.) without damaging pavement, for each project. Strength needed can be adjusted during construction if contractor provides detailed engineering calculations supporting actual construction loads.

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The Contractor shall have available materials for the protection of the concrete during cold, hot and/or inclement weather in accordance with paragraph 501-4.7.

a. Slip-form construction. The concrete shall be distributed uniformly into final position by a self-propelled slip-form paver without delay. The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose. The paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed and the vibration shall be adequate to provide a consistency of concrete that will stand normal to the surface with sharp well-defined edges. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The plastic concrete shall be effectively consolidated by internal vibration with transverse vibrating units for the full width of the pavement and/or a series of equally placed longitudinal vibrating units. The space from the outer edge of the pavement to longitudinal unit shall not exceed 9 inches (23 cm) for slipform and at the end of the dowels for the fill-in lanes. The spacing of internal units shall be uniform and shall not exceed 18 inches (0.5 m).

The term internal vibration means vibrating units located within the specified thickness of pavement section.

The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without, segregation, voids, or vibrator trails and the amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete along the entire length of the vibrating unit and for a distance of at least one foot (30 cm). The frequency of vibration or amplitude should be adjusted proportionately with the rate of travel to result in a uniform density and air content. The paving machine shall be equipped with a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.

The concrete shall be held at a uniform consistency. The slip-form paver shall be operated with as nearly a continuous forward movement as possible and all operations of mixing, delivering, and spreading concrete shall be coordinated 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.

When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall be equipped with protective pads on crawler tracks or rubber-tired wheels on which the bearing surface is offset to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge.

Not more than 15% of the total free edge of each 500-foot (150 m) segment of pavement, or fraction thereof, shall have an edge slump exceeding 1/4 inch (6 mm), and none of the free edge of the pavement shall have an edge slump exceeding 3/8 inch (9 mm). (The total free edge of 500 feet (150 m) of pavement will be considered the cumulative total linear measurement of pavement edge originally constructed as nonadjacent to any existing pavement; that is, 500 feet (150 m) of paving lane originally constructed as a separate lane will have 1,000 feet (300 m) of free edge, 500 feet (150 m) of fill-in lane will have no free edge, etc.). The area affected by the downward movement of the concrete along the pavement edge shall be limited to not more than 18 inches (0.5 m) from the edge.

When excessive edge slump cannot be corrected before the concrete has hardened, the area with excessive edge slump will be removed the full width of the slip form lane and replaced at the expense of the Contractor as directed by the RPR.

b. Fixed-form construction. Forms shall be drilled in advance of being placed to line and grade to accommodate tie bars / dowel bars where these are specified.

Immediately in advance of placing concrete and after all subbase operations are completed, side forms shall be trued and maintained to the required line and grade for a distance sufficient to prevent delay in placing.

Side forms shall remain in place at least 12 hours after the concrete has been placed, and in all cases until the edge of the pavement no longer requires the protection of the forms. Curing compound shall be applied to the concrete immediately after the forms have been removed.

Side forms shall be thoroughly cleaned and coated with a release agent each time they are used and before concrete is placed against them.

Concrete shall be spread, screed, shaped and consolidated by one or more self-propelled machines. These machines shall uniformly distribute and consolidate concrete without segregation so that the completed pavement will conform to the required cross-section with a minimum of handwork.

The number and capacity of machines furnished shall be adequate to perform the work required at a rate equal to that of concrete delivery. The equipment must be specifically designed for placement and finishing using stationary side forms. Methods and equipment shall be reviewed and accepted by the RPR.

Concrete for the full paving width shall be effectively consolidated by internal vibrators. The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation, voids, or leaving vibrator trails.

Power to vibrators shall be connected so that vibration ceases when forward or backward motion of the machine is stopped.

c. Consolidation. Concrete shall be consolidated with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. The vibrators shall be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than 2 inches (50 mm). Vibrators shall not be used to transport or spread the concrete. For each paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators shall be maintained at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) or over-consolidation (vibrator trails, segregation, or any other evidence) shall require the immediate stopping of the paving operation and adjustment of the equipment or procedures as approved by the RPR.

If a lack of consolidation of the hardened concrete is suspected by the RPR, referee testing may be required. Referee testing of hardened concrete will be performed by the RPR by cutting cores from the finished pavement after a minimum of 24 hours curing. The RPR shall visually examine the cores for evidence of lack of consolidation. Density determinations will be made by the RPR based on the water content of the core as taken. ASTM C642 shall be used for the determination of core density in the saturated-surface dry condition. When required, referee cores will be taken at the minimum rate of one for each 500 cubic yards (382 m^2) of pavement, or fraction. The Contractor shall be responsible for all referee testing cost if they fail to meet the required density.

The average density of the cores shall be at least 97% of the original concrete mix density, with no cores having a density of less than 96% of the original concrete mix density. Failure to meet the referee tests will be considered evidence that the minimum requirements for vibration are inadequate for the job conditions. Additional vibrating units or other means of increasing the effect of vibration shall be employed so that the density of the hardened concrete conforms to the above requirements.

501-4.9 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 that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck off to such length and depth that the sheet of reinforcing steel 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 screed. If any portion of the bottom layer of concrete has been placed more than 30 minutes without being covered with the top layer or if initial set has taken place, it 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 positioned in advance of concrete placement or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements.

501-4.10 Joints. Joints shall be constructed as shown on the plans and in accordance with these requirements. All joints shall be constructed with their faces perpendicular to the surface of the pavement and finished or edged as shown on the plans. Joints shall not vary more than 1/2-inch (12 mm) from their designated position and shall be true to line with not more than 1/4-inch (6 mm) variation in 10 feet (3 m). The surface across the joints shall be tested with a 12-foot (3 m) straightedge as the joints are finished and any irregularities in excess of 1/4 inch (6 mm) shall be corrected before the concrete has hardened. All joints shall be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on the plans.

a. Construction. Longitudinal construction joints shall be slip-formed or formed against side forms as shown in the plans.

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. The installation of the joint shall be located at a planned contraction or expansion joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete back to the previous planned joint.

b. Contraction. Contraction joints shall be installed at the locations and spacing as shown on the plans. Contraction joints shall be installed to the dimensions required by forming a groove or cleft in the top of the slab while the concrete is still plastic or by sawing a groove into the concrete surface after the concrete has hardened. When the groove is formed in plastic concrete the sides of the grooves shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge

finish shall be according to the manufacturer's instructions. The groove shall be finished or cut clean so that spalling will be avoided at intersections with other joints. Grooving or sawing shall produce a slot at least 1/8 inch (3 mm) wide and to the depth shown on the plans.

c. Isolation (expansion). Isolation joints shall be installed as shown on the plans. The premolded filler of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint. The filler shall be fastened uniformly along the hardened joint face with no buckling or debris between the filler and the concrete interface, including a temporary filler for the sealant reservoir at the top of the slab. The edges of the joint shall be finished and tooled while the concrete is still plastic

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An isolation joint is primarily used to separate structures with different foundations and pavements with different joint patterns. It does not provide for expansion by the material compressing, but rather allowing the joint to slip. There should rarely be an occasion to dowel an isolation joint since it defeats the purpose of the joint and does not permit isolation and slippage. A thickened-edge is the preferred load transfer method for isolation joints.

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d. Dowels and Tie Bars for Joints

(1) Tie bars. Tie bars shall consist of deformed bars installed in joints as shown on the plans. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals shown on the plans. They shall be held in position parallel to the pavement surface and in the middle of the slab depth and within the tolerances in paragraph 501-4.10(f.). When tie bars extend into an unpaved lane, they may be bent against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. Tie bars shall not be painted, greased, or enclosed in sleeves. When slip-form operations call for tie bars, two-piece hook bolts can be installed.

(2) Dowel bars. Dowel bars shall be placed across joints in the proper horizontal and vertical alignment as shown on the plans. The dowels shall be coated with a bond-breaker or other lubricant recommended by the manufacturer and approved by the RPR. Dowels bars at longitudinal construction joints shall be bonded in drilled holes.

(3) Placing dowels and tie bars. Horizontal spacing of dowels shall be within a tolerance of ±3/4 inch (19 mm). The vertical location on the face of the slab shall be within a tolerance of ±1/2 inch (12 mm). The method used to install dowels shall ensure that the horizontal and vertical alignment will not be greater than 1/4 inch per feet (6 mm per 0.3 m), except for those across the crown or other grade change joints. Dowels across crowns and other joints at grade changes shall be measured to a level surface. Horizontal alignment shall be checked perpendicular to the joint edge. The portion of each dowel intended to move within the concrete or expansion cap shall be wiped clean and coated with a thin, even film of lubricating oil or light grease before the concrete is placed. Dowels shall be installed as specified in the following subparagraphs.

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Dowels and tie bars shall not be placed closer than 0.6 times the dowel bar or tie bar length to the planned joint line. If the last regularly spaced longitudinal dowel and/or tie bar is closer than that dimension, it shall be moved away from the joint to a location 0.6 times the dowel bar and/or tie bar length, but not closer than 6 inches (150 mm) to its nearest neighbor.

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(a) Contraction joints. Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal frames or basket assemblies of an approved type. The basket assemblies shall be held securely in the proper location by means of suitable pins or anchors. Do not cut or crimp the dowel basket tie wires.

At the Contractor's option, dowels and tie bars in contraction joints may be installed by insertion into the plastic concrete using approved equipment and procedures per the paver manufacturer's design. Approval of installation methods will be based on the results of the control strip showing that the dowels and tie bars are installed within specified tolerances as verified by cores or non-destructive rebar location devices approved by the RPR.

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Non-destructive rebar location devices include the MIT scanner, Pachometer, R-Meter, etc.

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(b) Construction joints. Install dowels and tie bars by the cast-in- place or the drill-and-dowel method. Installation by removing and replacing in preformed holes will not be permitted. Dowels and tie bars shall be prepared and placed across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms.

(c) Joints in hardened concrete. Install dowels in hardened concrete by bonding the dowels into holes drilled into the concrete. The concrete shall have cured for seven (7) days or reached a minimum **[** compressive strength of 3100 psi ((21.4 MPa)) **] [** flexural strength of 450 psi (3.1 MPa) **]** before drilling begins. Holes 1/8 inch (3 mm) greater in diameter than the dowels shall be drilled into the hardened concrete using rotary-core drills. Rotary-percussion drills may be used, provided that excessive spalling does not occur. Spalling beyond the limits of the grout retention ring will require modification of the equipment and operation. Depth of dowel hole shall be within a tolerance of ±1/2 inch (12 mm) of the dimension shown on the drawings. On completion of the drilling operation, the dowel hole shall be blown out with oil-free, compressed air. Dowels shall be bonded in the drilled holes using epoxy resin. Epoxy resin shall be injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel will not be permitted. The dowels shall be held in alignment at the collar of the hole by means of a suitable metal or plastic grout retention ring fitted around the dowel.

e. Sawing of joints. Sawing shall commence, without regard to day or night, as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing and before uncontrolled shrinkage cracking of the pavement occurs and shall continue without interruption until all joints have been sawn. All slurry and debris produced in the sawing of joints shall be removed by vacuuming and washing. Curing compound or system shall be reapplied in the initial saw-cut and maintained for the remaining cure period.

Joints shall be cut in locations as shown on the plans. The initial joint cut shall be a minimum 1/8 inch (3 mm) wide and to the depth shown on the plans. Prior to placement of joint sealant or seals, the top of the joint shall be widened by sawing as shown on the plans.

501-4.11 Finishing. Finishing operations shall be a continuing part of placing operations starting immediately behind the strike-off of the paver. Initial finishing shall be provided by the transverse screed or extrusion plate. The sequence of operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, edging of joints, and then texturing. Finishing shall be by the machine method. The hand method shall be used only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing, shall be immediately stopped and proper adjustments made or the equipment replaced. Equipment, mixture, and/or procedures which produce more than 1/4 inch (6 mm) of mortar-rich surface shall be immediately modified as necessary to eliminate this condition or operations shall cease. Compensation shall be made for surging behind the screeds or extrusion plate and settlement during hardening and care shall be taken to ensure that paving and finishing machines are properly adjusted so that the finished surface of the concrete (not just the cutting edges of the screeds) will be at the required line and grade. Finishing equipment and tools shall be maintained clean and in an approved condition. At no time shall water be added to the surface of the slab with the finishing equipment or tools, or in any other way. Fog (mist) sprays or other surface applied finishing aids specified to prevent plastic shrinkage cracking, approved by the RPR, may be used in accordance with the manufacturers requirements.

a. Machine finishing with slipform pavers. The slipform paver shall be operated so that only a very minimum of additional finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Any equipment or procedure that fails to meet these specified requirements shall immediately be replaced or modified as necessary. A self-propelled non-rotating pipe float may be used while the concrete is still plastic, to remove minor irregularities and score marks. Only one pass of the pipe float shall be allowed. Equipment, mixture, and/or procedures which produce more than 1/4 inch (6 mm) of mortar-rich surface shall be immediately modified as necessary to eliminate this condition or operations shall cease. Remove excessive slurry from the surface with a cutting straightedge and wipe off the edge. Any slurry which does run down the vertical edges shall be immediately removed by hand, using stiff brushes or scrapers. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

b. Machine finishing with fixed forms. The machine shall be designed to straddle the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment

and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

c. Other types of finishing equipment. Clary screeds, other rotating tube floats, or bridge deck finishers are not allowed on mainline paving, but may be allowed on irregular or odd-shaped slabs, and near buildings or trench drains, subject to the RPR's approval.

Bridge deck finishers shall have a minimum operating weight of 7500 pounds (3400 kg) and shall have a transversely operating carriage containing a knock-down auger and a minimum of two immersion vibrators. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved.

d. Hand finishing. Hand finishing methods will not be permitted, except under the following conditions: (1) in the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade and (2) in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical.

e. Straightedge testing and surface correction. After the pavement has been struck off and while the concrete is still plastic, it shall be tested for trueness with a 12-foot (3.7-m) finishing straightedge swung from handles capable of spanning at least one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance in excess of 1/8 inch (3 mm) thick shall be removed from the surface of the pavement and wasted. Any depressions 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 smoothness requirements. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross-section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

501-4.12 Surface texture. The surface of the pavement shall be finished as designated below for all newly constructed concrete pavements. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. The texture shall be uniform in appearance and approximately 1/16 inch (2 mm) in depth. Any imperfections resulting from the texturing operation shall be corrected to the satisfaction of the RPR.

a. Brush or broom finish. [Shall be applied when the water sheen has practically disappeared. The equipment shall operate transversely across the pavement surface. **] [** Not used. **]**

b. Burlap drag finish. [Burlap, at least 15 ounces per square yard (555 grams per square meter), will typically produce acceptable texture. To obtain a textured surface, the transverse threads of the burlap shall be removed approximately one foot (30 cm) from the trailing edge. A heavy buildup of grout on the burlap threads produces the desired wide sweeping longitudinal striations on the pavement surface. **] [** Not used. **]**

c. Artificial turf finish. [Shall be applied by dragging the surface of the pavement in the direction of concrete placement with an approved full-width drag made with artificial turf. The leading transverse

edge of the artificial turf drag will be securely fastened to a lightweight pole on a traveling bridge. At least 2 feet (60 cm) of the artificial turf shall be in contact with the concrete surface during dragging operations. Approval of the artificial turf will be done only after it has been demonstrated by the Contractor to provide a satisfactory texture. One type that has provided satisfactory texture consists of 7,200 approximately 0.85-inch-long polyethylene turf blades per square foot. **] [** Not used. **]**

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The Engineer shall specify the type(s) of finishes to be used on project.

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501-4.13 Curing. Immediately after finishing operations are completed and bleed water is gone from the surface, all exposed surfaces of the newly placed concrete shall be cured for a 7-day cure period in accordance with one of the methods below. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period.

When a two-saw-cut method is used to construct the contraction joint, the curing compound shall be applied to the saw-cut immediately after the initial cut has been made. The sealant reservoir shall not be sawed until after the curing period has been completed. When the one cut method is used to construct the contraction joint, the joint shall be cured with wet rope, wet rags, or wet blankets. The rags, ropes, or blankets shall be kept moist for the duration of the curing period.

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The Engineer shall delete cure types that may not be feasible in operating areas subject to aircraft jet blast.

The use of supplementary cementitious materials (for example, fly ash, slag cement) or set-retarding admixtures may delay the occurrence of bleed water.

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a. Impervious membrane method. Curing with liquid membrane compounds should not occur until bleed and surface moisture has evaporated. All exposed surfaces 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. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of one gallon (4 liters) to not more than 150 square feet (14 sq m). The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. 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 mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. When hand spraying is approved by the RPR, a double application rate shall be used to ensure coverage. Should the film become damaged from any cause, including sawing operations, within the required curing period, the damaged portions shall be repaired immediately with additional compound or other approved means.

Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

b. White burlap-polyethylene sheets. The surface of the pavement shall be entirely covered with the sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully saturated and in position for seven (7) days after the concrete has been placed.

c. Water method. The entire area shall be covered with burlap or other water absorbing material. The material shall be of sufficient thickness to retain water for adequate curing without excessive runoff. The material shall be kept wet at all times and maintained for seven (7) days. When the forms are stripped, the vertical walls shall also be kept moist. It shall be the responsibility of the Contractor to prevent ponding of the curing water on the subbase.

d. Concrete protection for cold weather. Maintain the concrete at a temperature of at least 50°F (10°C) for a period of 72 hours after placing and at a temperature above freezing for the remainder of the 7-day curing period. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather; and any concrete damaged shall be removed and replaced at the Contractor's expense.

e. Concrete protection for hot weather. Concrete should be continuous moisture cured for the entire curing period and shall commence as soon as the surfaces are finished and continue for at least 24 hours. However, if moisture curing is not practical beyond 24 hours, the concrete surface shall be protected from drying with application of a liquid membrane-forming curing compound while the surfaces are still damp. Other curing methods may be approved by the RPR.

501-4.14 Removing forms. Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has hardened sufficiently to permit removal without chipping, spalling, or tearing. After the forms have been removed, the sides of the slab shall be cured in accordance with paragraph 501-4.13.

If honeycombed areas are evident when the forms are removed, materials, placement, and consolidation methods must be reviewed and appropriate adjustments made to assure adequate consolidation at the edges of future concrete placements. Honeycombed areas that extend into the slab less than approximately 1 inch (25 mm), shall be repaired with an approved grout, as directed by the RPR. Honeycombed areas that extend into the slab greater than a depth of 1 inch (25 mm) shall be considered as defective work and shall be removed and replaced in accordance with paragraph 501-4.19.

501-4.15 Saw-cut grooving. If shown on the plans, grooved surfaces shall be provided in accordance with the requirements of Item P-621.

501-4.16 Sealing joints. The joints in the pavement shall be sealed in accordance with Item **[** P-604 **]** **[** P-605 **]**.

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The Engineer shall include the applicable specifications.

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501-4.17 Protection of pavement. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents until accepted by the RPR. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, crossovers, and protection of unsealed joints from intrusion of foreign material, etc. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense.

Aggregates, rubble, or other similar construction materials shall not be placed on airfield pavements. Traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least seven (7) days old, or for a longer period if directed by the RPR.

In paving intermediate lanes between newly paved pilot lanes, operation of the hauling and paving equipment will be permitted on the new pavement after the pavement has been cured for seven (7) days, the joints are protected, the concrete has attained a minimum field cured flexural strength of [450 psi (3100 kPa)], and the slab edge is protected.

All new and existing pavement carrying construction traffic or equipment shall be kept clean and spillage of concrete and other materials shall be cleaned up immediately.

Damaged pavements shall be removed and replaced at the Contractor's expense. Slabs shall be removed to the full depth, width, and length of the slab.

501-4.18 Opening to construction traffic. The pavement shall not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have attained a flexural strength of [450 pounds per square inch (3100 kPa)] when tested in accordance with ASTM C78. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints shall either be sealed or protected from damage to the joint edge and intrusion of foreign materials into the joint. As a minimum, backer rod or tape may be used to protect the joints from foreign matter intrusion.

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When the design strength in paragraph 501-3.3 is based on compressive strength, a strength of 3,100 psi (21400 kPa) shall be specified. Testing shall be in accordance with ASTM C39. See note with paragraph 501-4.8 for guidance on editing 501-4.17 and 501-4.18.

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501-4.19 Repair, removal, or replacement of slabs. New pavement slabs that are broken or contain cracks or are otherwise defective or unacceptable as defined by acceptance criteria in paragraph 501-6.6 shall be removed and replaced or repaired, as directed by the RPR, at the Contractor's expense. Spalls along joints shall be repaired as specified. Removal of partial slabs is not permitted. Removal

and replacement shall be full depth, shall be full width of the slab, and the limit of removal shall be normal to the paving lane and to each original transverse joint. The RPR will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be have a diameter of 2 inches (50 mm) to 4 inches (100 mm), shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with a bonding agent, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the Owner. Repair of cracks as described in this section shall not be allowed if in the opinion of the RPR the overall condition of the pavement indicates that such repair is unlikely to achieve an acceptable and durable finished pavement. No repair of cracks shall be allowed in any panel that demonstrates segregated aggregate with an absence of coarse aggregate in the upper 1/8 inch (3 mm) of the pavement surface.

a. Shrinkage cracks. Shrinkage cracks which do not exceed one-third of the pavement depth shall be cleaned and either high molecular weight methacrylate (HMWM) applied; or epoxy resin (Type IV, Grade 1) pressure injected using procedures recommended by the manufacturer and approved by the RPR. Sandblasting of the surface may be required following the application of HMWM to restore skid resistance. Care shall be taken to ensure that the crack is not widened during epoxy resin injection. All epoxy resin injection shall take place in the presence of the RPR. Shrinkage cracks which exceed one-third the pavement depth shall be treated as full depth cracks in accordance with paragraphs 501-4.19b and 501-19c.

b. Slabs with cracks through interior areas. Interior area is defined as that area more than 6 inches (150 mm) from either adjacent original transverse joint. The full slab shall be removed and replaced at no cost to the Owner, when there are any full depth cracks, or cracks greater than one-third the pavement depth, that extend into the interior area.

c. Cracks close to and parallel to joints. All full-depth cracks within 6 inches (150 mm) either side of the joint and essentially parallel to the original joints, shall be treated as follows.

(1) Full depth cracks and original joint not cracked. The full-depth crack shall be treated as the new joint and the original joint filled with an epoxy resin.

i. Full-depth crack. The joint sealant reservoir for the crack shall be formed by sawing to a depth of 3/4 inches (19 mm), ±1/16 inch (2 mm), and to a width of 5/8 inch (16 mm), ±1/8 inch (3 mm). The crack shall be sawed with equipment specially designed to follow random cracks. Any equipment or procedure which causes raveling or spalling along the crack shall be modified or replaced to prevent raveling or spalling. The joint shall be sealed with sealant in accordance with P-605 or as directed by the RPR.

ii. Original joint. If the original joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures.

If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures.

Where a parallel crack goes part way across paving lane and then intersects and follows the original joint which is cracked only for the remained of the width, it shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

(2) Full depth cracks and original joint cracked. If there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, the entire slab containing the crack shall be removed and replaced.

d. Removal and replacement of full slabs. Make a full depth cut perpendicular to the slab surface along all edges of the slab with a concrete saw cutting any dowels or tie-bars. Remove damaged slab protecting adjacent pavement from damage. Damage to adjacent slabs may result in removal of additional slabs as directed by the RPR at the Contractor's expense.

The underlying material shall be repaired, re-compacted and shaped to grade.

Dowels of the size and spacing specified for other joints in similar pavement on the project shall be installed along all four (4) edges of the new slab in accordance with paragraph 501-4.10d.

Placement of concrete shall be as specified for original construction. The joints around the new slab shall be prepared and sealed as specified for original construction.

e. Spalls along joints.

(1) Spalls less than one inch wide and less than the depth of the joint sealant reservoir, shall be filled with joint sealant material.

(2) Spalls larger than one inch and/or deeper than the joint reservoir, but less than ½ the slab depth, and less than 25% of the length of the adjacent joint shall be repaired as follows:

i. Make a vertical saw cut at least one inch (25 mm) outside the spalled area and to a depth of at least 2 inches (50 mm). Saw cuts shall be straight lines forming rectangular areas surrounding the spalled area.

ii. Remove unsound concrete and at least 1/2 inch (12 mm) of visually sound concrete between the saw cut and the joint or crack with a light chipping hammer.

iii. Clean cavity with high-pressure water jets supplemented with compressed air as needed to remove all loose material.

iv. Apply a prime coat of epoxy resin, Type III, Grade I, to the dry, cleaned surface of all sides and bottom of the cavity, except any joint face.

v. Fill the cavity with low slump concrete or mortar or with epoxy resin concrete or mortar.

vi. An insert or other bond-breaking medium shall be used to prevent bond at all joint faces.

vii. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and sealed with the sealer specified for the joints.

(3) Spalls deeper than 1/2 of the slab depth or spalls longer than 25% of the adjacent joint require replacement of the entire slab.

f. Diamond grinding of Concrete surfaces. Diamond grinding shall be completed prior to pavement grooving. Diamond grinding of the hardened concrete should not be performed until the concrete is at least 14 days old and has achieved full minimum strength. Equipment that causes ravels, aggregate fractures, spalls or disturbance to the joints will not be permitted. The depth of diamond grinding shall not exceed 1/2 inch (13 mm) and all areas in which diamond grinding has been performed will be subject to the final pavement thickness tolerances specified.

Diamond grinding shall be performed with a machine specifically designed for diamond grinding capable of cutting a path at least 3 feet (0.9 m) wide. The saw blades shall be 1/8-inch (3-mm) wide with sufficient number of flush cut blades that create grooves between 0.090 and 0.130 inches (2 and 3.5 mm) wide; and peaks and ridges approximately 1/32 inch (1 mm) higher than the bottom of the grinding cut. The Contractor shall determine the number and type of blades based on the hardness of the aggregate. Contractor shall demonstrate to the RPR that the grinding equipment will produce satisfactory results prior to making corrections to surfaces.

Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The slurry resulting from the grinding operation shall be continuously removed and the pavement left in a clean condition. All grinding shall be at the expense of the Contractor.

CONTRACTOR QUALITY CONTROL (CQC)

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All federally funded projects over $500K dollars where paving is the major work item must have a CQCP. It is strongly encouraged that a Contractor Quality Control Program (CQCP) be developed for all projects.

For projects that do not include a formal CQCP, this section can be edited to remove reference to a CQCP. However, QC testing is still required regardless of project size.

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501-5.1 Quality control program. [The Contractor shall develop a Quality Control Program in accordance with Item C-100. No partial payment will be made for materials that are subject to specific quality control requirements without an approved quality control program. **]**

501-5.2 Contractor Quality Control (CQC). [The Contractor shall provide or contract for testing facilities in accordance with Item C-100. The RPR shall be permitted unrestricted access to inspect the Contractor's QC facilities and witness QC activities. The RPR will advise the Contractor in writing of any noted deficiencies concerning the QC facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected. **]**

501-5.3 Contractor QC testing. The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to this specification **[** and as set forth in the CQCP. The testing program shall include, but not necessarily be limited to, tests for aggregate gradation, aggregate moisture content, slump, and air content. A QC Testing Plan shall be developed and approved by the RPR as part of the CQCP.

The RPR may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of concrete mixture which is rendered unfit for use due to contamination,

segregation, or improper slump. Such rejection may be based on only visual inspection. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the RPR, and if it can be demonstrated in the laboratory, in the presence of the RPR, that such material was erroneously rejected, payment will be made for the material at the contract unit price **].**

a. Fine aggregate.

(1) Gradation. A sieve analysis shall be made at least twice daily in accordance with ASTM C136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

(2) Moisture content. If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C70 or ASTM C566.

(3) Deleterious substances. Fine aggregate as delivered to the mixer shall be tested for deleterious substances in fine aggregate for concrete as specified in paragraph 501-2.1b, prior to production of the control strip, and a minimum of every 30-days during production or more frequently as necessary to control deleterious substances.

b. Coarse Aggregate.

(1) Gradation. A sieve analysis shall be made at least twice daily for each size of aggregate. Tests shall be made in accordance with ASTM C136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

(2) Moisture content. If an electric moisture meter is used, at least two direct measurements of moisture content shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C566.

(3) Deleterious substances. Coarse aggregate as delivered to the mixer shall be tested for deleterious substances in coarse aggregate for concrete as specified in paragraph 501-2.1c, prior to production of the control strip, and a minimum of every 30-days during production or more frequently as necessary to control deleterious substances.

c. Slump. One test shall be made for each sublot. Slump tests shall be performed in accordance with ASTM C143 from material randomly sampled from material discharged from trucks at the paving site. Material samples shall be taken in accordance with ASTM C172.

d. Air content. One test shall be made for each sublot. Air content tests shall be performed in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag or other porous coarse aggregate, from material randomly sampled from trucks at the paving site. Material samples shall be taken in accordance with ASTM C172.

e. Unit weight and Yield. One test shall be made for each sublot. Unit weight and yield tests shall be in accordance with ASTM C138. The samples shall be taken in accordance with ASTM C172 and at the same time as the air content tests.

f. Temperatures. Temperatures shall be checked at least four times per lot at the job site in accordance with ASTM C1064.

g. Smoothness for Contractor Quality Control.

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Note change in deviations on final surface course that require grinding, limited to deviations > 1/4 inch that trap water, intent here is to focus on areas that may cause issues with the safe operation of aircraft and to minimize grinding if it will not improve safety

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The Contractor shall perform smoothness testing in transverse and longitudinal directions daily to verify that the construction processes are producing pavement with variances less than ¼ inch in 12 feet, identifying areas that may pond water which could lead to hydroplaning of aircraft. If the smoothness criteria is not met, appropriate changes and corrections to the construction process shall be made by the Contractor before construction continues

The Contractor may use a 12-foot (3.7 m) "straightedge, a rolling inclinometer meeting the requirements of ASTM E2133 or rolling external reference device that can simulate a 12-foot (3.7m) straightedge approved by the RPR. Straight-edge testing shall start with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Testing shall be continuous across all joints. The surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using either the FAA profile program, ProFAA, or FHWA profile program ProVal, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions. The transition between new and existing pavement shall be evaluated separately for conformance with the plans.

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Include detail for transition between new and existing pavement including smoothness and grade limitations.

****

(1) Transverse measurements. Transverse measurements shall be taken for each day's production placed. Transverse measurements shall be taken perpendicular to the pavement centerline each 50 feet (15 m) or more often as determined by the RPR. The joint between lanes shall be tested separately to facilitate smoothness between lanes.

(2) Longitudinal measurements. Longitudinal measurements shall be taken for each day's production placed. Longitudinal tests shall be parallel to the centerline of paving; at the center of

paving lanes when widths of paving lanes are less than 20 feet (6 m); and at the third points of paving lanes when widths of paving lanes are 20 ft (6 m) or greater. When placement abuts previously placed material the first measurement shall start with one half the length of the straight edge on the previously placed material.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4 inch (6 mm) shall be corrected with diamond grinding per paragraph 501-4.19f or by removing and replacing the surface course to full depth. Grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. All areas in which diamond grinding has been performed shall be subject to the final pavement thickness tolerances specified in paragraph 501-6.6.

Control charts shall be kept to show area of each day's placement and the percentage of corrective grinding required. Corrections to production and placement shall be initiated when corrective grinding is required. If the Contractor's machines and/or methods produce significant areas that need corrective actions in excess of 10 percent of a day's production, production shall be stopped until corrective measures are implemented by the Contractor.

h. Grade. Grade will be evaluated prior to and after placement of the concrete surface.

Measurements will be taken at appropriate gradelines (as a minimum at center and edges of paving lane) and longitudinal spacing as shown on cross-sections and plans. The final surface of the pavement will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm) vertically **[** and 0.1 feet (30 mm) laterally **]**. The documentation will be provided by the Contractor to the RPR **[** within 48 hours **] [** by the end of the following working day **]**.

Areas with humps or depression that that exceed grade or smoothness and that retain water on the surface must be ground off provided the course thickness after grinding is not more than 1/2 inch (12 mm) less than the thickness specified on the plans. If these areas cannot be corrected with grinding then the slabs that are retaining water must be removed and replaced in accordance with paragraph 501-4.19d. Grinding shall be in accordance with paragraph 501-4.19f. All corrections will be at the Contractors expense.

501-5.4 Control charts. The Contractor shall maintain linear control charts for fine and coarse aggregate gradation, slump, and air content. The Contractor shall also maintain a control chart plotting the coarseness factor/workability factor from the combined gradations in accordance with paragraph 501-2.1d.

Control charts shall be posted in a location satisfactory to the RPR and shall be kept up to date at all times. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and suspension Limits, or Specification limits, applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a potential problem and the Contractor is not taking satisfactory corrective action, the RPR may halt production or acceptance of the material.

a. Fine and coarse aggregate gradation. The Contractor shall record the running average of the last five gradation tests for each control sieve on linear control charts. Superimposed on the control

charts shall be the action and suspension limits. Gradation tests shall be performed by the Contractor per ASTM C136. The Contractor shall take at least **[** two **]** samples per lot to check the final gradation. Sampling shall be per ASTM D75 from the flowing aggregate stream or conveyor belt.

b. Slump and air content. The Contractor shall maintain linear control charts both for individual measurements and range (that is, difference between highest and lowest measurements) for slump and air content in accordance with the following Action and Suspension Limits.

c. Combined gradation. The Contractor shall maintain a control chart plotting the coarseness factor and workability factor on a chart in accordance with paragraph 501-2.1d.

Control Chart Limits[1]

Control Parameter	**Individual Measurements**	
	Action Limit	**Suspension Limit**
Gradation[2]	*[3]	*[3]
Coarseness Factor (CF)	±3.5	±5
Workability Factor (WF)	±2	±3
Slump	+0.5 to -1 inch (+13 to -25 mm)	+1 to -1.5 inch (+25 to -38 mm)
Air Content	±1.5%	±2.0%

[1] Control charts shall developed and maintained for each control parameter indicated.

[2] Control charts shall be developed and maintained for each sieve size.

[3] Action and suspension limits shall be determined by the Contractor.

501-5.5 Corrective action at Suspension Limit. [The CQCP shall indicate that appropriate action shall be taken when the process is believed to be out of control. The CQCP shall detail what action will be taken to bring the process into control and shall contain sets of rules to gauge when a process is out of control. As a minimum, a process shall be deemed out of control and corrective action taken if any one of the following conditions exists.

a. Fine and coarse aggregate gradation. When two consecutive averages of five tests are outside of the suspension limits, immediate steps, including a halt to production, shall be taken to correct the grading.

b. Coarseness and Workability factor. When the CF or WF reaches the applicable suspension limits, the Contractor, immediate steps, including a halt to production, shall be taken to correct the CF and WF.

c. Fine and coarse aggregate moisture content. Whenever the moisture content of the fine or coarse aggregate changes by more than 0.5%, the scale settings for the aggregate batcher and water batcher shall be adjusted.

d. Slump. The Contractor shall halt production and make appropriate adjustments whenever:

(1) one point falls outside the Suspension Limit line for individual measurements

OR

(2) two points in a row fall outside the Action Limit line for individual measurements.

d. Air content. The Contractor shall halt production and adjust the amount of air-entraining admixture whenever:

(1) one point falls outside the Suspension Limit line for individual measurements

OR

(2) two points in a row fall outside the Action Limit line for individual measurements. **]**

MATERIAL ACCEPTANCE

501-6.1 Quality Assurance (QA) Acceptance sampling and testing. All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section, with the exception of coring for thickness determination, will be performed by the RPR. The Contractor shall provide adequate facilities for the initial curing of beams. The Contractor shall bear the cost of providing initial curing facilities and coring and filling operations, per paragraph 501-6.5b(1).

The samples will be transported while in the molds. The curing, except for the initial cure period, will be accomplished using the immersion in saturated lime water method. During the 24 hours after molding, the temperature immediately adjacent to the specimens must be maintained in the range of 60° to 80°F (16° to 27°C), and loss of moisture from the specimens must be prevented. The specimens may be stored in tightly constructed wooden boxes, damp sand pits, temporary buildings at construction sites, under wet burlap in favorable weather, or in heavyweight closed plastic bags, or using other suitable methods, provided the temperature and moisture loss requirements are met.

501-6.2 Quality Assurance (QA) testing laboratory. Quality assurance testing organizations performing these acceptance tests will be accredited in accordance with ASTM C1077. The quality assurance laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods will be submitted to the RPR prior to start of construction.

501-6.3 Lot size. Concrete will be accepted for strength and thickness on a lot basis. A lot will consist of a day's production not to exceed 2,000 cubic yards (1530 cubic meters) **[[___]** square yards (**[___]** square meters) **]**. Each lot will be divided into approximately equal sublots with individual sublots between 400 to 600 cubic yards. Where three sublots are produced, they will constitute a lot. Where one or two sublots are produced, they will be incorporated into the previous or next lot. Where more than one plant is simultaneously producing concrete for the job, the lot sizes will apply separately for each plant.

501-6.4 Partial lots. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot or for overages or minor placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.

Where three sublots have been produced, they will constitute a lot. Where one or two sublots have been produced, they will be incorporated into the next lot or the previous lot and the total number of sublots will be used in the acceptance criteria calculation, that is, n=5 or n=6.

****

The Engineer will specify the lot size for a project based on the total quantity and the expected production rate. The lot size should not exceed 2,000 cubic yards (1,530 cubic meters). For projects where basis of payment is square yards (square meters), the Engineer will convert the lot size to an equivalent area that contains 2,000 cubic yards (1,530 cubic meters) or less.

****

501-6.5 Acceptance Sampling and Testing.

a. Strength.

(1) Sampling. One sample will be taken for each sublot from the concrete delivered to the job site. Sampling locations will be determined by the RPR in accordance with random sampling procedures contained in ASTM D3665. The concrete will be sampled in accordance with ASTM C172.

(2) Test Specimens. The RPR will be responsible for the casting, initial curing, transportation, and curing of specimens in accordance with ASTM C31. Two (2) specimens will be made from each sample and slump, air content, unit weight, and temperature tests will be conducted for each set of strength specimens. Within 24 to 48 hours, the samples will be transported from the field to the laboratory while in the molds. Samples will be cured in saturated lime water.

The strength of each specimen will be determined in accordance with **[** ASTM C39 **]** **[** ASTM C78 **]**. The strength for each sublot will be computed by averaging the results of the two test specimens representing that sublot.

(3) Acceptance. Acceptance of pavement for strength will be determined by the RPR in accordance with paragraph 501-6.6b(1). All individual strength tests within a lot will be checked for outliers in accordance with ASTM E178, at a significance level of 5%. Outliers will be discarded and the remaining test values will be used to determine acceptance in accordance with paragraph 501-6.5b.

****

The Engineer must make the appropriate selections in paragraph 501-3.3 based on whether the strength is based on flexural or compressive strength.

****

b. Pavement thickness.

(1) Sampling. One core will be taken by the Contractor for each sublot in the presence of the RPR. Sampling locations will be determined by the RPR in accordance with random sampling procedures contained in ASTM D3665. Areas, such as thickened edges, with planned variable thickness, will be excluded from sample locations.

Cores shall be a minimum 4 inch (100 mm) in diameter neatly cut with a core drill. The Contractor will furnish all tools, labor, and materials for cutting samples and filling the cored hole. Core holes will be filled by the Contractor with a non-shrink grout approved by the RPR within one day after sampling.

(2) Testing. The thickness of the cores will be determined by the RPR by the average caliper measurement in accordance with ASTM C174. Each core shall be photographed and the photograph included with the test report.

(3) Acceptance. Acceptance of pavement for thickness will be determined by the RPR in accordance with paragraph 501-6.6.

501-6.6 Acceptance criteria.

a. General. Acceptance will be based on the following characteristics of the completed pavement discussed in paragraph 501-6.5b:

(1) Strength

(2) Thickness

(3) Grade

(4) Profilograph smoothness **[** Not used. **]**

(5) Adjustments for repairs

****

Add bracketed text when profilograph smoothness not used.

Profilograph smoothness and acceptance adjustment paragraphs only apply when the overall project is a new and/or reconstructed runway(s) and/or taxiway(s) greater than 500 feet (152 m) in length. Any changes to the profilograph smoothness acceptance limits requires a modification to standards in accordance with FAA Order 5300.1, Modifications to Agency Airport Design, Construction, and Equipment Standards.

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Acceptance for strength, thickness, and grade, will be based on the criteria contained in accordance with paragraph 501-6.6b(1), 501-6.6b(2), and 501-6.6b(3), respectively. **[** Acceptance for profilograph smoothness will be based on the criteria contained in paragraph 501-6.6b(4). **]**

[Production quality must achieve 90 PWL or higher to receive full payment.

****

When the design strength in paragraph 501-3.3 is based on compressive strength, substitute compressive strength for flexural strength.

****

Strength and thickness will be evaluated for acceptance on a lot basis using the method of estimating PWL. Production quality must achieve 90 PWL or higher to receive full pavement. The PWL will be determined in accordance with procedures specified in Item C-110.

The lower specification tolerance limit (L) for strength and thickness will be:

Lower Specification Tolerance Limit (L)

Strength	0.93 × strength specified in paragraph 501-3.3
Thickness	Lot Plan Thickness in inches, - 0.50 in

]

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The lower specification tolerance limits above are based on applying statistical analysis to FAA design assumptions, and there is no need to compensate for the above factor in the design process.

****

b. Acceptance criteria.

[(1) Strength. If the PWL of the lot equals or exceeds 90%, the lot will be acceptable. Acceptance and payment for the lot will be determined in accordance with paragraph 501-8.1.

(**2) Thickness.** If the PWL of the lot equals or exceeds 90%, the lot will be acceptable. Acceptance and payment for the lot will be determined in accordance with paragraph 501-8.1. **]**

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For small maintenance and repair projects:

Where the project has multiple small placements or the total project size is less than 2000 cubic yards (1530 cubic meters), the use of percent within limits (PWL) is not appropriate and acceptable material will be paid for by the cubic yard (square yard).

Replace the above bracketed PWL requirements with the following:

(1) Strength. The strength for each sublot shall be computed by averaging the results of that sublot. When sublot strength equals or exceeds the strength as specified in paragraph 501-3.3, the lot will be acceptable. Acceptance and payment for the lot will be determined in accordance with paragraph 501-8.1.

(2) Thickness. If sublot thickness is not be less than ½ inch (12 mm) from plan thickness, the lot will be acceptable. Acceptance and payment for the lot will be determined in accordance with paragraph 501-8.1.

****

(3) Grade. The final finished surface of the pavement of the completed project will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm) vertically **[** or 0.1 feet (30 mm) laterally **]**. The documentation, stamped and signed by a licensed surveyor shall be in accordance with paragraph 501-5.3h. Payment for sublots that do not meet grade for over 25% of the sublot shall reduced by 5% and not be more than 95%.

(4) Profilograph roughness for QA Acceptance. [The final profilograph shall be the full length of the project to facilitate testing of roughness between lots. The **[** Contractor, in the presence of the RPR shall **] [** RPR will **]** perform a profilograph roughness test on the completed project with a profilograph meeting the requirements of ASTM E1274 or a Class I inertial profiler meeting ASTM E950. Data and results shall be provided within **[** 48 hrs **]** of profilograph roughness tests.

The pavement shall have an average profile index less than 15 inches per mile per 1/10 mile. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must grind" bumps and the Profile Index for the pavement using a 0.2-inch (5 mm) blanking band. The bump template must span one inch (25 mm) with an offset of 0.4 inches (10 mm). The profilograph must be calibrated prior to use and operated by a factory or State DOT approved, trained operator. Profilograms shall be recorded on a longitudinal scale of one inch (25 mm) equals 25 feet (7.5 m) and a vertical scale of one inch (25 mm) equals one inch (25 mm). Profilograph shall be performed one foot right and left of project centerline and 15 feet (4.5 m) right and left of project centerline. Any areas that indicate "must grind" shall be corrected with diamond grinding per paragraph 501-4.19f or by removing and replacing full depth of surface course. as directed by the RPR. Where corrections are necessary, a second profilograph run shall be performed to verify that the corrections produced an average profile index of 15 inches per mile per 1/10 mile or less. **] [** Not used. **]**

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Edit as required for project.

Profilograph roughness and acceptance paragraphs only apply when the overall project is a new and/or reconstructed runway(s) and/or taxiway(s) greater than 500 feet (152 m) in length.

Profilograph roughness is not applicable to aprons and should be used with caution on projects to rehabilitate runways and/or taxiways unless the project includes provisions to correct existing deficiencies.

Any changes to the profilograph roughness acceptance limits requires a modification to standards in accordance with FAA Order 5300.1, Modifications to Agency Airport Design, Construction, and Equipment Standards**.**

The Engineer must select who will provide the specified equipment and the timeframe for receiving the test data. The Airport should retain a copy of the profilograph roughness test and reports for inclusion in the Airport's Pavement Maintenance Management Program (PMP).

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(5) Adjustments for repair. Sublots with spall repairs, crack repairs, or partial panel replacement, will be limited to no more than 95% payment.

(6) Adjustment for grinding. For sublots with grinding over 25% of a sublot, payment will be reduced 5%.

METHOD OF MEASUREMENT

501-7.1 Concrete pavement shall be measured by the number of **[** cubic yards (cubic meters) **]** **[** square yards (square meters) **]** of **[** plain **]** **[** reinforced **]** pavement as specified in-place, completed and accepted.

BASIS OF PAYMENT

501-8.1 Payment. Payment for concrete pavement meeting all acceptance criteria as specified in paragraph 501-6.6. Acceptance Criteria shall be based on results of strength **[** , smoothness, **]** and thickness tests. Payment for acceptable lots of concrete pavement shall be adjusted in accordance with paragraph 501-8.1a for strength and thickness; 501-8.1b for repairs; 501-8.1c for grinding; and 501-8.1d for smoothness, subject to the limitation that:

The total project payment for concrete pavement shall not exceed **[___]** percent of the product of the contract unit price and the total number of **[** cubic yards (cubic meters) **]** **[** square yards (square meters) **]** of concrete pavement used in the accepted work (See Note 1 under the Price Adjustment Schedule table below).

Payment shall be full compensation for all labor, materials, tools, equipment, and incidentals required to complete the work as specified herein and on the drawings.

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The Engineer shall specify a value ranging from 100% to 106%. When the total project payment for Item P-501 pavement exceeds the contract unit price, any Airport Improvement Program (AIP) or Passenger Facility Charge (PFC) funds used to pay the excess may require an amendment to the AIP grant or PFC application for the project.

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a. Basis of adjusted payment. The pay factor for each individual lot shall be calculated in accordance with the Price Adjustment Schedule table below. A pay factor shall be calculated for both strength and thickness. The lot pay factor shall be the higher of the two values when calculations for both strength and thickness are 100% or higher. The lot pay factor shall be the product of the two values when only one of the calculations for either strength or thickness is 100% or higher. The lot pay factor shall be the lower of the two values when calculations for both strength and thickness are less than 100%.

Price Adjustment Schedule[1]

Percentage of Materials Within Specification Limits (PWL)	**Lot Pay Factor (Percent of Contract Unit Price)**
96 – 100	106
90 – 95	PWL + 10
75 – 90	0.5 PWL + 55
55 – 74	1.4 PWL – 12
Below 55	Reject[2]

[1] Although it is theoretically possible to achieve a pay factor of 106% for each lot, actual payment in excess of 100% shall be subject to the total project payment limitation specified in paragraph 501-8.1.

[2] The lot shall be removed and replaced unless, after receipt of FAA concurrence, the Owner and Contractor agree in writing that the lot will remain; the lot paid at 50% of the contract unit price; and the total project payment limitation reduced by the amount withheld for that lot.

For each lot accepted, the adjusted contract unit price shall be the product of the lot pay factor for the lot and the contract unit price. Payment shall be subject to the total project payment limitation specified in paragraph 501-8.1. Payment in excess of 100% for accepted lots of concrete pavement shall be used to offset payment for accepted lots of concrete pavement that achieve a lot pay factor less than 100%; except for rejected lots which remain in place and/or sublots with adjustments for repairs.

b. Adjusted payment for repairs. The PWL lot pay factor shall be reduced by 5% and be no higher than 95% for sublots which contain repairs in accordance with paragraph 501-4.19 on more than 20% of the slabs within the sublot. Payment factors greater than 100 percent for the strength and thickness cannot be used to offset adjustments for repairs.

c. Adjusted payment for grinding. The PWL lot pay factor shall be reduced by 5% and be no higher than 95% for sublots with grinding over 25% of a sublot.

d. Profilograph Roughness. [The Contractor will receive full payment when the profilograph average profile index is in accordance with paragraph 501-6.6b(4). When the final average profile index for the entire length of pavement does not exceed 15 inches per mile per 1/10 mile, payment will be made at the contract unit price for the completed pavement. **]**

[Not used. **]**

****

Edit as required for project.

****

e. Payment. Payment shall be made under:

Item P-501-8.1 **Concrete Pavement. [** per cubic yard (cubic meter) **] [** per square yard (square meter) **]**

Item P-620 Runway and Taxiway Marking

DESCRIPTION

620-1.1 This item shall consist of the preparation and painting of numbers, markings, and stripes on the surface of runways, taxiways, and aprons, in accordance with these specifications and at the locations shown on the plans, or as directed by the Resident Project Representative (RPR). The terms "paint" and "marking material" as well as "painting" and "application of markings" are interchangeable throughout this specification.

MATERIALS

620-2.1 Materials acceptance. The Contractor shall furnish manufacturer's certified test reports, for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. This certification along with a copy of the paint manufacturer's surface preparation; marking materials, including adhesion, flow promoting and/or floatation additive; and application requirements must be submitted and approved by the Resident Project Representative (RPR) prior to the initial application of markings. The reports can be used for material acceptance or the RPR may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the RPR upon arrival of a shipment of materials to the site. All material shall arrive in sealed containers that are easily quantifiable for inspection by the RPR.

620-2.2 Marking materials.

Table 1. Marking Materials

Paint[1]				**Glass Beads[2]**	
Type	**Color**	**Fed Std. 595 Number**	**Application Rate Maximum**	**Type**	**Application Rate Minimum**
*	*	*	*	*	*
*	*	*	*	*	*

[1] See paragraph 620-2.2a

[2] See paragraph 620-2.2b

****

Make the appropriate selections for paint type, color, Fed Std 595 number, application rates, and glass bead type and application rates and inserted into Table 1. Asterisks denote insert points.

****

a. Paint. Paint shall be **[** waterborne **][** epoxy **][** methacrylate **][** solvent-base **][** and **][** preformed thermoplastic **]** in accordance with the requirements of this paragraph. Paint colors shall comply with Federal Standard No. 595. **[___]**

****

The Engineer must specify paint type (s), colors and glass beads to be used for the project and populate that information above in Table 1. When more than one paint type is specified, the plans should clearly indicate paint type, paint color and bead type required for each marking.

Select type of paint.

Types: Waterborne, Epoxy, Methacrylate, solvent-base, or preformed Thermoplastic

For waterborne or solvent based paints, specify Type I, II, or III:

- **Type I intended for locations where slower tracking is not a problem.**
- **Type II intended for locations where faster curing is desirable.**
- **Type III intended for locations that require a thicker, more durable coating.**

1. Select paint color(s) from the following Table:

Paint Color	**Fed Std. No 595 Color Number**
White	37925
Red	31136
Yellow	33538 or 33655
Black	37038
Pink	1 part 31136 to 2 parts 37925
Green	34108

Waterborne or solvent base black paint should be used to outline a border at least 6 inches (150 mm) wide around markings on all light-colored pavements. Preformed thermoplastic markings shall have a non-reflectorized black border integral to the marking.

Select appropriate application rates for type of paint and bead selected:

Application Rates for Paint and Glass Beads for Table 1

Paint		**Glass Beads**		
Type	**Application Rate Maximum**	**Type I, Gradation A[1] Minimum**	**Type III Minimum**	**Type IV[1] Minimum**
Waterborne Type I or II	115 ft^2/gal (2.8 m^2/l)	7 lb/gal (0.85 kg/l)	10 lb/gal (1.2 kg/l)	--
Waterborne Type III	90 ft^2/gal (2.2 m^2/l)	7 lb/gal (0.85 kg/l)	8 lb/gal (1.0 kg/l)	
Waterborne Type III	55 ft^2/gal (1.4 m^2/l)		6 lb/gal (.8 kg/l)	5 lb/gal (.7 kg/l)
Solvent Base	115 ft^2/gal (2.8 m^2/l)	7 lb/gal (0.85 kg/l)	10 lb/gal (1. 2 kg/l)	--
Solvent Base	55 ft^2/gal (2.2 m^2/l)	--	--	5 lb/gal (.7 kg/l)
Epoxy	90 ft^2/gal (2.2 m^2/l)	15 lb/gal (1.8 kg/l)	20 lb/gal (2.4 kg/l)	16 lb/gal (1.9 kg/l)
Methacrylate	45 ft^2/gal (1.1 m^2/l)	15 lb/gal (1.8 kg/l)	20 lb/gal (2.4 kg/l)	16 lb/gal (1.9 kg/l)
Methacrylate Splatter-Profile	24ft^2/gal. (0.6 m^2/l)	8 lb/gal. (0.1 kg/l)	10 lb/gal. (1.2 kg/l)	10 lb/gal (1.2 kg/l)
Temporary Marking Waterborne Type I or II	230 ft^2/gal (5.6 m^2/l)	No beads	No beads	No beads

[1]Glass bead application rate for Red and Pink paint shall be reduced by 2 lb/gal (0.24 kg/l) for Type I and Type IV beads.

The Engineer shall specify the time period in paragraph 620-3.5 in order to allow adequate curing of the pavement surface. The Engineer should contact the paint manufacturer to determine the wait period. A 24- to 30-day waiting period is recommended for all types of paint used for pavement marking. The final application should occur after the waiting period has passed. The final marking application must be at a rate equal to 100% of the full application rate with glass beads.

Markings may be required before paving operations are complete. The Engineer may wish to specify waterborne or solvent-based materials for temporary

markings at 30% to 50% of the specified application rates. Glass beads will not adhere well at the low application rates for temporary markings.

CAUTION: Prior to reopening pavements at Part 139 airports verify that all markings comply with Part 139 requirements. Temporary markings not in compliance with AC 150/5340-1 will require a NOTAM regarding any non-standard marking be issued. For example, temporary markings without beads.

When painting Porous Friction Course, the paint should be applied to the pavement in two coats from opposite directions. The first coat should be applied at a rate equal to 50% of the full application rate with no glass beads. The second coat should be applied from the opposite direction at a rate equal to 100% of the full application rate with glass beads.

Preformed thermoplastic pavement markings shall yield at least 225 mcd/m^2/lux on white markings at installation and at least 100 mcd/m^2/lux on yellow markings at installation.

Retroreflectivity shall be measured by a portable retroreflectometer according to ASTM E1710 and the practices in ASTM D7585 shall be followed for taking retroreflectivity readings with a portable retroreflectometer and computing measurement averages. A vehicle-mounted retroreflectometer may also be used.

****

[Waterborne. Paint shall meet the requirements of Federal Specification TT-P-1952F, **[** Type I **]** **[** Type II **]** **[** Type III **]**. The non-volatile portion of the vehicle for all paint types shall be composed of a 100% acrylic polymer as determined by infrared spectral analysis. **[** The acrylic resin used for Type III shall be 100% cross linking acrylic as evidenced by infrared peaks at wavelengths 1568, 1624, and 1672 cm-l with intensities equal to those produced by an acrylic resin known to be 100% cross linking. **]**

[Epoxy. Paint shall be a two component, minimum 99% solids type system conforming to the following:

(1) Pigments. Component A. Percent by weight.

(a) White:

- Titanium Dioxide, ASTM D476, type II shall be 18% minimum (16.5% minimum at 100% purity).

(b) Yellow and Colors:

- Titanium Dioxide, ASTM D476, type II shall be 14 to 17%.
- Epoxy resin shall be 75 to 79%.
- Organic yellow, other colors, and tinting as required to meet color standard.

(2) Epoxy content. Component A. The weight per epoxy equivalent, when tested in accordance with ASTM D1652 shall be the manufacturer's target ±50.

(3) Amine number. Component B. When tested in accordance with ASTM D2074 shall be the manufacturer's target ±50.

(4) Prohibited materials. The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant federal regulations.

(5) Daylight directional reflectance.

(a) White: The daylight directional reflectance of the white paint shall not be less than 75% (relative to magnesium oxide), when tested in accordance with ASTM E2302.

(b) Yellow: The daylight directional reflectance of the yellow paint shall not be less than 55% (relative to magnesium oxide), when tested in accordance with ASTM E2302. The x and y values shall be consistent with the federal Hegman yellow color standard chart for traffic yellow standard 33538, or shall be consistent with the tolerance listed below:

x .462	x .470	x .479	x .501
y .438	y .455	y .428	y .452

(6) Accelerated weathering.

(a) Sample preparation. Apply the paint at a wet film thickness of 0.013-inch (0.33 mm) to four 3 × 6-inch (8 × 15 cm) aluminum panels prepared as described in ASTM E2302. Air dry the sample 48 hours under standard conditions.

(b) Testing conditions. Test in accordance with ASTM G154 using both Ultra Violet (UV-B) Light and condensate exposure, 72 hours total, alternating four (4) hour UV exposure at 140°F (60°C), and four (4) hours condensate exposure at 104°F (40°C).

(c) Evaluation. Remove the samples and condition for 24 hours under standard conditions. Determine the directional reflectance and color match using the procedures in paragraph 5 above. Evaluate for conformance with the color requirements.

(7) Volatile organic content. Determine the volatile organic content in accordance with 40 CFR Part 60 Appendix A, Method 24.

(8) Dry opacity. Use ASTM E2302. The wet film thickness shall be 0.015 inch (0.38 mm). The minimum opacity for white and colors shall be 0.92.

(9) Abrasion resistance. Subject the panels prepared in paragraph 620-2.2b(6) to the abrasion test in accordance with ASTM D968, Method A, except that the inside diameter of the metal guide tube shall be from 0.747 to 0.750 inch (18.97 to 19.05 mm). Five liters (17.5 lb (7.94 kg)) of unused sand shall be used for each test panel. The test shall be run on two test panels Both baked and weathered paint films shall require not less than 150 liters (525 lbs (239 kg)) of sand for the removal of the paint films.

(10) Hardness, shore. Hardness shall be at least 80 when tested in accordance with ASTM D2240. **]**

[Methacrylate. Paint shall be a two component, minimum 99% solids-type system conforming to the following:

(1) Pigments. Component A. Percent by weight.

(a) White:

- Titanium Dioxide, ASTM D476, type II shall be 10% minimum.
- Methacrylate resin shall be 18% minimum.

(b) Yellow and Colors:

- Titanium Dioxide, ASTM D476, type II shall be 1% minimum.

  Organic yellow, other colors, and tinting as required to meet color standard.
- Methacrylate resin shall be 18% minimum.

(2) Prohibited materials. The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant federal regulations.

(3) Daylight directional reflectance:

(a) White: The daylight directional reflectance of the white paint shall not be less than 80% (relative to magnesium oxide), when tested in accordance with ASTM E2302.

(b) Yellow: The daylight directional reflectance of the yellow paint shall not be less than 55% (relative to magnesium oxide), when tested in accordance with ASTM E2302. The x and y values shall be consistent with the federal Hegman yellow color standard chart for traffic yellow standard 33538, or shall be consistent with the tolerance listed below:

x .462	x .470	x .479	x .501
y .438	y .455	y .428	y .452

(4) Accelerated weathering.

(a) Sample preparation. Apply the paint at a wet film thickness of 0.013-inch (0.33 mm) to four 3 × 6-inch (8 × 15 cm) aluminum panels prepared as described in ASTM E2302. Air dry the sample 48 hours under standard conditions.

(b) Testing conditions. Test in accordance with ASTM G154 using both Ultra Violet (UV-B) Light and condensate exposure, 72 hours total, alternating four (4) hour UV exposure at 140°F (60°C), and four (4) hours condensate exposure at 104°F (40°C).

(c) Evaluation. Remove the samples and condition for 24 hours under standard conditions. Determine the directional reflectance and color match using the procedures in paragraph 3 above. Evaluate for conformance with the color requirements.

(5) Volatile organic content. Determine the volatile organic content in accordance with 40 CFR Part 60 Appendix A, Method 24.

(6) Dry opacity. Use ASTM E2302. The wet film thickness shall be 0.015 inch (0.38 mm). The minimum opacity for white and colors shall be 0.92.

(7) Abrasion resistance. Subject the panels prepared in paragraph 620-2.2c(4) to the abrasion test in accordance with ASTM D968, Method A, except that the inside diameter of the metal guide tube shall be from 0.747 to 0.750 inch (18.97 to 19.05 mm). Five liters (17.5 lb (7.94 kg)) of unused sand shall be used for each test panel. The test shall be run on two test panels Both baked and weathered

paint films shall require not less than 150 liters (525 lbs (239 kg) of sand for the removal of the paint films.

(8) Hardness, shore. Hardness shall be at least 60 when tested in accordance with ASTM D2240.

(9) Additional requirements for methacrylate splatter profiled pavement marking. Pavement markings of this type shall comply with all above requirements for methacrylate paint, except as noted below:

(a) The thickness of the marking will be irregular ranging from 0.000 to 0.250 inches (0.00 to 6.4 mm), applied in a splatter pattern which comprises a minimum of 80% of the visible line (when traveling at 5 mph the line appears to be solid.).

(b) The hardness shall be 48 Shore D minimum. **]**

[Solvent-Base. Paint shall meet the requirements of Commercial Item Description **[** A-A-2886B Type I, Type II, and Type III **].]**

[Preformed Thermoplastic Airport Pavement Markings. Markings must be composed of ester modified resins in conjunction with aggregates, pigments, and binders that have been factory produced as a finished product. The material must be impervious to degradation by aviation fuels, motor fuels, and lubricants.

(1) The markings must be able to be applied in temperatures as low as 35°F without any special storage, preheating, or treatment of the material before application.

(a) The markings must be supplied with an integral, non-reflectorized black border.

(2) Graded glass beads.

(a) The material must contain a minimum of 30% intermixed graded glass beads by weight. The intermixed beads shall conform to Federal Specification TT-B-1325D, Type I, gradation A and Federal Specification TT-B-1325D, Type IV.

(b) The material must have factory applied coated surface beads in addition to the intermixed beads at a rate of one (1) lb (0.45 kg) (±10%) per 10 square feet (1 sq m). These factory-applied coated surface beads shall have a minimum of 90% true spheres, minimum refractive index of 1.50, and meet the following gradation.

Preformed Thermoplastic Bead Gradation

Size Gradation		Retained, %	Passing, %
U.S. Mesh	µm		
12	1700	0 - 2	98 - 100
14	1400	0 - 3.5	96.5 - 100
16	1180	2 - 25	75 - 98
18	1000	28 - 63	37 - 72
20	850	63 - 72	28 - 37
30	600	67 - 77	23 - 33
50	300	89 - 95	5 - 11
80	200	97 - 100	0 - 3

(3) Heating indicators. The material manufacturer shall provide a method to indicate that the material has achieved satisfactory adhesion and proper bead embedment during application and that the installation procedures have been followed.

(4) Pigments. Percent by weight.

(a) White:

- Titanium Dioxide, ASTM D476, type II shall be 10% minimum.

(b) Yellow and Colors:

- Titanium Dioxide, ASTM D476, type II shall be 1% minimum.
- Organic yellow, other colors, and tinting as required to meet color standard.

(5) Prohibited materials. The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant federal regulations.

(6) Daylight directional reflectance.

(a) White: The daylight directional reflectance of the white paint shall not be less than 75% (relative to magnesium oxide), when tested in accordance with ASTM E2302.

(b) Yellow: The daylight directional reflectance of the yellow paint shall not be less than 45% (relative to magnesium oxide), when tested in accordance with ASTM E2302. The x and y values shall be consistent with the federal Hegman yellow color standard chart for traffic yellow standard 33538, or shall be consistent with the tolerance listed below:

x .462	x .470	x .479	x .501
y .438	y .455	y .428	y .452

(7) Skid resistance. The surface, with properly applied and embedded surface beads, must provide a minimum resistance value of 45 BPN when tested according to ASTM E303.

(8) Thickness. The material must be supplied at a nominal thickness of 65 mil (1.7 mm).

(9) Environmental resistance. The material must be resistant to deterioration due to exposure to sunlight, water, salt, or adverse weather conditions and impervious to aviation fuels, gasoline, and oil.

(10) Retroreflectivity. The material, when applied in accordance with manufacturer's guidelines, must demonstrate a uniform level of nighttime retroreflection when tested in accordance to ASTM E1710.

(11) Packaging. Packaging shall protect the material from environmental conditions until installation.

(12) Preformed thermoplastic airport pavement marking requirements.

(a) The markings must be a resilient thermoplastic product with uniformly distributed glass beads throughout the entire cross-sectional area. The markings must be resistant to the detrimental effects of aviation fuels, motor fuels and lubricants, hydraulic fluids, deicers, anti-icers, protective coatings, etc. Lines, legends, and symbols must be capable of being affixed to asphalt and/or Portland cement concrete pavements by the use of a large radiant heater. Colors shall be available as required.

(b) The markings must be capable of conforming to pavement contours, breaks, and faults through the action of airport traffic at normal pavement temperatures. The markings must be capable of fully conforming to grooved pavements, including pavement grooving per advisory circular (AC) 150/5320-12, current version. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastics when heated with a heat source per manufacturer's recommendation.

(c) Multicolored markings must consist of interconnected individual pieces of preformed thermoplastic pavement marking material, which through a variety of colors and patterns, make up the desired design. The individual pieces in each large marking segment (typically more than 20 feet (6 m) long) must be factory assembled with a compatible material and interconnected so that in the field it is not necessary to assemble the individual pieces within a marking segment. Obtaining multicolored effect by overlaying materials of different colors is not acceptable due to resulting inconsistent marking thickness and inconsistent application temperature in the marking/substrate interface.

(d) The marking material must set up rapidly, permitting the access route to be re-opened to traffic after application.

(e) The marking material shall have an integral color throughout the thickness of the marking material. **]**

]

****

Thermoplastic airport markings will be subject to an Engineering life-cycle cost analysis prior to inclusion in specifications.

****

b. Reflective media. Glass beads for white and yellow paint shall meet the requirements for Federal Specification TT-B-1325D **[** Type I, Gradation A **] [** Type III **] [** Type IV, Gradation A **]**.

Glass beads for red and pink paint shall meet the requirements for **[** Type I, Gradation A **] [** Type IV, Gradation A **]**.

Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.

Glass beads shall not be used in black and green paint.

Type III glass beads shall not be used in red and pink paint.

****

The Engineer should insert all that will be used in the project. When more than one bead type is specified, the plans should indicate the bead type for each marking.

Federal Specification TT-B-1325D, Type I, gradation A shall be used when remarking on a frequent basis (at least every six months), and typically yield 300 mcd/m²/lux on white markings at installation and 175 mcd/m²/lux on yellow markings at installation.

Federal Specification TT-B-1325D, Type III. Initial readings typically yield 600 mcd/m²/lux on white markings and 300 mcd/m²/lux on yellow markings at installation and once in service, the reflectance values are approximately the same as Type I beads.

Federal Specification TT-B-1325D, Type IV, gradation A shall be used with TT-P-1952F, Type III paint. The glass beads are larger than either Type I or Type III, thus requiring more of the coating material to properly anchor. The Engineer should consult with the paint and bead manufacturer on the use of adhesion, flow promoting, and/or flotation additives.

Preformed thermoplastic pavement markings should yield at least 225 mcd/m^2/lux on white markings at installation and at least 100 mcd/m^2/lux on yellow markings at installation.

****

CONSTRUCTION METHODS

620-3.1 Weather limitations. Painting shall only be performed when the surface is dry, and the ambient temperature and the pavement surface temperature meet the manufacturer's recommendations in accordance with paragraph 620-2.1. Painting operations shall be discontinued when the ambient or surface temperatures does not meet the manufacturer's recommendations. Markings shall not be applied when the wind speed exceeds 10 mph unless windscreens are used to shroud the material guns. Markings shall not be applied when weather conditions are forecasts to not be within the manufacturers' recommendations for application and dry time.

620-3.2 Equipment. Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead dispensing machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an atomizing spray-type or airless type marking machine with automatic glass bead dispensers suitable for application of traffic paint. It shall produce an even and uniform film thickness and appearance of both paint and glass beads at the required coverage and shall apply markings of uniform cross-sections and clear-cut edges without running or spattering and without over spray. The marking equipment for both paint and beads shall be calibrated daily.

620-3.3 Preparation of surfaces. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other contaminates that would reduce the bond between the paint and the pavement. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the RPR. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

a. Preparation of new pavement surfaces. The area to be painted shall be cleaned by broom, blower, water blasting, or by other methods approved by the RPR to remove all contaminants, including PCC curing compounds, minimizing damage to the pavement surface.

b. Preparation of pavement to remove existing markings. Existing pavement markings shall be removed by rotary grinding, water blasting, or by other methods approved by the RPR minimizing damage to the pavement surface. The removal area may need to be larger than the area of the markings to eliminate ghost markings. After removal of markings on asphalt pavements, apply a fog seal or seal coat to 'block out' the removal area to eliminate 'ghost' markings.

c. Preparation of pavement markings prior to remarking. Prior to remarking existing markings, loose existing markings must be removed minimizing damage to the pavement surface, with a method approved by the RPR. After removal, the surface shall be cleaned of all residue or debris.

Prior to the application of markings, the Contractor shall certify in writing that the surface is dry and free from dirt, grease, oil, laitance, or other foreign material that would prevent the bond of the paint to the pavement or existing markings. This certification along with a copy of the paint manufactures application and surface preparation requirements must be submitted to the RPR prior to the initial application of markings.

****

Loose markings should always be removed prior to remarking, whether or not existing markings need to be removed is up to the Engineer and the Airport Operator. The type of removal method used depends upon whether you need to remove loose markings or all existing markings.

****

620-3.4 Layout of markings. The proposed markings shall be laid out in advance of the paint application. The locations of markings to receive glass beads shall be shown on the plans. **[** The locations of markings to receive silica sand shall be shown on the plans. **]**

****

Glass beads improve conspicuity and the friction characteristics of markings. At a minimum, the Engineer shall indicate the locations to receive glass beads per AC 150/5340-1, Standards for Airport Markings.

****

620-3.5 Application. A period of **[___]** days shall elapse between placement of surface course or seal coat and application of the permanent paint markings. Paint shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface has been approved by the RPR.

****

Select timeframe between placement of surface course or seal coat and application of the paint based on type of surface course or seal coat in the project and environment at the project location. The typical timeframe is 30-days for volatiles and moisture vapor to dissipate.

****

The edges of the markings shall not vary from a straight line more than 1/2 inch (12 mm) in 50 feet (15 m), and marking dimensions and spacing shall be within the following tolerances:

Marking Dimensions and Spacing Tolerance

Dimension and Spacing	**Tolerance**
36 inch (910 mm) or less	±1/2 inch (12 mm)
greater than 36 inch to 6 feet (910 mm to 1.85 m)	±1 inch (25 mm)
greater than 6 feet to 60 feet (1.85 m to 18.3 m)	±2 inch (50 mm)
greater than 60 feet (18.3 m)	±3 inch (76 mm)

The paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine at the rate shown in Table 1. The addition of thinner will not be permitted.

Glass beads shall be distributed upon the marked areas at the locations shown on the plans to receive glass beads immediately after application of the paint. A dispenser shall be furnished that is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Glass beads shall be applied at the rate shown in Table 1. Glass beads shall not be applied to black paint or green paint. Glass beads shall adhere to the cured paint or all marking operations shall cease until corrections are made. Different bead types shall not be mixed. Regular monitoring of glass bead embedment and distribution should be performed.

620-3.6 Application--preformed thermoplastic airport pavement markings.

[Preformed thermoplastic pavement markings not used. **]**

[To ensure minimum single-pass application time and optimum bond in the marking/substrate interface, the materials must be applied using a variable speed self-propelled mobile heater with an effective heating width of no less than 16 feet (5 m) and a free span between supporting wheels of no less than 18 feet (5.5 m). The heater must emit thermal radiation to the marking material in such a manner that the difference in temperature of 2 inches (50 mm) wide linear segments in the direction of heater travel must be within 5% of the overall average temperature of the heated thermoplastic material as it exits the heater. The material must be able to be applied at ambient and pavement temperatures down to 35°F (2°C) without any preheating of the pavement to a specific temperature. The material must be able to be applied without the use of a thermometer. The pavement shall be clean, dry, and free of debris. A non-volatile organic content (non-VOC) sealer with a maximum applied viscosity of 250 centiPoise must be applied to the pavement shortly before the markings are applied. The supplier must enclose application instructions with each box/package. **]**

****

The Engineer will make the appropriate selection for thermoplastic markings.

****

620-3.7 Control strip. Prior to the full application of airfield markings, the Contractor shall prepare a control strip in the presence of the RPR. The Contractor shall demonstrate the surface preparation method and all striping equipment to be used on the project. The marking equipment must achieve the prescribed application rate of paint and population of glass beads (per Table 1) that are properly embedded and evenly distributed across the full width of the marking. Prior to acceptance of the control strip, markings must be evaluated during darkness to ensure a uniform appearance.

620-3.8 Retro-reflectance. [Reflectance shall be measured with a portable retro-reflectometer meeting ASTM E1710 (or equivalent). A total of 6 reading shall be taken over a 6 square foot area with 3 readings taken from each direction. The average shall be equal to or above the minimum levels of all readings which are within 30% of each other.

Minimum Retro-Reflectance Values

Material	**Retro-reflectance mcd/m^2/lux**		
	White	**Yellow**	**Red**
Initial Type I	300	175	35
Initial Type III	600	300	35
Initial Thermoplastic	225	100	35
All materials, remark when less than[1]	100	75	10

[1] 'Prior to remarking determine if removal of contaminants on markings will restore retro-reflectance][not used]

****

Include tests of retro-reflectance at Part 139 airports, recommend testing at least 2 times per day. Enter Not Used at all other locations.

****

620-3.9 Protection and cleanup. After application of the markings, all markings shall be protected from damage until dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings. The Contractor shall remove from the work area all debris, waste, loose reflective media, and by-products generated by the surface preparation and application operations to the satisfaction of the RPR. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and federal environmental statutes and regulations.

METHOD OF MEASUREMENT

620-4.1a The quantity of surface preparation shall be measured by **[** the number of square feet (square meters) for each type of surface preparation specified in paragraph 620-3.3 **] [** lump sum **].**

620-4.1b The quantity of markings shall be paid for shall be measured **[** by the number of square feet (square meters) of painting **] [** by lump sum **].**

620-4.1c The quantity of reflective media shall be paid for by **[** the number of pounds (km) **] [** lump sum **]** of reflective media.

620-4.1d [The quantity of temporary markings to be paid for shall be **[** the number of square feet (square meters) of painting **] [** lump sum price **]** performed in accordance with the specifications and accepted by the RPR. Temporary marking includes surface preparation, application and complete removal of the temporary marking. **] [** Temporary markings not required. **]**

[620-4.1e The quantity of preformed markings to be paid for shall be **[** the number of square feet (square meters) of preformed markings **] [** lump sum **]].**

****

Separate pay items for surface preparation, marking, and reflective media is recommended, however on small jobs, lump sum pay items is acceptable.

****

BASIS OF PAYMENT

620-5.1 This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item complete in place and accepted by the RPR in accordance with these specifications.

620-5.1a Payment for surface preparation shall be made at the contract price for **[** the number of square feet (square meters) for each type of surface preparation specified in paragraph 620-3.3 **] [** lump sum **].**

620-5.2b Payment for markings shall be made at the contract price for **[** the number of square feet (square meters) of painting and the number of pounds (km) of reflective media **] [** by the number of square feet (square meters) of painting **] [** by lump sum **].**

620-5.3c Payment for reflective media shall be made at the contract unit price for **[** the number of pounds (km) of reflective media **] [** lump sum **].**

620-5.4d Payment for temporary markings shall be made at the contract price for **[** the number of square feet (square meters) of painting **] [** lump sum price **].** This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item. **[** Temporary markings are not required. **]**

[620-5.5e Payment for preformed markings shall be made at the contract price for **[** the number of square feet (square meters) of preformed markings **] [** lump sum price **].]**

Payment will be made under:

Item P-620-5.1a	Surface Preparation **[** per square foot (square meter) **] [** lump sum **]**
Item P-620-5.2b	Marking **[** per square foot (square meter) **] [** lump sum **]**
Item P-620-5.3c	Reflective Media **[** per pound (km) **] [** lump sum **]**

Item P-620-5.4d Temporary runway and taxiway marking **[** per square foot **] [** per square meter **] [** lump sum **]**.

[Item 620-5.5e Preformed markings per **[** the number of square feet (square meters) of preformed markings **] [** lump sum price **]**. **]**

Item L-110 Airport Underground Electrical Duct Banks and Conduits

DESCRIPTION

110-1.1 This item shall consist of underground electrical conduits and duct banks (single or multiple conduits encased in concrete or buried in sand) installed per this specification at the locations and per the dimensions, designs, and details shown on the plans. This item shall include furnishing and installing of all underground electrical duct banks and individual and multiple underground conduits. It shall also include all turfing trenching, backfilling, removal, and restoration of any paved or turfed areas; concrete encasement, mandrelling, pulling lines, duct markers, plugging of conduits, and the testing of the installation as a completed system ready for installation of cables per the plans and specifications. This item shall also include furnishing and installing conduits and all incidentals for providing positive drainage of the system. Verification of existing ducts is incidental to the pay items provided in this specification.

EQUIPMENT AND MATERIALS

110-2.1 General.

a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide **materials** per these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, that comply with these specifications, at the Contractor's cost.

c. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in project that accrue directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. **[** The Contractor's submittals shall be neatly bound in a properly sized 3-ring binder, tabbed by specification section. **]** The Engineer reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes specified in this document.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least **[** twelve (12) months **]** from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

****

The Engineer should specify the form in which submittals are to be received and number of copies.

The length of time for guarantee of materials and workmanship should be as stated in the contract between the Owner and Contractor and the contract special provisions.

****

110-2.2 Steel conduit. Rigid galvanized steel (RGS) conduit and fittings shall be hot dipped galvanized inside and out and conform to the requirements of Underwriters Laboratories Standards 6, 514B, and 1242. All RGS conduits or RGS elbows installed below grade, in concrete, permanently wet locations or other similar environments shall be painted with a 10 mil thick coat of asphaltum sealer or shall have a factory bonded polyvinyl chloride (PVC) cover. Any exposed galvanizing or steel shall be coated with 10 mil of asphaltum sealer. When using PVC coated RGS conduit, care shall be exercised not to damage the factory PVC coating. Damaged PVC coating shall be repaired per the manufacturer's written instructions.

110-2.3 Plastic conduit. Plastic conduit and fittings-shall conform to the following requirements:

- UL 514B covers W-C-1094-Conduit fittings all types, classes 1 thru 3 and 6 thru 10.
- UL 514C covers W-C-1094- all types, Class 5 junction box and cover in plastic (PVC).
- UL 651 covers W-C-1094-Rigid PVC Conduit, types I and II, Class 4.
- UL 651A covers W-C-1094-Rigid PVC Conduit and high density polyethylene (HDPE) Conduit type III and Class 4.

Underwriters Laboratories Standards UL-651 and Article 352 of the current National Electrical Code shall be one of the following, as shown on the plans:

a. Type I–Schedule 40 PVC suitable for underground use either direct-buried or encased in concrete.

b. Type II–Schedule 40 PVC suitable for either above ground or underground use.

c. Type III – Schedule 80 PVC suitable for either above ground or underground use either direct-buried or encased in concrete.

d. Type III –HDPE pipe, minimum standard dimensional ratio (SDR) 11, suitable for placement with directional boring under pavement.

The type of solvent cement shall be as recommended by the conduit/fitting manufacturer.

110-2.4 Split conduit. Split conduit shall be pre-manufactured for the intended purpose and shall be made of steel or plastic.

110-2.5 Conduit spacers. Conduit spacers shall be prefabricated interlocking units manufactured for the intended purpose. They shall be of double wall construction made of high grade, high density polyethylene complete with interlocking cap and base pads, They shall be designed to accept No. 4 reinforcing bars installed vertically.

110-2.6 Concrete. Concrete shall conform to Item P-610, Structural Portland Cement Concrete, using **[___]** inch maximum size coarse aggregate with a minimum 28-day compressive strength of **[___]** psi.

Where reinforced duct banks are specified, reinforcing steel shall conform to ASTM A615 Grade 60. Concrete and reinforcing steel are incidental to the respective pay item of which they are a component part.

****

Typically, the maximum size aggregate should be specified as one inch (25 mm); however, Engineer may specify smaller to accommodate special situations where one inch (25 mm) aggregate may be too large.

Item P-610 requires concrete to develop a 28-day compressive strength of 4,000 psi. Engineer to determine the strength of concrete appropriate for the project and insert in paragraph 110-2.6.

****

110-2.7 Flowable backfill. Flowable material used to back fill conduit and duct bank trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material. Fill shall be designed to achieve a 28-day compressive strength of 200 psi (1.4 MPa) under pavement.

110-2.8 Detectable warning tape. Plastic, detectable, American Public Works Association (APWA) Red (electrical power lines, cables, conduit and lighting cable) with continuous legend magnetic tape shall be polyethylene film with a metallized foil core and shall be 3-6 inches (75-150 mm) wide. Detectable tape is incidental to the respective bid item.

****

Specify color and legend.

****

CONSTRUCTION METHODS

110-3.1 General. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The Engineer shall indicate specific locations as the work progresses, if required to differ from the plans. Duct banks and conduits shall be of the size, material, and type indicated on the plans or specifications. Where no size is indicated on the plans or in the specifications, conduits shall be not less than 2 inches (50 mm) inside diameter or comply with the National Electrical Code based on cable to be installed, whichever is larger. All duct bank and conduit lines shall be laid so as to grade toward access points and duct or conduit ends for drainage. Unless shown otherwise on the plans, grades shall be at least 3 inches (75 mm) per 100 feet (30 m). On runs where it is not practicable to maintain the grade all one way, the duct bank and conduit lines shall be graded from the center in both directions toward access points or conduit ends, with a drain into the storm drainage system. Pockets or traps where moisture may accumulate shall be avoided. No duct bank or underground conduit shall be less than 18 inches (0.5 m) below finished grade. Where under pavement, the top of the duct bank shall not be less than 18 inches (0.5 m) below the subgrade.

****

For a closed conduit/duct bank system, the system should be designed to be connected to, and thus drain into, the airfield storm drainage system.

Engineer needs to be careful to define the term "subgrade" as it relates to pavement construction. In areas of pavement construction requiring the placement of embankment, or in areas requiring over-excavation to remove unsuitable material, the desired location of the top of the duct bank needs to be clearly identified in areas susceptible to frost, the top of the duct bank should be placed at or below the level of the frost line.

****

The Contractor shall mandrel each individual conduit whether the conduit is direct-buried or part of a duct bank. An iron-shod mandrel, not more than 1/4 inch (6 mm) smaller than the bore of the conduit shall be pulled or pushed through each conduit. The mandrel shall have a leather or rubber gasket slightly larger than the conduit hole.

The Contractor shall swab out all conduits/ducts and clean base can, manhole, pull boxes, etc., interiors IMMEDIATELY prior to pulling cable. Once cleaned and swabbed the light bases, manholes, pull boxes, etc., and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, base cans, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be recleaned at the Contractor's expense. All accessible points shall be kept closed when not installing cable. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the Engineer of any blockage in the existing ducts.

For pulling the permanent wiring, each individual conduit, whether the conduit is direct-buried or part of a duct bank, shall be provided with a 200 pound (90 kg) test polypropylene pull rope. The ends shall be secured and sufficient length shall be left in access points to prevent it from slipping back into the conduit. Where spare conduits are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed for this purpose.

All conduits shall be securely fastened in place during construction and shall be plugged to prevent contaminants from entering the conduits. Any conduit section having a defective joint shall not be installed. Ducts shall be supported and spaced apart using approved spacers at intervals not to exceed 5 feet (1.5 m).

Unless otherwise shown on the plans, concrete encased duct banks shall be used when crossing under pavements expected to carry aircraft loads, such as runways, taxiways, taxilanes, ramps and aprons. When under paved shoulders and other paved areas, conduit and duct banks shall be encased using flowable fill for protection.

All conduits within concrete encasement of the duct banks shall terminate with female ends for ease in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches (75 mm) below the required conduit or duct bank depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4 inch (6 mm) sieve. Flowable backfill may alternatively be used The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All such rock removal shall be performed and paid for under Item P-152.

Underground electrical warning (Caution) tape shall be installed in the trench above all underground duct banks and conduits in unpaved areas. Contractor shall submit a sample of the proposed warning tape for approval by the Engineer. If not shown on the plans, the warning tape shall be located 6 inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared per the manufacturer's recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet (60 cm).

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.

Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the Engineer, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Alternatively, additional duct bank supports that are adequate and stable shall be installed, as approved by the Engineer.

All excavation shall be unclassified and shall be considered incidental to the respective L-110 pay item of which it is a component part. Dewatering necessary for duct installation, erosion and turbidity control, per Federal, state, and local requirements is incidental to its respective pay item as a part of Item L-110. The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the L-110 Item.

Unless otherwise specified, excavated materials that are deemed by the Engineer to be unsuitable for use in backfill or embankments shall be removed and disposed of offsite.

Any excess excavation shall be filled with suitable material approved by the Engineer and compacted per Item P-152.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables) cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

a. Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred

b. Trenching, etc., in cable areas shall then proceed with approval of the Engineer, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair.

110-3.2 Duct banks. Unless otherwise shown in the plans, duct banks shall be installed so that the top of the concrete envelope is not less than 18 inches (0.5 m) below the bottom of the base or stabilized base course layers where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches (0.5 m) below finished grade where installed in unpaved areas.

Unless otherwise shown on the plans, duct banks under paved areas shall extend at least 3 feet (1 m) beyond the edges of the pavement or 3 feet (1 m) beyond any under drains that may be installed alongside the paved area. Trenches for duct banks shall be opened the complete length before concrete is placed so that if any obstructions are encountered, provisions can be made to avoid them. Unless otherwise shown on the plans, all duct banks shall be placed on a layer of concrete not less than 3 inches (75 mm) thick prior to its initial set. The Contractor shall space the conduits not less than 3 inch (75 mm) apart (measured from outside wall to outside wall). All such multiple conduits shall be placed using conduit spacers applicable to the type of conduit. As the conduit laying progresses, concrete shall be placed around and on top of the conduits not less than 3 inches (75 mm) thick unless otherwise shown on the plans. All conduits shall terminate with female ends for ease of access in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Conduits forming the duct bank shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth prior to placing the concrete encasement. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the Engineer for review prior to use.

When specified, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5-foot (1.5-m) intervals.

All pavement surfaces that are to have ducts installed therein shall be neatly saw cut to form a vertical face. All excavation shall be included in the contract with price for the duct.

Install a plastic, detectable, color as noted, 3 to 6 inches (75 to 150 mm) wide tape, 8 inches (200 mm) minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch (75-mm) wide tape only for single conduit runs. Utilize the 6-inch (150-mm) wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches (600 mm) in width, utilize more than one tape for sufficient coverage and identification of the duct bank as required.

When existing cables are to be placed in split duct, encased in concrete, the cable shall be carefully located and exposed by hand tools. Prior to being placed in duct, the Engineer shall be notified so that he may inspect the cable and determine that it is in good condition. Where required, split duct shall be installed as shown on the drawings or as required by the Engineer.

110-3.3 Conduits without concrete encasement. Trenches for single-conduit lines shall be not less than 6 inches (150 mm) nor more than 12 inches (300 mm) wide. The trench for 2 or more conduits installed at the same level shall be proportionately wider. Trench bottoms for conduits without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the conduit along its entire length.

Unless otherwise shown on the plans, a layer of fine earth material, at least 4 inches (100 mm) thick (loose measurement) shall be placed in the bottom of the trench as bedding for the conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4 inch (6 mm) sieve. The bedding material shall be tamped until firm. Flowable backfill may alternatively be used.

Unless otherwise shown on plans, conduits shall be installed so that the tops of all conduits within the Airport's secured area where trespassing is prohibited are at least 18 inches (0.5 m) below the finished grade. Conduits outside the Airport's secured area shall be installed so that the tops of the conduits are at least 24 inches (60 cm) below the finished grade per National Electric Code (NEC), Table 300.5.

When two or more individual conduits intended to carry conductors of equivalent voltage insulation rating are installed in the same trench without concrete encasement, they shall be spaced not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches (150 mm) apart in a vertical direction. Where two or more individual conduits intended to carry conductors of differing voltage insulation rating are installed in the same trench without concrete encasement, they shall be placed not less than 3 inches (75 mm) apart (measured from outside wall to outside wall) in a horizontal direction and lot less than 6 inches (150 mm) apart in a vertical direction.

Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.

Conduits shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches (150 mm) to anchor the assembly into the earth while backfilling. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot (1.5-m) intervals. Spacers shall be in the proper sizes and

configurations to fit the conduits. Locking collars and spacers shall be submitted to the Engineer for review prior to use.

110-3.4 Markers. The location of each end and of each change of direction of conduits and duct banks shall be marked by a concrete slab marker 2 feet (60 cm) square and 4 - 6 inches (100 - 150 mm) thick extending approximately one inch (25 mm) above the surface. The markers shall also be located directly above the ends of all conduits or duct banks, except where they terminate in a junction/access structure or building. Each cable or duct run from a line of lights and signs to the equipment vault must be marked at approximately every 200 feet (61 m) along the cable or duct run, with an additional marker at each change of direction of cable or duct run.

The Contractor shall impress the word "DUCT" or "CONDUIT" on each marker slab. Impression of letters shall be done in a manner, approved by the Engineer, for a neat, professional appearance. All letters and words must be neatly stenciled. After placement, all markers shall be given one coat of high-visibility orange paint, as approved by the Engineer. The Contractor shall also impress on the slab the number and size of conduits beneath the marker along with all other necessary information as determined by the Engineer. The letters shall be 4 inches (100 mm) high and 3 inches (75 mm) wide with width of stroke 1/2 inch (12 mm) and 1/4 inch (6 mm) deep or as large as the available space permits. Furnishing and installation of duct markers is incidental to the respective duct pay item.

110-3.5 Backfilling for conduits. For conduits, 8 inches (200 mm) of sand, soft earth, or other fine fill (loose measurement) shall be placed around the conduits ducts and carefully tamped around and over them with hand tampers. The remaining trench shall then be backfilled and compacted per Item P-152 "Excavation and Embankment" except that material used for back fill shall be select material not larger than 4 inches (100 mm) in diameter.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during back filling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the Engineer.

110-3.6 Backfilling for duct banks. After the concrete has cured, the remaining trench shall be backfilled and compacted per Item P-152 "Excavation and Embankment" except that the material used for backfill shall be select material not larger than 4 inches (100 mm) in diameter. In addition to the requirements of P-152, where duct banks are installed under pavement, one moisture/density test per lift shall be made for each 250 linear feet (76 m) of duct bank or one work period's construction, whichever is less.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the Engineer.

110-3.7 Restoration. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the work shall be restored to its original condition. The restoration shall include **[** sodding **] [** topsoiling **] [** fertilizing **] [** liming **] [** seeding **] [** sprigging **] [** mulching **]** shown on the plans. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. All restoration shall be considered incidental to the respective L-110 pay item. Following restoration of all trenching near airport movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object debris (FOD), and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.

****

Engineer to specify the correct method of turfing and include in the construction documents the appropriate FAA turfing specification for restoration related to the installation of such duct banks and conduits.

****

METHOD OF MEASUREMENT

110-4.1 Underground conduits and duct banks shall be measured by the linear feet (meter) of conduits and duct banks installed, including encasement, locator tape, trenching and backfill with designated material, and for drain lines, the termination at the drainage structure, all measured in place, completed, and accepted. Separate measurement shall be made for the various types and sizes.

BASIS OF PAYMENT

110-5.1 Payment will be made at the contract unit price per linear foot for each type and size of conduit and duct bank completed and accepted, including trench and backfill with the designated material, and, for drain lines, the termination at the drainage structure. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item per the provisions and intent of the plans and specifications.

Payment will be made under:

Item L-110-5.1	**[** Concrete Encased **] [** Non-Encased **]** Electrical Duct Bank, **[** # and Size **]** - per linear foot (meter)
Item L-110-5.2	**[** Concrete Encased **] [** Non-Encased **]** Electrical Conduit, **[** # and Size **]** - per linear foot (meter)

MATERIAL REQUIREMENTS

Advisory Circular (AC) 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-53	Airport Lighting Equipment Certification Program
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3(2,700 kN-m/m^3))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
NFPA-70	National Electrical Code (NEC)
Underwriters Laboratories Standard 6	Electrical Rigid Metal Conduit - Steel
Underwriters Laboratories Standard 514B	Conduit, Tubing, and Cable Fittings
Underwriters Laboratories Standard 514C	Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
Underwriters Laboratories Standard 1242	Electrical Intermediate Metal Conduit Steel
Underwriters Laboratories Standard 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
Underwriters Laboratories Standard 651A	Type EB and A Rigid PVC Conduit and HDPE Conduit

END OF ITEM L-110

1. CIVIL / STRUCTURAL WORKS

1.1. EXCAVATION, FILLING AND GRADING

SCOPE OF WORK

The work under this section of the Specifications consists of furnishing all items, materials, equipment, labor, plants, appliances, methods and all operations that may be necessary, and incidentals to complete excavation, filling, back-filling and grading in accordance with the Plans, and schedule if any, and subject to the terms and conditions of the Contract.

A. EXCAVATION

The Contractor shall make all necessary excavation for foundations to establish grades indicated on drawings without extra compensation including all other excavations required and necessary for the proper prosecution of the work.

1. Cut slope for permanent excavations shall not be steeper than 1-1/2 horizontal to one vertical, and slopes for permanent fills shall not be steeper than 2 horizontal to one vertical unless a substantiating data which justify steeper slopes are submitted.

2. Deviation from the foregoing limitations for slopes shall be permitted only upon presentation of a soil investigation report acceptable to the supervising Engineer.

3. Trim the excavation to the required depth, lines and grades and other incidental excavations to level up the footing plus compacting tamping which are included in the building contract.
4. The materials to be excavated shall include any rock, earth and other materials of any nature and description encountered in obtaining the indicated lines and grades.

5. If the required safe bearing power of the soil is not obtained at the excavations shall be continued until such safe bearing power is reached.

6. Piers and walls shall be lengthened accordingly and likewise, the footings shall be revised to suit the new conditions for which the Contractor shall be paid at the unit price bid for concrete work.

7. No fill or other surcharge loads shall be placed adjacent to any building or structure unless such building or structure is capable of withstanding the addition loads caused by the fill or surcharges.

8. Footings or foundations which may be affected by the excavation shall be underpinned adequately, or otherwise, protected against settlement and/or against lateral movement.

9. Fills to be used to support the foundations shall be placed in accordance with accepted engineering practices. A soil investigation report and a report of satisfactory placement of fill, both, shall be acceptable to the supervising Architect or Engineer.

10. Additional payment for excavation will be computed per unit bid price and/or at established unit price for same as follows:

EXCAVATION, FILLING AND GRADING

a) All materials of every nature and description, which in the Owner's opinion will require the use of air operated hammers, wedging, or drilling and blasting.

b) For additional excavation to safe-bearing power soil as required in 5 based upon work required between indicated grades and authorized grades.

B. UNAUTHORIZED EXCAVATION

1. Where existing surface levels are lower than the sub-grade levels required for work, or where excess or authorized excavation takes place beyond the indicated lines and grades, the contractor shall fill the indicated line and grade at his expense under the following conditions.

2. Where the footings and foundations occur, use concrete fill of the same class as specified for footings and foundations.

3. Where slabs occur, use well compacted sand and gravel fill.

C. EXCAVATION OMITTED

1. When the nature of the soil is such that good-bearing or safe-bearing is found to exist at higher grades than the sub-grade levels indicated on the Plan, the supervising Architect or Engineer may decide to stop the excavation work at those higher grades.

2. Should the Owner so decide, it will be ordered in writing. This will be subject to reduction in the contract price in favor of the Owner at Unit Price Bid and or at established price based upon measurements taken between authorized higher grades and grades indicated on drawings. The same is true for omitted filling due to change of grade.

3. Footing shall not be placed on fill.

D. PROTECTION, PUMPING AND MAINTENANCE

1. The Contractor shall at all times protect the excavations and trenches from damages of rain water, spring water, backing of drains, and all other water.

2. He shall provide and operate all pumps or other equipment necessary to drain and keep excavations, pits, trenches and the entire sub-grade area free of water under any circumstances and contingencies that may arise.

3. He shall build all necessary enclosures, construct and maintain temporary drainage for this purpose. He shall provide all shoring, bracing and sheathing as required for safety, or necessary to support adjoining walls, walks, soils, streets, buildings, fences, and the like and for prosecution of the work, all these to be removed when work is completed, and or required by the Owner.

E. BLASTING

F. INSPECTION

No pouring of concrete shall be done by the Contractor unless the bearing surfaces has been inspected and approved by the Owner, and the authority to proceed has been received by the contractor.

G. DRAINAGE SYSTEM AT SITE

The Contractor shall provide, construct and maintain for the duration of the work, drainage system of the site approved and or as directed by the supervising Architect or Engineer.

H. UTILITIES

1. The Contractor shall protect and maintain all conduits, drains, sewer pipes and other utility services that are to remain on the property or in the building, or in the site, where required for the proper execution of the work.

2. The Contractor shall notify all corporations, companies, individuals, or the other authorities concerned with the above conduits, drains, water and sewer pipes, running to the property of the site, and protect relocate, remove, cap or discontinue all pipes, sewer, and other utility services, which interfere with the excavation in accordance with instruction and requirements of the above notified parties.

I. FILLING AND GRADING

1. All excavations shall be back-filled immediately as work permits after concrete walls and piers have attained full design strength and or as the Owner's Engineer directs.

2. After the forms have been removed from the footings, walls and piers, the materials taken from excavations (free from waste and objectionable matter) shall be used for back-filling around them.

3. These filling materials shall be made in layers not to exceed 15 centimeters and thoroughly tamped before the next fill is placed. Excess excavated materials shall be placed and spread on the immediate premises as directed by the supervising Engineer, provided, however, that the Contractor shall not be required to remove such materials more than 50 meters from the building line.

4. Open tile drains around the building if any, shall be covered with crushed rock or gravel for a depth of 30 cm. and the same shall be graded from course to fine.

5. Open tile drains under floor slab (where so indicated on drawings) shall be covered with broken stones or gravel up to the bottom of the slab.

6. In spaces where slabs rest on ground, or on earth-fill as specified in paragraph 2, shall be labeled and accurately graded with 10 cm. thick of gravel and sand, and tamped thoroughly before concrete pouring is done.

7. All exterior grades shall be formed in accordance with the drawings and specifications, taking into account the requirements for landscaping work, if any, and giving due allowances for the top soil depth.

8. The Contractor shall grade the area included within clearing lines as defined "Clearing" under the General Conditions, and all such grading work should be included in the building Contract without extra or additional cost. Banks of graded areas shall have a slope of 3.8 cm. horizontal to one vertical distance.

9. Extra grading (cut or fill) beyond the ___meters and or due to change of grade shall be paid at the unit price bid for the same.

J. TOP SOIL STRIPPING AND SPREADING

For use when topsoil is salvaged for landscaping work.

1. Topsoil stripping operations shall start from the areas affected by the construction to limits indicated by the Owner and or as specified.

2. Topsoil shall be stripped to varying depths as approved by the Architect, but not beyond topsoil strata.

3. Topsoil shall be stripped by approved methods and stored where it will not interfere with the work.
4. This topsoil shall be evenly spreaded to the true contours and raked to even, smooth surfaces ready for seeding and planting.

K. TEMPORARY EASEMENT

The Contractor shall obtain the consent of adjoining property owners regarding the need for temporary easements or any other manner of physical encroachment at his own expense.

L. PAVEMENT

The Contractor shall restore, without extra cost to the Government, any street pavements, concrete sidewalks and curb, and similar public structures that may be opened, removed or demolished in the performance of work under this Section in the manner prescribed by authorities having jurisdiction.

M. PROTECTION OF TREES

The Contractor shall protect trees indicated to remain in place by boxing them, by using guys and the like, and or as indicated by the supervising Architect or Engineer.

N. PROTECTION OF ADJOINING PROPERTY

The Contractor shall protect the excavation to be made below existing grade line so that the soil of adjoining property will not cave-in or settle and shall defray the cost of underpinning or extending the foundation of buildings on adjoining properties.

1. Before starting the excavation, the Contractor shall notify in writing the owners of the adjoining buildings not less than 10 days before such excavation is to be made and that the adjoining building will be protected by him.

2. The Owners of the adjoining properties shall be given access to the excavation for the purpose of verifying if their properties are sufficiently protected by the contractor making the excavation.

3. In case there is a party wall along a lot-line of the premises where an excavation is being made, the contractor at his expense preserve such party wall in as safe a condition as it was before the excavation was commenced and shall, when necessary, underpin and support the same by adequate methods.

4. Guards or fences shall be provided along open sides of excavation except that, in the discretion of the Engineer such guards or fence may be omitted from any side or sides other than those adjacent to streets or public passageways.

1.2.CONCRETE WORKS

A. PLAIN AND REINFORCED CONCRETE

SCOPE OF WORK

This Item shall consist furnishing, placing and furnishing concrete in buildings and related structures, flood control and drainage, and water supply structures in accordance with this Specifications and conforming to the lines, grades, and dimensions shown on the Plans.

GENERAL REQUIREMENTS

1. Acronyms

The following acronyms for applicable standards/ publications are referred to this Specification:

ASTM – American Society for Testing Materials
ACI – American Concrete Institute
POI – Pre Stressed Concrete Institute
AWS – American Welding Society
AISC – American Institute of Steel Construction

2. Standard Specifications and Codes

The work covered by this Section unless otherwise specified or detailed, shall be governed by the Building Code requirements for Reinforced Concrete (ACI 318), Standard Code for Arc and Gas Welding Society. The latest edition of all standards Specifications or Codes will be used.

3. Coordination

The concrete work shall be coordinated with the work of other trades allow reasonable time to set sleeves, inserts and other accessories which must be in position before concrete bases and pads of mechanical equipment shall be placed to comply with approved shop drawings for the equipment.

4. Workmanship

The Contractor shall be responsible for any additional cost which may result from concrete surfaces which are not finished to the required profile or elevation.

5. Samples

The Contractor shall submit samples of cement and aggregates proposed for use in the concrete work for approval, enumerating names, sources and description of materials.

MATERIAL REQUIREMENTS

1. Portland Cement

a) Portland cement shall conform to the requirements of ASTM C-150 Type for normal Portland cement; Type-III for Highly Early Strength Portland Cement.

b) Cement shall be any standard commercial brand in 40 kilograms per bag such as: Filipinas, Union, Republic Apo or other locally available equivalent.

2. Fine Aggregates

Sand shall be clean, hard coarse river sand or crushed sand free from injurious amount of clay loam and vegetable matter and shall conform to ASTM C-33 or C330.

3. Coarse Aggregate

Gravel shall be river run gravel or broken stones. The maximum size shall be 1/5 of the nearest dimension between sides of forms of the concrete, or ¾ of the minimum clear spacing between reinforcing bars, or between re-bars and forms whichever is smaller.

4. Mixing Water

Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkali, organic materials or other deleterious substances.

5. Admixture

All air-entertaining admixtures if used shall conform to ASTM C-260. Water reducing admixtures, retarding admixtures, and water reducing and accelerating admixtures, if used, shall conform to the requirements of ASTM C-494.

STORAGE OF MATERIALS

1. Cement and Aggregates shall be stored in such a manner as to prevent their deterioration or the intrusion of foreign matter

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

PLAIN CONCRETE

General Requirements

1. Plain Concrete, other than fill, shall have a minimum ultimate compressive strength at 28 days of 140 kilograms per square centimeter or 2,000 pounds per square inch and material proportioning, and placing shall conform to the requirement of this section.

2. Concrete made with lightweight aggregate may be used with strengths less than 140 kg. per square centimeter if it has been shown by tests or experience have sufficient strength and durability.

3. The thickness of plain concrete walls may be 5 centimeters (2 inches) less than the required by 6.17 for plain masonry wall but in no case less than 18 centimeters and the ratio of unsupported height or length whichever is the lesser to thickness shall not be greater than 22.

4. Concrete shall consist of Portland Cement, fine aggregates, water, and where specified, Admixtures, proportioned mixed place, cured and finished as hereinafter specified.

5. The following special types of concrete shall be used where indicated on the detailed drawings or as specified.

    a) Lean Concrete
    b) Concrete with integral waterproofing
    c) Highly early strength concrete may be used subject to the approval of the supervising Architect or Engineer.

6. All provisions of the Specifications shall apply the seven (7) day compressive strength equal to the 28 day strength required for normal concrete. Admixture used in concrete shall be produced by a reputable manufacturer and used in accordance with the manufacturer's printed directions.

    a) **Plasticizing Admixture** – Concrete admixture shall be free from chlorides and shall conform to ASTM C-494-651. The admixtures shall be used in all concrete mixtures in accordance with the manufacturer's specifications.

    b) **Calcium Chloride** – shall not be used under any circumstances.

PROPORTIONING OF CONCRETE

1. The Contractor shall employ, at his own expense, an approved testing, laboratory which shall design the mix for each type of concrete required by the Specifications and drawings to obtain

strength as determined at least 15% higher than required. Strength requirements shall be as noted on the drawings.

2. The adequacy of the mix design shall be verified by a test on a minimum of 6 cylinders, 3 tested at 7 days; 3 at 28 days, in accordance with ASTM C-192 and G-3 and by Slump Tests in accordance with ASTM C-143.

3. The testing laboratory shall submit 5 copies of the mix design and the test results to the Owner or his duly authorized representative for approval before any concrete is placed.

4. If any time during construction, the concrete resulting from the approved mix design proves to be unsatisfactory for the reason such as too much water, lack of sufficient plasticity to prevent segregation, honeycomb, etc. or insufficient strength, the Contractor shall immediately notify the testing laboratory and the supervising Engineer.

5. The laboratory shall modify the design, subject to approval by the supervising Architect or Engineer until a satisfactory concrete is obtained.

6. **Stone concrete** – Minimum compressive cylinder strength of concrete fc' at 28 days area as follows:

   a) Fc' 27.58 Mpa for suspended beam, slab and columns
   b) Fc' 20.68 Mpa for footings and walls.

7. The **Water Content** shall not exceed 28 liters per 40 kilograms per bag cement, and the slump test shall not exceed 10 cm. in all cases unless otherwise changed by the supervising Architect or Engineer.

8. **Lean Concrete** – Lean concrete mix to be designated to produce concrete with 28 day strength of 13.79 Mpa, slump and size shall be subjected to approval depending where it is mixed.

DETERMINING CONCRETE PROPORTIONS
CONCRETE PROPORTIONS AND CONSISTENCY

1. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the form and around reinforcement without permitting the materials to segregate or excess free from water to collect on the surface.

2. The methods of measuring concrete materials shall be such that the proportions can be accurately controlled and easily checked at any time during the work.

CONCRETE TEST

1. **Testing Laboratory**

a) The Contractor shall employ at his own expenses, an approved Testing Laboratory which may shall make compression and Slum Tests and immediately submit 5 copies of the test reports to the supervising Architect or Engineer.

b) Ready mixed concrete companies may use their own laboratories provided that testing is done with the supervision of the Owner or his authorized representatives.

2. **Compression Slump Test**

Compression and Slump Tests shall be made every 50 cubic meters of concrete or fraction thereof; but not less than 1 set of tests shall be made from any one batch of concrete and all 3 tests shall be made from the same batch.

3. **Compression Tests**

Make 3 standards 15 cm x 30 cm. cylinder and tests in accordance with ASTM C-31 and C-39. The one (1) cylinder at the age of 28 days and one (1) cylinder in reserve for 56 days test. If the 28 days test does not meet the requirements, make additional cylinder as required to check strength of concrete in the construction. These cylinders are to be cured in the field in the same manner as to the concrete in the construction is cured.

4. **Slump Test**

For each representative quantity of concrete mentioned above, two slump tests shall be made in accordance with ASTM C-143.

5. **Test Report**

The testing laboratory shall submit 4 copies of its test cylinder reports which are to include, as far as applicable, the following information:

a) Location of the structure where the concrete is used, design number, concrete design strength, type and manufacturer of Portland cement.

b) Amount of any Admixtures used, Slump Tests, date of sampling, cylinder application number, days cured in the field, and days cured in laboratory.

c) Age at the time of testing, crushing stress, type of failure, who made the cylinders, who shipped the cylinders to the laboratory and whether concrete strength meets the specifications.

6. Inspection of Batch Plant Operation

Inspection on a "Spot Check" basis required to insure the concrete delivery to the job complies with the Specifications and the design mix. The testing laboratory shall provide this service as directed by the Owner's supervising Engineer.

7. Additional Tests

If, in the opinion of the supervising Engineer, based on cylinder strengths below specifications requirements or visual defects, concrete of poor quality has been placed, additional tests shall be made as directed by the Owner at the expense of the Contractor. Test may be Compression Test on core cylinder per ASTM C-42, and or Lead Tests as cut-lined in ACI 318, Section 202, or as specified.

MIXING CONCRETE

The mixing and measuring equipment shall be approved by the supervising Architect or Engineer. Unless otherwise authorized, concrete shall be machine mixed at the site or by ready-mixed concrete.

1. Site Mixed Concrete

Provide a batch mixer type equipped with accurate timing and measuring devices and operate in accordance with the manufacturer's recommendations:

2. Mixing Time

a) For each batch, after all solid materials are placed inside the mixing drum, and water is introduced before ¼ of the mixing time has elapsed, shall not be less than 1 minute for mixers having a capacity of one (1) cubic meter or a fraction thereof for additional concrete.

b) The concrete mixer shall revolve at no less than 14 or more than 20 revolutions per revolutions per minute. Speed greater than 20 revolutions per minute and less than 14 revolutionary per minute are usually found to be unsatisfactory.

READY MIXED CONCRETE

1. All ready mixed concrete shall conform to the requirements of ASTM C-94, placed in forms within one (1) hour after adding water or not more than ½ hours if a retarder is used. It shall be kept constantly agitated during the transit period.

2. Pouring of concrete should not be started until after the forms and reinforcement for the whole unit are properly laid and installed, cleaned, inspected and approved.

3. Construction joints shall be rough-in and clean thoroughly before any pouring starts. Wet and slush surface with cement mortar.

HANDLING AND PLACING CONCRETE

1. Immediately after the concrete is mixed, it shall be conveyed by the approved push cart or buggies to designated locations, and carefully deposited in such manner as to prevent the separation of ingredient or displacement of the reinforcements.

2. Keep temporary runways built in such a manner that runway supports will not bear upon reinforcement of fresh concrete. Conveying or hauling of concrete by the use of long inclined chutes or pipes shall not be permitted.

3. Dumping concrete into carts or buggies with a free fall of more than one (1) meter will not be permitted. Hardened splashes or accumulation of concrete on forms or reinforcements shall be removed before the work continues.

4. When placing more than 1.50 meters high, it shall be deposited through sheet metal or other approved conveyors.

5. As for practicability, the conveyers shall be kept full of concrete during the placing and their lower ends shall be kept buried in the newly placed concrete.

6. After the initial set of the concrete, the forms shall be jarred, and no strain' shall be placed on the ends of the projecting reinforcing bars. Foundation shall be free from water during concreting and construction joints shall be determined by the supervising Architect or Engineer.

7. Concrete in columns shall be placed in one continuous pouring operation and allowed to set 12 hours before caps are placed. Likewise, concrete in beams and slabs in superstructures shall be poured in one operation.

RE-TAMPERING

The contractor shall mix only such quantities that are required for immediate use. Mixture which has developed initial setting shall not be used. Concrete which has partially hardened shall not be re-tampered for use.

CURING AND PROTECTION

1. All concrete work shall be protected from drying out after removal of forms by covering with waterproof paper, polyethylene sheeting burlap, with a coating of approved membrane curing compound having a moisture retention equal 90% based on ATM C-309 and C-156, applied in accordance with the manufacturer's instruction for use

2. Membrane curing compound shall not be used where the floor hardener, membrane waterproofing, damp-proofing, resilient floor tile or other floor or wall covering set in adhesive, concrete-fill or setting beds, paint, plaster or other applied finishing or surfaces treatment are to be subsequently applied.

3. Wet burlap as often as required to keep concrete wet throughout each day for as period of at least 7 days where normal Portland cement is used and 3 days where high early strength cement is used.

METAL REINFORCEMENT

1. Steel Bars

a) Reinforcing bars shall conform to ASTM Specifications A-615. All mild steel for columns, shear wall, footings and footing beams shall be high grade deformed 413.7 Mpa.

b) For 10 mm and smaller bars use intermediate grade deformed bars. Fy = 275.8 Mpa

c) If reinforcing bars are to be welded, these specifications shall be supplemented by requirements assuring satisfactory weld ability.

d) Bar and rod mats for concrete reinforcement shall conform to ASTM Specifications A-184 and Wires for concrete reinforcement shall conform to ASTM A-82 Specifications.

e) Welded wire fabric for concrete reinforcement shall conform to ASTM A-185 except that the weld shear strength requirements shall be extended to include a wire size differential up to and including six gauges.

f) Wire and strand shall conform to ASTM A-416. Structural steel shall conform to ASTM A-26 and Steel pipe for composite column shall conform to ASTM Specification A-377.

2. Accessories

Provide bar supports and other accessories necessary to hold reinforcing bars in the proper positions while concrete is being placed. Bar supports which come in contact with forms for concrete exposed to view in the finished structure shall be galvanized or stainless subject to approval.

3. Mill Certificate and Test

a) The Contractor shall furnish 2 copies of the manufacturer's certificate of mill tests al reinforcing steel.

b) The Contractor shall, employ at his own expense an approved testing laboratory which shall conduct testing of all reinforcement sizes of each bulk under the supervision of the supervising Architect or Engineer.

4. Shop Drawing

a) Each reinforcing steel detail and placement drawings shall be submitted for approval. Any material fabricated before the final approval of the shop drawings will be done at the Contractor's risk, but no material shall be installed until final approval of the "Shop Drawings".

b) All shop drawings shall be in accordance with the Manual Standard Practice for Detailing Reinforced Concrete Structure ACT-315.

5. Labeling

Bars shall be properly labeled with weatherproof tags to facilitate identification.

PLACING OF REINFORECEMENT

1. All reinforcement shall be placed according to the approved drawings. The Contractor shall provide sufficient bar supports, ties, anchors and other accessories to hold all bars securely in place.

2. Unless detailed on drawings, all stirrup shall be held in place by bar spacer. Reinforcing steel shall be cleaned of oil, grease, scale, rust or other coatings which will impair bond.

3. All bars shall be bent cold

4. All welded spices shall be done by certified welders having welder's certificate and shall be submitted and approved by the supervising Architect or Engineer before any welding works shall be started.

5. The welding of bars shall conform to AWS D -12.1 Recommended Practices for Welding Reinforcing Steel.

STORAGE OF MATERIALS

Reinforcing steel bars shall be stored on supports above the ground level properly covered with roof or plastic materials for protection from direct effect of moisture and the considerable delay in use.

FORMS

General Conditions

1. Forms shall conform to the shape, lines and dimensions shown on the drawings. They shall be substantial and designed to resist the pressure and weight of the concrete.

2. Forms shall be properly tied and braced or shored so as to maintain their position and shape. Forms shall be sufficiently tight and strong to prevent leakage of mortar.

3. Where required by the Owner, Shop drawings of formwork, shall be submitted for approval before fabrication and erection of such formwork.

4. Provide temporary openings where necessary to facilitate cleaning and inspection before depositing concrete.

5. Before construction, all form materials are subject to approval. The type of form used shall be in accordance with the finish requirements as specified or as shown on the detailed drawings.

6. Forming shall start at the first floor level with new materials. Forms for exposed concrete may be reused only if the surface has not absorbed moisture and has not splintered, warped or peeled, subject to the approval of the supervising Architect or Engineer.

7. Forms shall be coated with non-staining form oil before setting reinforcement. The form oil shall not contain chemical that will impair the strength of the concrete.

8. Side forms of footings may be omitted and concrete be placed against the next excavation only when approved by the supervising Architect or Engineer.

9. All exposed corners shall be square. Extra care shall be exercised while stripping the forms. Corners shall be protected against chipping or other damages that may be caused by the working force.

10. Removal of forms or shoring is subject to approval by the supervising Architect or Engineer, and under no circumstances shall bottom form and shoring be removed until after the members have acquired sufficient strength to support their weight and the load thereon. Forms shall main in place for a minimum time as follows:

    Columns, shear and bearing walls --------- 3 days
    Stairs (bottom forms) ---------- 21 days
    Beams and Slabs (bottom form) --------- 21 days

OTHER FORMS

Exposed exterior surfaces of building where Architectural finishing is required and as shown on detailed drawings, the following conditions shall be observed:

1. Forms shall be designed and constructed to facilitate early removal without damage to exposed surfaces of the concrete, free of offsets, and square corners true to lines and profiles as detailed.

2. Form ties will not be permitted through forms for surfaces which will be exposed. Formworks shall not be used twice unless otherwise approved by the supervising Architect or Engineer.

3. Exposed and Interior Surfaces treated plywood forms or moisture resistant plywood shall be laid vertically or horizontally in large are with joints so arranged and treated properly as required to provide smooth concrete surfaces.

FORMWORK ACCESSORIES

Form ties shall be submitted for approval. It shall be so designed as to leave no metal closer than 19 mm to the surface of the concrete or to leave a hole greater than 22mm in diameter on the face of the concrete.

FINISHING OF FORMED SURFACE

Remove forms and form tie ends then fill holes with 1:2 Portland cement mortar mixed to match the concrete. All defective areas below grade line not exposed to view shall be patched with Portland cement mortar mixed to match the concrete mixture as directed by the supervising Architect or Engineer.

1. *Exposed Exterior surfaces of the building where special finish is indicated* – Concrete shall be placed and finished as herein before specified and as required to provide eve dense surface of uniform color, free from marks, aggregate, pockets, honeycomb or other imperfections so that after treatment of the finished surfaces will not be required.

2. Any concrete which is not formed on level of alignment, or shows defective surfaces shall be considered as not conforming with the expense of the Contractor, unless the Owner or his authorized representative grants permission to patch or otherwise correct the defective areas.

3. Permission to patch any such area shall not be a waiver of the right of the Owner to require complete removal of the defective works.

4. *Exposed Interior Finishes* – patch all defective areas and remove all fins, form joint marks, rough spots and other defects by rubbing with a suitable tools until such defects and rough areas

are completely removes and surfaces free from imperfections so as to produce dense, smooth, uniform finish with desired texture and design.

5. Silicone water repellent shall be applied to all exterior exposed concrete surfaces above grade which are not to be painted.

INSERT, SLEEVE AND SIMILAR ITEMS

1. All required flashing, reglets, seal, masonry ties, anchors, wood locks, nailing strips, ground, inserts, wire hangers, sleeves, drains, guard angles, (***insert for elevator guide supports where required)***, provisions for floor hinges boxes, and concealed overhead door closer and al items specified, as furnished under this and other sections of the Specifications shall be in their final position at time concrete is placed and shall be properly located, accurately positioned and built-in to the construction and maintained securely in place.

2. Insert on hangers for ceiling construction specified under the plastering section shall be located only in bottom of concrete ribs or other concrete members crossed such ceiling construction.

3. Sleeves shall not be installed in beams, ribs, or column, except upon formal approval of the Architect or Engineer.

4. All stone-cut and V-cut lines, Sunk fillets, and the like, on concrete wall surface shall be integrated into the concrete with the corresponding removable mould on the forms before the concrete is poured and shall be finished straight and clean-cut in accordance with the size and shape as shown on full size details.

FINISHING OF SLAB

1. Finish floor and roof slabs shall be level plane surfaces unless otherwise specified on the drawings, with a tolerance of 3 mm in 3.0 meters. Surfaces shall be slope towards the drains as required.

2. Resilient flooring, Ceramic Tile or Marble, base slabs which are to receive these finishes or other finished requiring “Thin-Set” installation shall be floated and toweled with a steel trowel to provide a smooth surface as required to receive the flooring.

3. For roofing membrane waterproofing, the working processes is the same as that for Resilient Flooring except steel troweling which may be omitted.

4. Exposed concrete finish surface where no finishing applied as called for on the drawings shall be finished with a steel trowel as required to produce a hard, dense finish free from surface imperfections.

5. Dry materials should not be used on the surface to be finished. Apply hardener and sealer in accordance with the manufacturer's printed instructions.

WATERTIGHT CONCRETE

1. All waterproofing on deck wherever called for in the plan shall be guaranteed to be absolutely water proofed and free from leaking for a period of two (2) years.

2. Should any leakage develop in these areas, they shall be made waterproof by approved waterproofing methods and materials and this shall be repeated if necessary until all leaks has been stopped.

3. Guarantee shall extend for a full two years after the last leak has stopped

4. All pipes or piping under slabs must be completed before the slabs are poured.

CONCRETE FLOORS ON FILL

Concrete floor and steps on fill shall be laid on a prepared foundation which shall be placed as follows:

1. Earth or sand fill shall be laid to a uniform grade as shown on the detailed drawings; fill shall be placed in layers not to exceed 15 centimeters thick, for each layer being thoroughly wetted and rolled or tampered.

2. Earth or sand fill shall be made as soon as the concrete of the walls and foundations has set sufficiently to permit the filing load and pressure. On top of this fill shall be placed 10 cm. layer of gravel which shall be rolled or tampered.

3. All of these sand and gravel foundations specified above shall be kept wet for at least 30 days after rolling or tamping so as to allow settlement before the floors are placed.

4. Concrete floors shall be laid in alternate strips about one (1) meter in width by 6 meters minimum length, but following pattern shown on drawings. The construction joints shall coincide with the groove in case such items are called for in the cement finish. After the concrete has set, the form shall be removed and the remaining strips, laid.

5. All concrete shall be of such consistency as to require a tamping to bring the water to the surface. Tampering shall be done mechanically.

6. Concrete floor and steps on fill or in ground shall be reinforced if indicated in the drawings. The size and spacing of the reinforcing steel shall be in accordance with the drawing of Specifications.

HANDLING AND PLACING OF CONCRETE

Concrete during and immediately after depositing, shall be thoroughly compacted. The compaction shall be done by mechanical vibration subject to the following provisions:

1. The vibration shall be internal unless special authorization of the other method is given by the supervising Architect or Engineer or as provided herein.

2. Vibrators shall be of a type and design approved by the supervising Engineer. They shall be capable of transmitting vibration to the concrete at frequencies of not less than 4,500 impulses per minute.

3. The intensity of vibration shall be as such as to visibly affect a mass of concrete of 25 mm, slope over a radius of at least 50 centimeters.

4. The Contractor shall provide a sufficient number of vibrators to properly compact each batch immediately after it is placed in the forms.

5. Vibrations shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrator shall be inserted into and withdrawn from the concrete slowly and gradually.

6. The vibration shall be sufficient duration and intensity to compact the concrete thoroughly but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point to the extent that localized areas of grout are formed.

7. Vibrators shall be thoroughly manipulated so as to work the concrete around the reinforcement and embedded fixtures and into the corners and angles of the forms.

8. Application of vibrators shall be at points uniformly spaced and not farther apart than twice the radius over which the vibration is visibly affected.

9. Vibration shall not be applied directly or through the reinforcement sections of layers of concrete which have hardened to a degree that the concrete ceases to be plastic under vibration.

10. It shall not be used to make concrete flow in the form over distances so great as to cause segregation and vibration shall not be used to transport concrete.

GRADATION OF AGGREGATES

1. Fine and Coarse aggregates used in concrete, shall be tested in accordance with the requirements of the *"Standard Specifications for Concrete Aggregates"* ASTM 033-67m with a minimum frequency of one (1) set of 6 and one (1) set of 7 test per 1,000 cubic meter source, as follows:

2. At least one sample of fine and coarse aggregates used in concrete shall be tested in accordance with the requirements of the *"Standard Specifications for Concrete Aggregates"* ASTM 033-67 grading as follows:

Coarse Aggregates

Specific …….. Grading
Gravity ……... Soundness
Absorption ……. Abrasion
Material finer than No. 200 sieve

Fine Aggregates

Grading ……Absorption
Soundness…….Organic Impurities
Material Finer than No. 200 sieve
Mortar strength, 7 days
Specific Gravity

Coarse Aggregates (percent passing)

38 mm sieve …… 100%
25 mm sieve …… 95-100
13 mm sieve …… 25-50
No. 4 sieve …….. 0-10
No. 8 sieve …….. 0-5

Fine Aggregates (percent passing)

9 mm sieve ….… 100%
No. 1 sieve ….… 90-100
No. 8 sieve ….… 80-95
No. 16 sieve ….. 50-85
No. 30 sieve ….. 30-70
No. 50 sieve ….. 10-45
No. 100 sieve ….. 0-10

3. Aggregates failing to meet these specifications, but which have been shown by approved laboratory tests to produce concrete of the required quality may be used where authorized by the Architect or Engineer.

4. Aggregates shall be quarried or washed in fresh water and shall contain no more than one twentieth 1/20 of (1%) percent salt by weight.

STORAGE OF MATERIALS

1. Portland Cement

a) Cement delivered in bags shall be stored immediately upon receipt at the work site in a weather proof structure which shall be air tight as practicable with suitable wooden floors which shall be elevated above the ground at a distance sufficient enough to prevent the absorption of moisture.

b) Bags shall have guaranteed constant cement content and shall be provided with proper labels showing the number of consignment and the date of site delivery.

c) The bag shall be stacked close together to reduce circulation of air but should not be stacked against outside walls but in such a way that they will be easily accessible for inspection and testing and shall be used in the order of their delivery.

d) Cement that has been in storage longer than six months will be tested by standard mortar tested or other tests as deemed necessary by the Owner to determine its suitability and such cement shall not be used without the express approval of the Owner.

e) Bags shall not be stored to a height greater than two (2) meters. All cement must be free from lumps or evident for deterioration.

f) Cement delivered in bulk shall be stored in properly designated elevated airtight and waterproofed silos or bins, provided at the Contractor's expense. The silos shall be adequate in size to ensure continuity of work at all times.

g) The site shall be kept perfectly dry. Bag cement shall be transported closed and effectively protected from weather by adequate coverings. Bulk cement shall be transported in closed container.

2. Aggregates

a) All aggregates shall be stored in bunkers provided with proper floors or tightly laid wood planes sheet metals, or other hard and clean surface. Fine and coarse aggregates of different sizes shall be stored in separate bunkers or piles in such a manner as to prevent aggregation, inclusion and contamination by dirt and other injurious foreign materials.

b) Stockpiles of coarse aggregate shall be built in horizontal layers not exceeding 1.20 meters in depth to minimize segregation. Should the coarse aggregate become segregated, it should be re-mixed to conform to the grading requirements given herein before.

3. **Reinforcing Steel Bars**

Reinforcing steel bars shall be transported and stored at the site in such a way as to prevent damage or deterioration of the steel by rust or coating with grease, oil, dirt and other objectionable materials. Storage shall be in separate piles or racks so as to avoid confusion or loose of identification after bundle are broken.

REBAR SPACING AND COVER

1. Reinforcing Bars

Reinforcing bars shall be fixed one to the other by means of adequate steel wire ties to form rigid reinforcement cages or nets. The reinforcement shall be fixed in the form by approved concrete distance blocks, space bars, links and stirrups, and all to be provided at the Contractor's expense. Reinforcing bars shall be spaced according to the approved working drawings and the distance between bars shall not be less than those recommended in ACI-318.

2. Concrete Cover

The concrete to the gutter reinforcing bars shall be those recommended in ACI 318, unless otherwise specifically indicated on the drawings.

3. Anchorage Length

Plain bars shall be provided with end hook unless otherwise specified. The lengths of the anchorage of reinforcing bars shall be at least those recommended in ACI 318

4. Splices

Splices in bars shall be avoided as far as possible and shall be staggered in any one structural member. They shall conform to the recommendations in ACI 318. In no case shall splices be made at critical points of maximum stress.

PATCHING

1. Immediately after the forms have been removed and work has been examined by the Owner, and his permission given, all loose materials shall be removed.
2. All holes, stone pockets and other surfaces which were in contact with forms treated with cement retarding materials shall be removed with wire brush or other approved method until a rough bonding surface of exposed aggregate is obtained.

3. Any surface considered by the supervising Engineer to be insufficiently roughened shall be further roughened by an approved mechanical means. Surfaces shall be thoroughly washed down with water.

4. Honey combed and other defective areas must be chipped out to solid concrete, the edge cut as straight as possible and at right angles to the surface of slightly undercut to provide a key at the edge of the patch.

5. Shallow patches may be filled with mortar similar to that used in the concrete. This should be placed in layers not more than 12 mm thick and each layer given a scratch finish to improve bond with the succeeding layer.

CONSTRUCTION JOINTS

1. Once started, concreting shall be continued without interruption and shall only be stopped at properly indicated and prepared construction joints.

2. The position of construction joints shall be decided in advance so that the amount of concrete required to be placed at any one time does not exceed the capacity of the mixing plant.

3. In all cases where the positions of construction joints have not been indicated on the drawings, they must be approved by the Architect or Engineer.

4. Except where inclined joints are specified, all joints shall be formed to vertical or horizontal planes. Vertical joints shall be formed against a properly constructed stop-board.

5. As a general rule, joints in columns shall be made as near as possible to a beam haunching and joint in beams and slabs shall be made at positions shown on the drawings.

6. Construction joints shall be wire-brushed while the concrete is still green, roughened or hacked to expose the aggregate across the whole area of the joint.

7. Before fresh concrete is placed, the roughened surface shall be swept clean of all loose materials, thoroughly wetted and covered with a 12 mm thick layer of mortar composed of cement and sand in the same ratio as the cement and sand in the concrete mix.

8. Special care shall be taken to ensure that the first layer of fresh concrete is thoroughly rammed against the existing layer.

9. The cost of all measures necessary to form construction joints, whether shown on the Drawings or not, shall be deemed to be included in the Contractor's rates for concrete.

B. CONCRETE MASONRY

GENERAL CONDITIONS

The concrete masonry Contractor shall examine all drawings, specifications and all conditions that has relations and may affect his work and performance in the execution the Contract.

Where any deviation on the Plans and Specifications is to be made, the Owner shall be notified and his written approval shall be obtained before proceeding with the work.

SCOPE OF WORK

The work covered by this Item shall include the following:

1. Furnishing of all necessary materials, tools, equipment, labor, and appliances necessary to complete the execution of the concrete masonry work as shown on the drawings and herein specified.

2. All preparations for masonry work necessary to receive and adjoin other work, including provisions for inserts and attachment as noted in the plans and specifications which shall be installed under the terms of work.

3. Coordination with all other trades in laying out and execution of the concrete masonry work. Giving the work his personal supervision and keeping a competent foreman on the job at all times.

4. Arranging for adequate bracing, forming and shoring required in conjunction with and in the course of constructing the concrete masonry although not provided for under other sections.

5. Furnishing of all reinforcing steel for concrete masonry work and their placement including those not provided for under other sections but necessary for proper prosecution of the work.

6. Arranging for the necessary storage space and protection for materials at the job site.

7. Providing assistance and facilities for all inspections by the Owner or his authorized representatives as required in the course of execution of the work.

8. Arranging for furnishing test specimens and samples of materials as may be required.

MATERIAL REQUIREMENTS

The following materials to be used under this section of the specifications shall conform to the concrete masonry standards as indicated.

1. Cement to conform with ASTM C-150
2. Sand or fine aggregate shall be clear, sharp and well graded, and free from injurious amount of dust, lumps, shale, alkali, surface coatings and organic matter.

3. Lime: Hydrated lime shall conform with ASTM C-207

4. Quicklime shall conform with ASTM C-5 Specifications. Quicklime shall be slaked and then screened through a 16 mesh sleeve.

5. After slaking, screening and before using, it shall be stored and protected for not less than 10 days. The resulting product shall weigh not less than 1330 kilogram per cubic meter.

6. Hollow load bearing masonry units shall be type I Class A or B unit conforming with ASTM C-90-70 and the Philippine Bureau of Standard No. 15-2, series of 1979.

7. Solid load bearing masonry units shall be class a units conforming to ASTM C-145. All load bearing masonry units shall have a minimum compressive strength of not less than 5.5 Mpa (800 psi) based on 5 individual units when tested in accordance with the methods set forth in ASTM C-140-70 or as tested by the Bureau of Research and Standard, DPWH.

8. Masonry units shall have been cured for not less than 14 days if steamed-cured, or 28 days if air-cured when placed in the structure.

CONCRETE HOLLOW BLOCKS

1. For walls and partitions shown on the detailed drawings requiring concrete hollow blocks, the Contractor either uses of concrete or ceramic hollow blocks upon approval of the Architect or Engineer.

2. The load bearing of hollow blocks shall have a minimum compressive strength of 6.89 Mpa (1000 psi) computed from the average of five (5) units based on the average gross area, and a minimum of 5.41 Mpa (800 psi) for the individual unit respectively, all based on gross area.

Visual Inspection

All units shall be sound and free from cracks or other defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction.

Sampling of Specimen

In sampling blocks for the strength, absorption and moisture content determination, ten (10) individual units shall be selected from each lot of 10,000 units or fraction thereof and 20 individual units from each lot of more than 10,000 units.

Sampling

For lots of more than 10,000 units, 10 individual units shall be selected from each 50,000 units or fraction thereof, contained in the lot. For non-bearing type of CHB, no sampling for test shall be required for less than 500 units to be used in the job.

Testing

Units shall be tested in accordance with the standard method of testing Masonry units of the American Society of Testing Materials ASTM designation C-140 and or by the Bureau of Materials and Quality Control, DPWH. No blocks shall be used unless results of tests are known and duly approved by the supervising Architect or Engineer.

Reinforcement

All units shall be laid with a mortar composed of one part Portland cement and three parts of sand. Reinforcement shall be done in accordance with the structural plans as to size, spacing and other requirements.

MORTAR AND GROUT

Cement to be used for mortar and grout shall be: Type 1, 2, 3 or type 4 Portland cement conforming to ASTM C-150

1. Plastic cement shall have less than 12% of the total volume in approved types of plastic agents and shall conform to all the requirements for Portland cement per ASTM C-150, except the limitations in insoluble residue, air entrainment, and addition subsequent to calciration.

2. Mortar shall be freshly prepared and uniformly mixed in the proportion of 1 part Portland cement ¼ part maximum line putty or hydrated lime, loose sand not less than 1-1/2 and not more than 3 times the sum of the volume of cement and lime used, and shall conform to ASTM C-270.

3. Grout for pouring shall be of fluid consistency and mixed in the proportion by volume: 1 part Portland cement, 2-1/2 part minimum to 3 parts maximum damp loose sand where the grout space is less than 7.5 cm in its least dimension.

4. Grout for pouring shall be fluid consistency and mixed in the ratio by volumes; 1 part Portland cement, 2 parts minimum to 3 parts maximum damp loose sand, 2 parts coarse aggregate where the grout space is not more than 7.5 cm. in its least dimension.

5. Grout for pumping shall be fluid consistency and shall have not less than 7 bags of cement in each cubic meter of grout. Not mix design shall be approved by the supervising Engineer.

6. Fluid consistency shall mean; as fluid as possible for pouring without segregation of the constituent parts.

7. Aggregate for mortar shall conform to ASTM C-144.

8. Aggregate for grout shall conform to ASTM C-404

ADMIXTURE

1. The used of admixtures shall not be permitted in mortar or grout unless substantiating data is submitted to and approved by the supervising Architect or Engineer.

2. The use of Admixtures shall not be permitted in mortar without reducing lime content

3. Insert coloring pigments may be added but not to exceed 6% by weight of the cement.

4. The use of uncontrolled fire clay, dirt and other deleterious materials is prohibited.

5. Water to be used shall be fresh, clean and free from deleterious quantities of acids alkali and organic materials.

REINFORCING STEEL

1. The minimum requirements for deformed steel bars shall conform to ASTM A-305.

2. Wire reinforcement shall also conform with ASTM A-82.

3. Reinforcement shall be clean and free from loose, rust, scales and any coatings that will reduce bond.

CONSTRUCTION

1. **Workmanship**

a) Masonry work shall not be started when the horizontal and vertical alignment of the foundation has a maximum total error of 25 mm OR 2.5 centimeters.

b) All masonry work shall be laid true to line, level, plumb and neat in accordance with the plans and to the satisfaction of the Owner.

c) Units shall be cut accurately to fit all plumbing ducts, openings electrical works, etc. and all holes shall be neatly patched.

d) Extra care shall be taken to prevent visible grout mortar stain.

e) No construction supports shall be attached to the wall except where specifically permitted by the supervising Architect or Engineer.

2. Masonry Unit

a) Masonry unit shall be sound, dry, clean and free from cracks when placed in the structure.

b) All masonry units shall be stored on the job and kept off the ground and protected from the elements of weather.

c) Wetting the units shall not be permitted except when hot dry weather exists causing the units to be warm to the touch, and then the surface only may be wetted with a light fog spray.

d) Proper masonry units shall be used to provide for all window, doors, bond beams, lintels, plasters, etc., with a minimum of unit cutting.

e) Where a masonry unit cutting is necessary, all cuts shall be neat and true line.

f) Mixing of Mortar and Grout Mortar shall be mixed by placing ½ of the water and sand in the operating mixer, then add the cement, lime and the remainder of the sand and water.

g) Mortar should be re-tampered with water as required to maintain high plasticity. Re-tampering on mortar boards shall be done only by adding water within a basin formed with mortar and the mortar re-worked into the water.

h) Any mortar which is unused after 1 – ½ hours from the initial mixing time shall not be used.

i) After all ingredients are in the batch mixer, they shall be mechanically mixed for not less than 3 minutes. Hand mixing shall not be employed unless specifically approved.

3. Bonding

Concrete masonry units shall be laid with the thicker edge of the core up to provide a wider mortar bed.

a) Both face core and ends of all blocks should receive a full bed of mortar.

b) Cross web should be mortared.

c) For bonding masonry to the foundation, the top surface of the concrete foundation shall be clean with laitance removed and aggregate exposed before masonry construction can be started.

d) Where no bond pattern is shown, the wall shall be laid up in straight, uniform coarse with regular running bond.

e) Intersecting masonry walls and partitions shall be bounded by the use of steel ties at 60 centimeter on.

4. Reinforcement

When the foundation dowel does not line up with a vertical core, it shall not be sloped more than one horizontal in six vertical.

a) Dowels shall be grouted into a core in vertical alignment, even though it is an adjacent cell to the vertical wall.

b) Reinforcing bars shall be straight except for bends around corners and where bends or hooks are detailed the plans.

c) Reinforcing steel shall be lapped 30 bar diameters minimum where spliced bars shall be separated by one bar diameter or wired together.

d) Vertical bars shall be held in position at the top and bottom and at intervals not exceeding 192 diameter of the reinforcement.

e) Horizontal reinforcing bars shall be laid on the webs of the units on continuous masonry courses, consisting of bond-beam or channel units, and shall be solidly grouted in place.

f) Vertical reinforcing steel shall have a minimum clearance of 6 mm from the masonry, and not less than one bar diameter between bars.

g) Wire reinforcement shall be completely embedded in mortar or grout. Joints with wire reinforcement shall be at least twice the thickness of the wire.

h) Wire reinforcement shall be lapped at least 16 cm. at slices and shall contain at least one cross wire of each piece of reinforcement in the lapped distance.

5. Grouting

Reinforcing steel shall be secured in place and inspected before grouting starts.

a) Mortar dropping should be kept out of the grout space.

b) All grout shall be puddle or vibrated in place

c) Vertical cells to be filled with grout shall have vertical alignment to maintain a continuous unobstructed core space.

d) Cells containing reinforcement shall be solidly filled with grout and pours shall be stopped 3.8 centimeters below the top of a course to form a key at pour joints.

e) Grouting of beams over openings shall be done in continuous operation.

f) The tops of unfilled cell columns under a horizontal masonry beam shall be covered with metal latch or special units used to confine the front fill to the beam section.

g) All bolts, anchors, or inserts in the wall shall be solidly grouted in place.

h) Spaces around metal door frame and other built-in items shall be filled solidly with grout of mortar.

REJECTION

In case the shipment fails to conform to the specified requirements, the Contractor may sort it, and new specimen shall be selected by the Owner or his supervising Engineer from the retained lot and tested at the expense of the Contractor. In case the second set of specimens fails to conform to the test requirements, the entire lot shall be rejected.

C. MASONRY FINISH

CONSTRUCTION REQUIREMENTS

1. Curing

The granolithic topping shall be cured at least 6 days before grinding or until such time when it has set sufficiently hard to permit machine grinding or rubbing with coarse sandstone grit without disclosing any surface aggregate.

2. Surfacing

a) After curing all granolithic topping, surfaces shall be wetted and grinded with electric grinding machine to a smooth and even surface.

b) Where it is not possible to use electric grinding machine, surface shall be hard-rubbed manually using No. 24 abrasive grit stone rubbing after which a light grouting of white Portland cement paste of creamy consistency as the matrix used in the topping.

c) Grout shall remain on the surface until the time of final grinding and cleaning.

3. Finishing

a) Allow at least 72 hours after the granolithic surface have been grouted before removing the grout coat, cleaning and fine stone grinding by electric grinding machine using no coarser than No. 80 abrasive grit.

b) Final grinding or rubbing of granolithic marble surface shall remove scratches and produce a true plane surface of uniform color and texture without objectionable irregularities of any description as that of the approved samples.

c) *Cleaning, Waxing and Polishing.* Upon completion of final grading or rubbing of granolithic marble the Contractor shall apply two coats of natural wax penetrating type. Surface shall be allowed to dry and polished.

MEASUREMENT AND PAYMENT

1. All granolithic marble finish indicated on the Plans and described herein shall be measured in square and lineal meter or part thereof for work completed and accepted to the satisfaction of the supervising Architect or Engineer.

2. The quantified area determined in the preceding section and provided in the Bill of Quantities shall be paid for at the Unit Bid or Contract Unit Price

(A) PEA GRAVEL WASHOUT FINISH

GENERAL CONDITIONS

The Contractor shall furnish all materials, equipment, labor, and tools required in undertaking the proper application of pea gravel washout finish as shown on the Plans and in accordance with this Specifications.

A-1 MATERIAL REQUIREMENTS

a) **Pea-Gravel** – pie-gravel specie shall be of well graded sizes consisting of 4 mm to 8 mm round variation wash river gravel.

b) **Cement** – Portland cement shall conform to the Specification requirements of Hydraulic Cement. Use only one brand of cement throughout the pea-gravel washout finish mix.

A-2 CONSTRUCTION REQUIREMENTS

a) All pea-gravel washout finish shall be done by men experienced and qualified to do this particular type of trade.

b) The Contractor shall submit at least two (2) samples to the supervising Architect or Engineer for approval measuring 30 cm. x 30 cm. showing its color, texture and design patterns.

1. Surface Preparation

a) Walks, ramps, driveways and elsewhere indicated on the Plans as pea-gravel washout finish shall be properly sloped and rendered under bed.

b) The under-bed mixture shall be spread to bring mortar under-bed to a level of 16 mm below the finish floor line.

c) For concrete masonry walls, columns, etc., the surface to be applied shall be first rendered a scratch coat and made true to plane, leveled plumbed and squared then allowed to cure for seven (7) days

2. Mixture and Proportion

a) Pea gravel washout mix shall consist of one part Portland cement and two parts pea-gravel measured by volume or a proportion equivalent to 1:2.

b) Mixtures shall be in approved containers to ensure that the specified materials are controlled and accurately measured. Mixture measured by shovel or shovel counts will not be permitted.

c) Unless specified otherwise, pea-gravel washout mix shall be in the proportion by volume in approved mixing machines or mortar boxes.

d) The aggregates introduced and mixed in such a manner that the materials will be uniformly distributed throughout the mass.

e) A sufficient amount of water shall be added gradually and the mass further mixed until a mortar plasticity necessary for the purpose intended is obtained.

f) Mortar boxes, pans, etc., where mixtures are mixed shall be kept clean and free from debris or dried mortar.

3. Application

a) Before work is started, the slope for drainage should be properly done and provided in the prepared under-bed.

b) Concrete setting bed must be sufficiently rough and all loose particles or anything which will diminish bond shall be thoroughly cleaned off.

c) The concrete under-bed must be kept wet for at least four (4) hours before the pea-gravel mix is applied.

d) Pea-gravel mix shall be applied with pressure to obtain solid adhesion to the under-bed and setting bed.

e) The finish surface shall be firmly, evenly, and monolithically applied.

f) When the surface applied with pea-gravel mix has sufficiently set, the cement paste shall be removed by use of sponge or water spraying equipment used in this specially trade in order to expose the pea-gravel quarter face but still intact.

4. Curing, Cleaning and Finishing

As soon as possible as the pea-gravel are exposed to desire appearance the surface shall be covered with damp burlap other approved covers. At the proper time when surface are semi-dry and stable allowing the applied surface to cure.

5. Protection

a) For proper curing, keep the pea-gravel washed finish moistened for a period of at least seven (7) days by thoroughly wetting the surface three (3) times a day and protecting it from the strong rays of the sun with burlap or layer of sand.

b) Upon completion of the work and the surface has completely seasoned, wash with clean water and brush thoroughly to produce a clean and sparkling appearance and protected until work has been accepted.

A-3 METHOD OF MEASUREMENT

All works done under this Item shall be measured in square meter or linear meter or part thereof for work completed and accepted to the satisfaction of the supervising Architect.

A-4 BASIS OF PAYMENT

The quantity determined in the Method of Measurement shall be paid for at the unit price bid or contract unit price as stated in the Bill of Quantities, which price constitute full compensation including labor and materials, tools and incidentals to complete this item.

(B) BUSH HAMMERED FINISH

GENERAL CONDITIONS

1. The Contractor shall furnish all materials, tools, plant, equipment and labor and other facilities and undertaking the proper application of Bush Hammered finish complete required as shown on the Plans and in accordance with this Specifications.

2. The Contractor shall submit for approval samples of each applied finish 30 cm. x 30 cm. of different shades to the Architect. Approved samples shall be kept for future reference.

B-1 MATERIAL REQUIREMENTS

1. Cement

Cement shall be ordinary gray Portland cement conforming to the specification requirement for Hydraulic cement. One (1) brand of Portland cement shall be used throughout the plaster mortar mix.

2. Adobe Aggregate

Adobe aggregate shall be crushed and pulverized to an approved graded size improving its mixing ability as coarse aggregate.

B-2 CONSTRUCTION REQUIREMENTS

1. Surface Preparation

Wall surfaces to be rendered with bush hammered finish shall be scratching coated with plaster cement mortar and be made true to plane plumbed and squared. The scratch coat must be properly cured within seven days.

2. Adobe Mortar Mixture

Adobe plaster shall be a mixture of Portland cement, crushed and pulverized graded adobe stones. It shall be uniformly mixed in the proportion by volume of one part Portland cement and two parts adobe aggregates or 1:2 proportions.

3. Application

a) Before any application work is commended, all wood moulds for horizontal and vertical groove joints shall be first established and set. The scratch coast has to be seasoned for 7 days

b) Surfaces to be applied with adobe plaster mortar shall be thoroughly moistened with fog spray.

c) Adobe plaster mortar shall be floated to a true and even surface. It may also be floated / troweled to a hard fluted surface with series of grooves also known as corduroy finish.

d) As soon as the plastered surface is hard enough to react hammering, the surface by hammering with an ax or hatchet leaving or exposing the natural appearance of the aggregate composition of mortar mixture.

4. Workmanship

a) Bush hammered finish shall be level, plumbed squared and true to a tolerance of 3 mm in 3.0 meters without caves, cracks, blisters, pits, crazing, discolorations, projection or other imperfections.

b) Plastering work shall be formed carefully around angles, contours and cants. Special care shall be taken to prevent sagging and consequent dropping of applications.

c) There shall be no junction marks in the finish where one day work adjoins another.

5. Curing and Protection

Upon completion of the work all surfaces shall be cleaned with steel brush and water to remove loose particles leaving the cleaned surfaces in its natural appearance. When cleaned surfaces dries spray a coat of water repellant.

B-3 METHODS OF MEASUREMENT

Bush hammered finish shall be measure in square meter area and linear meter actually done completed and accepted to the satisfaction of the supervising Architect.

B-4 BASIS OF PAYMENT

The work quantified and determined in the preceding section or as provided in the Bill of Quantities shall be paid for at the Contract unit bid price which payment constitute full compensation including labor, materials and other incidentals necessary to complete this Item.

(C) PEBBLE WASHOUT FINISH

GENERAL CONDITIONS

The Contractor shall furnish all materials, labor tools, and equipment required in undertaking proper application of pebble washout finish as shown on the Plans and in accordance with this Specifications.

C-1 MATERIAL REQUIREMENTS

a) Pebble

Pebble shall be well graded stones sized ranging from No.4 to No. 10 rounded shape.

b) Cement

Cement shall be Portland type hydraulic cement gray or whit specie depending on the tone or color scheme approved. Colored cement shall be powder type pigmented used to the desired shade and color of finish.

C-2 CONSTRUCTION REQUIREMENTS

All pebble washout finish shall be done by men experienced and qualified to do this particular type of trade. The contractor shall submit at least two samples for each type of pebble washout finish to the Architect or Engineer for approval showing its color, texture and design patterns.

1. Surface Preparation

a) Surface to receive pebble washout finish shall be clean of all projection, dust, loose particles and foreign matters.

b) It shall be thoroughly wetted with clean water before application of scratch coat mortar. When the surface has sufficiently set, scratch with hard broom.

2. Mixture

a) Pebble finish mortar mixture shall consist of one part Portland cement and two parts pebble measured by volume or a proportion equivalent to 1:2

b) Mixtures shall be in approved containers to ensure that the specified materials are controlled accurately measured.

c) Mixtures measured by shovel or shovel counts will not be permitted. Unless specified otherwise, pebble washout mix shall be in the proportion by volume in approved mixing machines or mortar boxes.

d) The aggregate introduced and mixed shall be in such a manner that the materials will be uniformly distributed throughout the mass.

e) A sufficient amount of water shall be added gradually and the mass further mixed until a mortar plasticity necessary for the purpose intended is obtained.

f) Mortar boxes, pans etc., where mixtures are mixed shall be keep clean and free from debris or dried mortar.

3. Application

a) Before any application work started, the Contractor shall established all wood molding for vertical and horizontal groove lines after the scratch coat has seasoned for seven days in the case of masonry wall or concrete columns, beams and parapets etc.

b) In the case of finish flooring application and the like the slope of drainage shall be properly provided and design pattern properly placed.

c) The proposed under-bed shall be done to a level of 16 mm below the finish floor line to accommodate the pebble washout mix.

d) The prepared surface to receive the pebble washout mix shall be kept damp for at least 4 hours before the application work is started

e) Pebble washout finish mix shall be applied with pressure to obtain solid adhesion to the prepared surface. The applied surface shall be firm, even and monolithically applied, then allowed to set initially.

f) When the applied surface has initially set to withstand the removal of the cement paste, spray evenly by spray apparatus to washout the cement paste on the outer surface so that the pebbles are partly exposed or,

g) By means of paint brush of foam and water, or by means of spraying washing down the cement paste leaving the pebbles partially exposed in their natural texture appearance.

4. Workmanship

a) Pebble washout shall be leveled, plumbed, squared and true to line within a tolerance of 3 mm in 3.0 meters without caves cracks, blisters, pits, crazing, discoloration, projections or other imperfection.

b) There shall be no visible junction marks in the finish surface where one day work adjoins another.

c) Where required by the supervising Architect or Engineer, provide vertical and or horizontal groove joints.

5. **Curing and Protection**

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

b) After all other trade have been completed the pebbles washout finish surfaces shall be saturated with diluted hydrochloric acid and cleaned with steel brush

c) Allow the clean surface to dry then apply a coat of silicon water repellant to protect the natural physical appearance of the pebble washout finish.

C-3 MEASUREMENT AND PAYMENT

1. Pebble washout finish shall be measure in square meters, lineal meters or part thereof for work actually completed and accepted to the satisfaction of the supervising Architect or Engineer.

2. The work done under this Item as provided in the Bill of Quantities shall be paid for at the Contract Unit Bid which price and payments constitute full compensation including materials and labor and incidentals necessary to complete this Item.

(D) CEMENT PLASTER

GENERAL CONDITONS

The Contractor shall furnish all cement plaster materials, labor, tools and equipment required in undertaking cement plaster finish as shown on the Plans and in accordance with this Specifications.

D-1 MATERIAL REQUIREMENTS

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

1. **Cement**. Cement shall be Portland Hydraulic Cement of any approved brand.

2. **Hydrated Lime** shall conform with the requirements as defined in Hydraulic Cement of any approved brand.

3. **Fine Aggregates**. Fine aggregates (sand) shall be clean, washed and sharp river sand, free from dirt, clay, organic matter or other deleterious substances

Sand derived from crushed gravel or stone may be used with the supervising Architect or Engineer's approval but in no case, shall such sand be derived from stone unsuitable for use as coarse aggregates.

D-2 CONSTRUCTION REQUIREMENTS

1. Mixture

a) Mortar mixture for brown coat shall be freshly prepared and uniformly mixed in the proportion by volume of one part Portland Cement, three (3) parts sand and one fourth (1/4) part hydrated lime.

b) Finish coat shall be pure Portland cement properly graded and mixed with water to approved consistency and plasticity.

2. Surface Preparation

a) After removal of forms, reinforced concrete surfaces shall be roughened to improve adhesion of the cement plaster.

b) Surfaces to receive cement plaster shall be cleaned of all projections, dust, loose particles, grease and bond breakers.

c) Before any application of brown coat is started, all surfaces that are to be plastered shall be wetted thoroughly with clean water to produce a uniformly moist condition.

d) Brown coat mortar mix shall be applied with sufficient pressure starting from the lower portion of the surface to fill the grooved and to prevent air pockets in the reinforced concrete/masonry work and avoid mortar mix dropping.

e) The brown coat shall be lightly broomed or scratch before surface has properly set and allowed to cure.

f) Finish coat shall not be applied until after the brown coat has seasoned for 7 days and corrective measures had been done by the Contractor on surfaces that are defective.

g) Just before the application of the finish coat, the brown coat surface shall be evenly moistened with clean water.

h) Finish coat shall be floated first to a true and even surface, and then troweled in a manner that will force mixture to penetrate into the brown coat.

i) Surfaces applied with finish coat shall then be smooth with paper or foam in a vertical motion to remove trowel marks, checks and blemishes.

j) All cement plaster finish shall be 10 mm thick minimum on vertical concrete and or masonry walls.

Wherever indicated on the Plans to be *"Simulated Red Brick Finish,* the Contractor shall render brick design on plaster surface before brown coat had properly set and then allowed to dry.

Cement shall not be directly applied to:

a) Concrete or masonry surface that had been coated with bituminous compound and,

b) Surface that had been painted or previously plastered.

3. Workmanship

a) Cement plaster finish shall be true to details and plumbed. Finish surface shall have no visible junction marks where one day's work adjoins the other.

b) Where directed by the Architect or Engineer or as shown on the Plans vertical and horizontal groove joints shall be 25 mm wide and 10 mm depth.

D-3 MEASUREMENT AND PAYMENT

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

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

(E) PLAIN CEMENT PLASTER FINISH

GENERAL CONDITIONS

The Contractor shall furnish all materials, tools, equipment and labor required in undertaking the proper application of plain cement plaster finish as provided where plastering is noted the drawings and schedules. Plastering work shall be properly coordinated with the work of other trades.

1. The work of other trades shall be adequately from damages during the plastering operations. Finishing work shall be protected with a covering of heavy craft, waterproof paper or other approved protective covering with lapped and sealed joints.

2. Scaffolding shall be amply strong, well braced, tied securely and inspected regularly. Overloading of scaffolding will not be permitted.

E-1 MATERIAL REQUIREMENTS

1. Portland Cement shall conform with the standard specifications of the ASTM 1-150, type-I, latest edition.

2. Hydrated lime shall conform with the standard specification of the ASTM C-6, latest edition.

3. Sand shall be hard, sharp, well washed, siliceous, clean and free from deleterious material.

4. Water shall be fresh, clean and free from organic matter, acids and alkali.

E-2 DELIVERY, STORAGE AND HANDLING

Manufactured materials shall be delivered with unbroken packages or containers which are plainly labeled with the manufacturer's name and brand. All cement materials shall be kept dry until ready for use.

They shall be stored off ground, under cover and away from sweating walls and other damp surfaces.

E-3 MIXTURE

1. Plaster materials, specified on a volume basis, shall be measured accurately in approved containers that will insure the specified proportion.

2. Measuring materials with shovels or shovel count will not be permitted

3. Mortar for brown coat shall be mixed in the proportion by volume of 1 part Portland cement 3 parts sand, an 1/4 part hydrated lime

4. Mortar for finish coat shall be the same as specified for brown coats, except that the proportions of sand shall be increased to not more than 4 parts.

E-4 APPLICATION

1. All surfaces to receive plaster shall be cleaned of all projections, dust, loose particles, grease bond breakers and other foreign matter.

2. Plaster shall not be applied directly to concrete of masonry surfaces that have been painted or previously plastered.

3. Before the plastering work is started, masonry surfaces shall be wetted thoroughly with a fog spray of clean water to produce a uniformly moist condition.

4. Brown coat – shall be applied with sufficient pressure to fill the grooves in hollow block or concrete to prevent air pockets and secure a good bond.

5. The brown coat shall be lightly scratched and broomed. Each coat of cement plaster shall be kept moist for 48 hours after application and then allowed to dry.

6. Finish coat – shall not be applied until after the brown coat has seasoned for 7 days.

    a) Dust before the application of the finish coat.

    b) The brown coat shall again be evenly moistened with a fog spray

    c) The finish coat shall be floated first to a true and even surface then troweled in a manner that will force the sand particles down into the plaster.

    d) Plastered surfaces shall be smooth and free from rough areas, troweled marks, checks and blemishes.

    e) Thickness of the plaster shall be 10 mm (3/8") to 12 mm (½") on vertical concrete and on masonry

E-5 WORKMANSHIP

Plaster work shall be finished level, plumb, square and true to line within a tolerance of 3 mm (1/8") in 3.00 meters without waves, cracks, blisters, pits, crazing, discolorations, projection and other imperfections.

1. Plaster work shall be formed carefully around angles, contours, and well- up to screeds.

2. Special care shall be taken to prevent sagging and consequent dropping of mortar during applications.

3. There shall be no visible junction marks in the final coat where on day work adjoins the other.

E-6 PATCHING, PAINTING AND CLEANING

1. Upon completion of the building, and when directed, all loose, cracked, damage or defective parts shall be cut out and re-plastered in a satisfactory and approved workmanlike manner.

2. All painting and patching of plastered surfaces and plaster work abutting or adjoining any other finish work, shall be done in a neat and workmanlike manner.

3. Plaster drops or spatter shall be removed from all surfaces. Exposed plastered surfaces shall be left in a clean, unblemished condition ready to receive paint or other finish.

4. After the work has done, all protective coverings of cement finishes shall be removed from the floors. All rubbish and debris shall be removed from the building.

1.3. STRUCTURAL STEEL

SCOPE OF WORK

The scope of work under this section consists of furnishing of all materials, labor, tools, equipment, and performance of all operations relative to the fabrication, delivery to site, erection and painting of structural steel trusses and purlins as shown on the plans.

A. DESIGN CONDITIONS

1. All structural work shall in accordance with AISC Specification for the Design, Fabrication and Erection of Structural and steel for buildings.

2. Materials , and parts necessary to complete each item through such work which is not shown or specified shall be included, such as miscellaneous bolts, anchor, supports, braces and connections etc.

3. Shop drawings as well as erection drawings shall be prepared and submitted by the contractor to the supervising Architect or Engineer for approval before any fabrication is made.

B. SHOP DRAWINGS

1. Shop drawings giving complete information necessary for the fabrication of the component parts of the structure, including the location, type and size of all rivets, bolts and welds, shall clearly distinguish between shop and field rivets, bolts and welds.

2. Shop drawings shall be made on conformly with the best modern practice and with due regard to speed and economy in fabrication and erection.

C. MATERIALS

1. All structural steel shapes and plates shall conform to ASTM A-36.

2. Light-gauge Cold-formed Structural Steel shall conform to pertinent specifications of the American Iron and Steel Institute (AISI).

3. Machine bolts shall conform to ASTM A-307. Each bolt shall be provided with standard nuts and washers.

4. Anchor Bolts – shall conform to ASTM A-141.

5. Cross Bracing with Turnbuckles shall conform to ASTM A-307.

6. Welding Electrodes – shall conform to AWS A-5.1 or A-5.5, E 70 Electrodes.

D. FABRICATION

1. Field fabrication shall be kept to a minimum. And shop fabrication shall be employed to the greatest extent possible with members shop fabricated as practicable with a minimum requirement for field connections.

2. Welding, shearing, gas cutting, chipping and all other works involved in the fabrication of structural steel shall be done with accuracy and of the highest quality of workmanship, within the allowable tolerance prescribed in the AISC specifications.

E. WELDING

1. The technique, appearance and quality of welds and the method of correcting defective work shall conform to the applicable provisions of "*Workmanship of the Standard Code for Welding in Building Construction of the American Welding Society"*

2. Welding of structural members in shop and on field, shall be done only by certified and experienced welder.

3. Surfaces to be welded shall be free from loose side, rust, grease, paint and other foreign materials that will impair the soundness of the weld.

4. Temporary weld and assembly attachments shall be kept to a minimum. All temporary attachment that are welded, shall be removed by a flame torch above the parent metal surface and ground to smooth surface by power grinding.

5. Note shall be made on the Plans and on the shop drawings of those joints or groups of joints in which it is especially important for the welding sequence and technique of welding to be controlled carefully, to minimize welding under restraint, and to avoid undue distortion.

6. Weld length called on the Plans and on the shop drawings shall be the net effective length.

F. CONNECTION AND HOLES

Connections shall be as shown in the drawings and shall develop the full capacity of the members.

1. Surfaces or joints prepared for welded or high strength bolted connections shall comply with the cleanliness requirements of all joints surfaces and contact surfaces within friction types joints as specified in “Bolted parts” of the AUSC Specifications.

2. Holes shall be punched or drilled at right angles to the surface of the metals and shall not be enlarged by burning.

3. Holes shall be clean-cut without rugged edges. Outside burrs resulting from drilling or reaming operations shall be removed with a tool which reaches a 1.588 mm level around the bolt holes.

G. QUALITY CONTROL PROCEDURES

1. Quality control shall be practiced by the Fabricator to assure high quality in the work. In addition to the Fabricator’s quality control procedures, materials and workmanship shall be subject to Inspection by qualified inspectors representing the Owner.

2. Fabricator shall cooperate harmoniously with the inspector to avoid interpretation in the work, when correction will be needed.

H. REJECTION

1. Materials or workmanship not in reasonable conformance with the provisions of this Specification shall be rejected at any time during the progress of the work.

2. The Fabricator shall receive of all reports made by the Inspector authorized by the Owner and/or his supervising Architect or Engineer.

I. ERECTION

1. The steel structures shall be erected plumb and true to line and grade. Bracings and supports shall be introduced whenever necessary to take care of all the loads to which the structure may be subjected. Such bracings shall be left in place as long as may be required for safety.
2.
3. Base plates and bearing plates shall be supported on steel wedges until the supported members shall have been aligned and plumb, following which the entire bearing are shall be grouted solid with non-shrink cement.

J. MARKING

1. Shop fabricated members shall be marked prior to delivery to facilitate the erection of the members.

2. Markings shall be listed and given description and copies of which shall be furnished to the Owner.

3. Markings shall be neatly painted on the members with a distinctive color of enamel paint.

K. SHOP PAINTING

1. Steel works to be encased in concrete shall not be painted. All other steel works shall be given one coat of shop paint of red lead primer, applied thoroughly and evenly to dry surfaces, which have been cleaned, by brush, spray roller coating, floor coating or dipping at the selection of the Fabricator.

2. Steel work prior to painting and after inspection and approval shall be cleaned of loose mil scale, loose rust, weld slag or flux deposit, dirt and other foreign materials.

3. Oil and grease shall be removed by solvent. Parts of the steel work which shall be fielded, welded or connected shall not be painted. All steel work specified to have no shop paint shall likewise be thoroughly cleaned.

L. FIELD PAINTING

All the steel work after complete erection, shall be field painted with the type and color specified in the section of painting of this Specifications. Painting shall not be done on any steel surface that is thoroughly clean and dry.

1.4.ROOFFING WORKS

CORRUGATED METAL ROOFING
PRE-PAINTED METAL SHEET

SCOPE OF WORK

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

A. MATERIAL REQUIREMENTS

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

Pre-painted roofing sheets shall be fabricated from cold rolled galvanized iron sheets specially tempered steel for extra strength and durability. It shall conform to the material requirements defined in PNS 67:1985.

Profile section in identifying the architectural moulded rib to be used is: Regular corrugated Quad-rib, Tri-wave, Rig-wide, Twin rib, etc. Desired color shall be subject to the approval of the Architect.

1. Gutters, valleys, Flashings, Hips and Ridge roll shall be fabricated from gauge 24 (6 mm) thick cold rolled plain galvanized iron sheets specially tempered steel. Profile section shall be as indicated on the Plans.

2. Fastening hardware shall be of galvanized iron straps and rivets. G.I. straps are of .50 mm thick x 16 mm gauge 26 and standard G.I. rivets.

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

Base Metal Thickness	Designated Gauge
.40 mm thick	Gauge 28
.50 mm thick	Gauge 26
.60 mm thick	Gauge 24
.80 mm thick	Gauge 22

Length of roof sheets available in cut from 5 feet to 12') long. Long span length up to 8 meters. Special length by arrangements.

B. CONSTRUCTION REQUIREMENTS

1. Before any installation begins, the Contractor shall ascertain that the top face of the purlins is in proper alignment.

2. Correct the alignment as necessary in order to have the top faces of the purlins on an even plane.

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

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

5. Place the down-turned edge of the next sheet over the edge of the first sheet, to provide side lap and hold the side lap firmly in place. Continue the same procedure for the subsequent sheets until the whole roofing area is covered and or adopt installation procedure provided in the instruction manual for each type of molded rib profile.

6. For walling applications follow the procedure for roofing but allow a minimum end lap of 10 cm. for vertical walling.

7. **End Lap.** In case handling or transport consideration requires to use two or more end lapped sheets to provide full length coverage for the roof run, install each line of sheets from bottom to top or from eave line apex roof framing. Provide 15 cm. minimum end lap.

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

9. For Steel Frame up to 4.5 mm thick, use self-drilling screw No.12 by 4.0 cm long hexagonal head with neoprene washer.

10. For Steel Support up to 5 mm thick or more, use threaded cutting screw No. 12 by 4.0 cm long hexagonal head with neoprene washer.

11. For side lap fastener use self drills screw No. 10 by 1.6 cm. long hexagonal head with neoprene washer.

12. Valley fastened to lumber and for walling, use self drilling wood screw No. 12 by 2.5 cm. long hexagonal head with neoprene washer.

13. Valley fastened to steel supports, use self drilling screws, hexagonal head with neoprene washer, drill size is 5 mm diameter.

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

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

16. Storage and Protection. Pre-painted steel roofing, walling products and accessories should be delivered to the job site in strapped bundles.

17. Sheets and or bundles shall be neatly stacked in the ground and if left in the open it shall be protected by covering the stack materials with loose tarpaulin.

C. MEASUREMENT AND PAYMENT

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

2. The area of pre-painted steel roofing and or walling in square meters shall be paid for at the Unit Bid Price or contract unit price which payment shall constitute full payment including labor, materials, tools and incidentals necessary to complete the work.

CLAY ROOF TILES

SCOPE OF WORK

This Item consist of furnishing all plant, labor tools, equipment and clay roof tiles required to complete the roofing as shown on the Plans in accordance with this Specifications.

A. MATERIAL REQUIREMENTS

1. Clay Roof Tiles

Clay tiles shall be manufactured from red clay specie molded to custom pile patterns. It shall be kiln dried to improve natural aesthetic appearance and resistance to erosion and withstand any climate condition in the tropics. Where required and indicated to be glazed, color shall be approved by the Architect.

2. Sheating

a) Corrugated G. I. sub-roofing shall be 0.5 mm thick long span. Plywood sheating when used instead of G.I. shall be 12 mm thick marine plywood treated with two piles of felt paper asphalt impregnated.

b) Wood Batten shall be 2.5 cm. x 5.0 cm. pressure treated lumber properly laid to fit clay roof tiles and accessories as indicated on the Plans.

c) Fasteners shall be non-corrosive materials. Nails shall have large head sufficient length to give 19 mm penetration on wood batten and # 16 tie wires to be copper or brass as the case may be.

B. CONSTRUCTION REQUIREMENTS

1. Before the work is started, the Contractor shall secure approved roof framing Plan and determine or evaluate actual site condition.

2. In case modification is necessary, the Contractor shall submit shop drawings to the supervising Architect or Engineer.

3. Batten roof shall be installed in straight lines, level squared and firm. It may rest on sheeting and anchored rigidly by means of galvanized iron straps gauge 24 thick riveted on sheating, or nailed on top chord or jack rafter when it rests on plywood sheating.

4. The top chord or jack rafter shall have at least a minimum roof pitch of 25 degrees.

5. Plywood sheating shall be overlaid with two piles of felt paper, asphalt impregnated to control moisture. The batten shall be spaced to fit the clay roof tiles and accessories.

6. Gutter and valleys shall be set in place before wood battens are installed. Use gauge 24 plain galvanized iron sheet molded true to profile section indicated on the plans or as directed by the supervising Architect or Engineer.

7. For clay tiles on concrete roof slab provide and install pressure treated lumber 25 mm x 50 mm or metal strips properly aligned, level squared and firm.

8. Apply waterproofing on the slab surface to control moisture by cold process.

9. Laying of tiles shall start at the lower layer from right to left. See to it that the left anchorage of tile is placed near or close to hip truss as much as possible.

10. Continue to the next layer of clay roof tiles following the same procedure

11. After all clay roof tiles are laid out, mark the clay roof tiles at hips and valleys which are to be cut using straight edge or string as guide.

12. Where tiles join a hip stringer, provide waterproof elastic cement. Cement hip roll and ridge in lap and fasten with nails or tie wires as specified.

13. Fill voids at hip starters and ridge ends with mortar, color to match the tile.

14. Remove all debris and clean roof are for service.

C. METHODS OD MEASUREMENT

This item shall be measured by actual roof area laid with clay roof tiles and accessories in square meters or part thereof, for work completed and accepted to the satisfaction of the Architect.

D. BASIS OF PAYMENT

The accepted work quantified and provided in the Bill of Quantities shall be paid for at the Unit Bid Price which constitute full payment for furnishing all materials, labor, tools, equipment and other incidentals necessary to complete this item.

ROOF DRAINAGE

SCOPE OF WORK

This Item shall consist if furnishing all items, articles plant equipment, labor and materials and performing all methods necessary or required for the complete installation of all roof drains with strainers in accordance with all applicable drawings as shown on the approved plans and the provisions of this Specifications

A. GENERAL CONDITIONS

1. Performing all operations or methods necessary and required for the complete installation of all Roof Drains with strainers, including connections to downspout, in accordance with all applicable drawings and details, and subject to the terms and conditions of the contract.

2. Should there be any conflict between the sizes of roof drains and downspout, the size of the latter shall govern.

3. The size of any roof drain with strainer shall follow the diameter of the corresponding roof leader or downspout to be installed.

B. CONSTRUCTION REQUIREMENTS

1. Drainage

a) The contractor shall provide, fit or install all necessary drains with strainers where so shown or indicated on plans and or where the supervising Engineer directs.

b) Each drain with strainers shall fit the size of the corresponding downspouts or conductor over which is to be installed and in accordance with the following schedule.

c) Over each downspouts of cast iron body lacquer finish low “Dome” roof drain (rough brass strainer) 45 threaded outlet or side outlet respectively, secured to caming ring by screws.

2. Drain and Over flow Pipes

a) Concrete roof gutters or any other work which catches drains or collect rain water shall be provided with adequate drain overflow, pipes, one inch in diameter pipe spaced at 2.00 meters on centers and or as specified.

b) Weep holes, where so indicated on plans, of the size and spacing shown, shall be provided by the contractor to allow the free flow of water to drain from one level over lower level or to outside all in accordance with the detailed drawings.

3. Downspout

a) All conductors or downspout encased in concrete unless otherwise shown in drawings shall be PVc pipe as specified in plans. Size of downspout shall be as shown or indicated on plans.

b) Downspout of all floor drains indicated on reinforced concrete gutters shall be 75 mm in diameter except where specified other use and each shall branch from the adjacent main downspout if any as shown on plans.

c) Any drain with strainers of approved quality, locally made, in accordance with full size details may be substituted subject to the written approval of the supervising Architect or Engineer.

d) Should the series and type number specified herein be not suitable to a particular location due to concrete space limitations, any adaptation of the series specified of the same size, body material and finish may be substituted, subject to the approval of the supervising Architect or Engineer.

e) Any other drain shown but not specified herein and necessary to leave the work complete, shall be provided and installed by the contractor suitable to the service required and fitted to the concrete limitations at the point of installation, based on or similar as specified herein or as directed by the supervising Architect or Engineer.

C. MEASUREMENT AND PAYMENT

1. All roof drains strainers actually installed shall be measured and determined by the number of pieces or units ready for service as provided in the Bill of Quantities accepted to the satisfaction of the supervising Architect or Engineer.

2. The Item measured and determined shall be paid for at the Unit Bid Price which payment constitute full compensation of materials, labor and incidentals necessary to complete this Item.

1.5. WATERPROOFING

SCOPE OF WORK

This Item shall consist of furnishing all materials, labor, tools, equipment, plant and other facilities required as shown on the Plans and undertaking the proper application of integral and membrane waterproofing complete in accordance with this Specifications.

A. MATERIAL REQUIREMENTS

1. Integral Waterproofing

Integral waterproofing compound shall be cementitious powder pre-mix admixture or water base surface coat conforming with the standard Specifications set by the Bureau of Product Standards, Department of Trade and Industry.

2. Membrane Waterproofing

Membrane waterproofing shall be Osmo-seal powder; Liquid Elastomeric or Epoxy Solvent less waterproofing compound formulated for extra flexibility and resiliency to give lasting waterproof effect.

B. CONSTRUCTION REQUIREMENTS

1. Concrete mixture for decks, balconies, toilet and bathrooms, gutters, parapets, canopies and other areas indicated on the Plans to be integrally waterproofed shall be blended with integral waterproofing compound.

2. Only a minimum quantity of clean water shall be used in the concrete mixture to be sufficiently plastic and to obtain enough workability in placing concrete.

3. Concrete surface to be applied with membrane waterproofing shall have been integrally waterproofed, thoroughly set, dry, clean and free from foreign matters.

4. Surface shall be topped and plastered with double strength integral waterproofing compound pre-mix admixture of screened mixture: 1 part Portland cement, 3 parts clean and sharp sand and 2 packages integral waterproofing compound steel trowelled to smooth surface finish.

5. Concrete slab shall be properly graded to drain rainwater. A minimum pitch of 1 percent is satisfactory to drain water freely into the drain lines.

6. Drainage connection and weep-holes shall be set up to permit the free flow of water.

7. Any expansion and contraction joints shall be cleaned, primed, fitted with a backing rod and caulked with sealant.

8. Prepared surfaces shall be cured and kept wet by sprinkling water at regular intervals for a period of at least 3 days when smooth surface finish have actually set.

9. Allow cured surfaces to dry and remove all dust, dirt, debris and oil.

10. All lose areas shall be refitted and well secured. Repair cracks, breaks and open seams. Where required or as directed in the membrane waterproofing product instruction manual, prepared surface shall be prime coated.

C. APPLICATION PROCEDURES

1. Prior to application, concrete surface shall be sound and cured without the use of curing compound.

2. Apply a coat of neutralizer to remove oil, dirt, and other contaminants.

3. Apply a coat of concrete primer on surfaces to be installed with membrane self-sealing type when required or as directed in the product instruction manual.

4. Stir thoroughly each container of membrane waterproofing before use.

5. Apply a coat of membrane waterproofing by brush, airless spray, notched trowel, squeegee or roller preferably 15 to 20 mils maximum thickness of wet coat.

6. Three applications is recommended and each coat is allowed a minimum of 24 hours curing time between each coat or as recommended in the product manufacturer's instruction manual.

7. Application of membrane waterproofing coat should not commence unless the ambient temperature is 4.44^0 C or higher and shall not proceed during inclement weather condition.

8. The waterproofing compound is combustible. Extra care shall be observed by persons having skin sensitiveness to wear protective gloves while applying.

D. PROTECTION OF MEMBRANE WATERPROOFING SURFACES

1. To have a bond between the membrane waterproofing and the slab, concrete topping shall be placed as the membrane dries after 48 hours of application.

2. If a bond is not required, the membrane shall be protected with asphalt asbestos board or asphalt felt paper until such time as topping and concrete covering is applied.

3. Prior topping or placing concrete cover, inspect the membrane for any damage and repair work as required.

4. Exposed membrane surfaces at basement shall be covered and protected by installing tightly butted asphalt impregnated protection boards with a minimum thickness of 6 mm and 12 m on all horizontal areas.

5. Use asphalt impregnated joint boards along all walls and cove areas.

E. MEASUREMENT AND PAYMENT

1. Integral and membrane waterproofing works rendered under this Item shall be measured in square meters for areas actually waterproofed as provided in the Bill of Quantities and accepted to the Owner satisfaction.

2. The areas provided with integral and membrane waterproofing measured in accordance with the preceding section shall be paid for at the Unit Bid Price which price and payment constitute full compensation for furnishing all materials, tools equipment, labor and incidentals necessary to complete this Item.

2. ARCHITECTURAL WORKS

2.1 CARPENTRY AND JOINERY WORKS

SCOPE OF WORK

The work to be done under this Item consist of furnishing all required materials, fabricated woodwork, tools, equipment and labor and performing all operations necessary for the satisfactory completion of all carpentry and joinery works in strict accord with applicable drawings, details and these Specifications.

A. MATERIAL REQUIREMENTS

1. Lumber

Lumber of the different species herein specified for the various parts of the structure shall be well seasoned, sawn straight sun-dried or kiln-dried and free from defects such as loose and unsound knots, pitch, pockets, sapwood, cracks and other imperfections impairing its strength, durability and appearance.

2. Grades of Lumber and Usage

a) **Stress grade lumber** is seasoned, close-grained and high quality lumber of the specified specie, free from defects and suitable for sustaining heavy load.

b) Stress grade limber shall be used for wooden structural members subject to heavy loads, and for sub-floor framing imbedded or in contact with concrete and masonry.

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

d) Select grade lumber shall be used for flooring, sidings, fascia and base boards, trims, molding, millwork, railings, stairs, cabinet work, shelves, doors, windows and frame of openings.

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

f) Common grade lumber shall be used for light framework for walls and partitions, ceiling joists and nailers.

3. Lumber Species and Usage

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

a) Yacal (*stress grade*) for structural member such as posts, girders, girts, sleeper door and window frames set or in contact with concrete or masonry.

b) Guijo (*select grade*) for door and window frames set in wooden framework, for stair, for roof framing supporting ceramic or cement tiles, for floors and other wooden structural parts.

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

d) Tanguile (*select grade*) for doors and windows, fascia and base boards, trims, mouldings, mill work, railings, stairs, cabinet work, shelves, floorings and sidings.

e) Narra (*select grade*) for stair railings, flooring boards, cabinet, work millwork, doors and windows when indicated as such in the plans.

f) Dao (*selected grade*) for parts of the structure as enumerated or when indicated in the plan.

4. Moisture Content

a) Rough Lumber for framing and siding boards shall be air-dried or sun-dried such that its moisture content shall not exceed 22 percent.

b) Dressed lumber for exterior and interior finishing for doors and windows, millwork, cabinet work and flooring boards shall be kiln dried having no moisture content in excess of 14 percent at the time of its installation.

5. Substitution in Lumber Specie

a) Any lumber equally good for purpose intended may be substituted for the specified kind subject to the prior approval of the supervising Architect or Engineer. Provided that the substitution shall be have equal or better specie acceptable to the supervising Architect.

b) In case of substitution with better specie, no additional cost therefore shall be allowed to the Contractor.

6. Plywood

Plywood shall be of good grade and made of laminated wood strips bonded together with water resistant resin glue.

a) The laminated glue core shall be finished both faces with select grade tan guile, red lauan veneers or equivalent not less than 2mm thick, similarly bonded to the core.

b) The plywood of not less than 19 mm thick shall be free from defects such as split in veneer, buckling or warping and shall conform to the requirements of the Philippine Trade Standard 631-02

c) Thickness of a single layer of laminae shall not be less than 2m. The laminae shall be superimposed in layers with grains crossing at right angles in successive layers to produce stiffness.

d) The face veneers shall be rotary cut from selected grade timber. The laminae and face veneers shall be bonded with water resistant resin glue, hot pressed and pressure treated.

e) Ordinary tan guile, red lauan, palosapis, or equivalent grade with good quality face veneers, 6 mm thick shall be used for double walling and ceiling not exposed to moisture.

f) Waterproof or marine plywood shall be used for ceiling exposed to moisture such as at toilets and eaves, and ceiling to be finished with acrytex.

7. Lawanit or Hardiflex

a) Lawanit or Hardiflex when required in the plan shall be 6 mm and 8 mm thick respectively, tempered or oil impregnated for moisture/ water resistance.

b) Texture of Lawanit or Hardiflex shall be subject to the approval of the supervising Architect or Engineer.

8. Materials Other than Lumber

a) Plastic Sheet

When required for counter top, plastic sheet such as Formica shall not be less than 1.50 mm thick and shall have hard, durable and glossy surface resistant to stain, abrasion and .

Color and design shall be as selected from the manufacturer's standard and approval by the supervising Architect or Engineer.

b) Glue

Shall be from water resistant resins which, upon hardening, shall not dissolve nor lose its bond or holding power even when soaked with water for extended period. Glue in powder form shall be sealed container shall be without evidence of lumping or deterioration in quality.

c) Fasteners

Nails screw; bolts and straps shall be provided and used where suitable for fixing carpentry and joinery works. All fasteners shall be brand new and of adequate size to ensure rigidity of connections.

Nails of adequate size shall be steel wire, diamond-pointed, ribbed shank and bright finish.

Screw of adequate size shall be cadmium or brass plated steel with slotted head.

Lag Screw of adequate size, for anchoring heavy timber framing in concrete or masonry, shall be galvanized steel.

Bolts and nuts shall be of steel having a yield point of not less than 245 Mpa. Bolts shall have square heads and provided with standard flat steel washers and hexagonal nuts and provided with standard flat steel washers and hexagonal nuts.

Threads shall conform to American coarse thread series. The threaded portion shall be long enough such that the nut can be tightened against the bolted members without any need for blocking.

Wrought Iron Straps or Angles, when required in conjunction with bolts or lag screws to provide proper anchorage shall be of the shape and size shown on Plans.

B. CONSTRUCTION REQUIREMENTS

1. Quality of Materials

All materials to be incorporated in the carpentry and joinery works shall be of approved quality as specified. Before using all materials shall have been inspected and accepted by the supervising Architect or Engineer.

2. Storage and Protection of Materials

a) Lumber and other materials shall be protected from dampness during and after delivery at the site.

b) Materials shall be delivered well in advance of actual need and in adequate quantity to preclude delay in the work.
c) Lumber shall be piled in orderly stack at least 15.0 cm. above the ground and at sheltered place where it will be of least obstruction to work.

3. Shop Drawing

Complete Shop Drawings with essential dimensions and details of construction, as may be required by the supervising Architect or Engineer in connection with carpentry and joinery work, shall be submitted for approval before proceeding with the work.

4. Rough Carpentry

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

a) Framing shall be *stress grade or common grade lumber* of the specie specified. Rough carpentry shall be done true to lines, levels and dimensions. It shall be squared, aligned, plumbed and well fitted at joints

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

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

d) Members damaged by such cutting or boring shall be reinforced by means of specifically formed and approved steel plates or shapes. Otherwise, damaged structural members shall be remove and replaced to the satisfaction of the Architect or Engineer.

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

5. Finished Carpentry

Finished carpentry covers work on flooring, siding and ceiling boards, stairs, cabinets, fabricated woodwork, millwork and trims.

a) Framing lumber shall be select grade, free from defects and where exposed in finished work, shall be selected for color and grain.

b) Joints of framing shall be tenoned, mortised or doweled where suitable, closely fitted and secured with water resistant resin glue. Exterior joints shall be mitered and interior angles coped.

c) Panels shall be fitted to allow for construction or expansion and insure that the panels remain in place without warping, splitting and opening of joints.

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

e) Fabricated woodwork shall be done preferably at the shop. It shall be done true to details and profiles indicated on the Plans.

f) Where set against concrete or masonry, woodwork shall be installed after curing is completed.

g) Exposed wood surfaces shall be free from disfiguring defects such as raised grains, stains, uneven planning, sanding, tool marks and scratches.

h) Exposed surfaces shall be machine or hand sanded to an even smooth surface, ready for finish.

6. Fasteners

a) Nails shall not be driven closer together than one half their length unless driven in bored holes, or closer to the edge of the timber than one quarter their length.

b) Nails shall penetrate by at least half their length into the timber farthest from the head. End distance, edge distance and spacing of nails shall be such as to avoid splitting of the wood.

c) Lag Screw shall be set into pre-bored lead holes and not driven. The lead hole for the hank shall have the same diameter as the shank and the same depth as the unthreaded portion of the shank.

d) The lead hole for the threaded portion shall have the same diameter equal to about 75% of the diameter of the shank and the same length as the threaded portion.

e) Lengths of bolts shall be enough to extend through the nut and an allowance for nut tightening.

f) Bolts shall be set into drill holes suitably sized enough for snug fit.

7. Pressure Treated Lumber and Plywood.

a) Lumber, plywood and ply board specified a treated with wood preservative shall be pressure treated with water borne preservatives as Wolman Salt, Boliden Salt or Tanalith H-R.

b) Pressure treatment shall meet the standards set by the American Wood Preservers Association per publication C 2-77, or the Philippines Trade Standards PTS 243-02.00 as to penetration and amount of chemicals retained in the treated lumber.

c) Final retention of chemicals in the wood shall be a minimum of 5.6 kg/m3.

d) Pressure treated lumber shall be accompanied by a certification of pressure treatment from the wood preserving plant as to the pressure treatment, sizes and quantity of wood treated.

e) Notwithstanding the presentation of said certification, the supervising Architect or Engineer may require physical inspection and undertake borings to ascertain penetration of preservative into the wood.

f) Each boring should show penetration of not less than 2.5 centimeters.

8. Rat Proofing

a) Enclosed hollow spaces between wooden flooring and ceiling and between double sidings or partitions shall be made rat proof in accordance with Department of Health Requirements

b) Hollow space between wooden flooring and ceiling shall be rendered rat-proof by laying continuous strips of galvanized iron sheet or 10 mm wire mesh, about 25 cm. wide and centered along floor plates or sills of partitions and exterior walls.

c) The rat proofing strips shall be sandwiched between floor joists/plates and sills of partitions or sidings. The strips shall be nailed to the top of joists as well as to underside of sills and floor boards.

d) This part of the rat proofing man be omitted whenever it is clear than an equally effective protection is provided by concrete or tile floors or by the upper surface of reinforced concrete or steel directly supporting the sidings.

e) all exterior openings between adjoining floor joist and girders or beam that might give rats direct access into the hollow space inside, shall when not closed by fascia board or the like, be covered with strips of the same rat proofing material or sufficient size to close entirely the opening in question.

f) Double sidings or partitions as well as furred posts are made rat proof by lining the inner face of the board or panel sheeting with continuous vertical strips of the aforementioned rat proofing material up to height of at least 30 cm from the base of the partition, siding or furred post. The lower edge of the pat proofing sheet shall be in contact with floor throughout its entire length.

9. Measurement and Payment

a) Carpentry and Joinery Work shall be measured per complete item supplied, installed and accepted.

b) Payment shall be based on the measured quantity of each completed item and the Unit Bid Price as quoted in the Bid Proposal.

c) Such unit bid price shall be inclusive of all plant, materials, labor, overhead, profit and other incidental expenses in connection with the finished work.

d) Structural timber framework for roofing, flooring, partition and siding shall be measured on the basis of lumber board feet involved and paid for based on the quoted bid price per board foot. Such bid price shall be inclusive fasteners needed to complete the framework.

e) Flooring and siding boards, base and fascia boards, solid panels, stairs, handrails and trim shall be measured on the basis of number of board feet involved and paid for based on the corresponding quoted unit bid price per board foot.

f) Double walling for partitions and sidings shall be measured on the basis of the area involved in square meters and paid for based on the quoted unit bid price per square meter.

g) Ceiling boards shall be measured based on the area involved in square meters. Payment shall be based on the quoted unit bid price per square meter. Such unit bid price shall be inclusive of the cost of nailers, hangers and fasteners.

h) Cabinets shall be measured based on the number of units completed, installed and accepted. Payment shall be based on the number of units completed and the unit bid price per unit.

i) Incidental work for the main items on carpentry and joinery work such wood preservation, rat proofing and any other items necessary to complete the work but not specifically mentioned in the Bill of Quantities contained in the Bid Proposal shall be deemed to be covered by the unit or lump sum prices quoted for the other items of work listed in said Bill of Quantities

Pay item Number	Description	Unit of Measure

Item – 1 ---------- Structural timber framework ---------- Bd. Ft.
Item – 2 ---------- flooring, and siding boards,
Base and fascia board shall
Panels, stair, handrails and trims -------- Bd. Ft.
Item – 3 ---------- Double walling ---------- Sq. M.
Item – 4 ---------- Ceiling Boards ---------- Sq. M.
Item – 5 ---------- Cabinets ---------- Each

2.2 HARDWARE

SCOPE OF WORK

This Item shall consist of furnishing and installing all building hardware required to ensure rigidity of joints or connections of the different parts of the structure such as door, windows, cabinets, lockers, drawers and other similar operating parts as indicated on the plans in accordance with this Specifications.

A. GENERAL CONDITIONS

1. The contractor shall provide all rough hardware required for the completion of the work, including nails, spikes, bolts, log screws, etc., and shall provide and fit in place all finishing hardware hereinafter specified – put on in the most improved manner with screws to match the finish.

2. The contractor shall provide and fit in place all hardware not herein specifically mentioned but necessary to leave the work complete. All such hardware should there be any, shall conform in every respect to the balance of the hardware herein specified.

3. Finishing hardware, suitable to the service required to fully equip in the most satisfactory operative condition, for all doors, windows transom sashes, screen doors and windows, closet, built-in cabinets counters, drawers, lockers and other operating members throughout the project shall be furnished and installed or fitted by the Contractor.

4. Where the exact types of hardware specified are not adoptable to the finishing, shape or size of members requiring the hardware, suitable types having as applicable the same operation and quality as the corresponding individual types specified shall be furnished.

B. MATERIAL REQUIREMENTS

1. Rough Hardware

All rough hardware such as nails, screw, lag screws, bolts and other related fasteners required for carpentry work shall be first class quality and locally available.

2. Finishing Hardware

All finishing hardware consisting of locksets, latches, bolts, and other devices, door closers, knobs, handles, hinges and other similar hardware shall be first class quality available locally and conforming with the following Specifications.

a) Door Locksets

Door locks appropriate for particular functions shall be of durable construction, preferably the product of reputable manufacturer for consistent quality and master keying.

b) Door Closer

i. All door closer shall be cast bronze provided with a key valve or cap valve for making necessary adjustment.

ii. The following table shall serve as guide in determining door closer sizes.

Door Maximum Width	Size of Closer
76 cm.	Size 2
90 cm.	Size 3
107 cm.	Size 4
120 cm.	Size 5
137 cm.	Size 6

Use larger size where unusual conditions exist.

c) Hinge

Hinge unless otherwise indicated on the Plans shall be rass coated wrought iron steel for interior doors and wrought bronze for exterior doors with non rising loose steel pins with button tips and mounting screws of the same materials.

d) Sliding Door Hardware

i. Track is of rolled steel formed or extruded aluminum.

ii. Bearing is of plain steel balls or steel rollers

iii. Wheels to be steel, brass, rubber or plastic as the case maybe.

e) Make

i. The plate numbers herein given designates the quality and style as to the type, design, operation, materials and finish of hardware designated.

ii. Any other hardware equally good, may be substituted only in cases of urgent necessity and subject to the written approval of the supervising Architect or Engineer.

f) Finish

Unless otherwise shown or specified on the plans, exposed surfaces shall have the following Standard Finishes.

i. *Polished, bright brass or Bronze.* Bronze surfaces exposed on exterior of building not specified to have US 26 finish.

ii. *US 26 polished chromium plated over nickel or brass.* Brass or bronze surfaces exposed on toilets, lavatory and shower rooms and all others in the interior of the building.

iii. *USP Prime coated for painting.* Ferrous metal surfaces unless zinc coated.

g) Fastenings

Fastenings of suitable size, quality and type shall be provided to secure hardware in position. Machine screws and expansion shields shall be provided for securing items of hardware concrete, brick tile or masonry instead of wood screws.

h) Exposed Items of Hardware

i. After hardware has been properly fitted, all exposed items such as knobs platers, pulls, locks, etc., shall be removed until final coat of painters finish has been applied, and then hardware installed.

ii. Other items of hardware, unless to be painted over that are not to be removed before painting shall be properly marked or completely covered until final coat of painter's finish has been applied, after which such protective shall be removed.

C. PLACING ORDER OF HARDWARE

1. The contractor shall place his order for all hardware early in order to avoid delay in the job.

2. No request for extension of time shall be entertained by the Owner due to this delay an

3. No substitution of hardware shall be allowed due to negligence of contractor on this matter.

D. CONSTRUCTION REQUIREMENTS

1. Door Knobs, and Latch Strikes

a) All lock and latch strikes shall be installed in door frames at the same height from the floor.

b) Door knobs shall be located so that the center of the knob in 95 centimeters from the finished floor and or as directed by the supervising Architect or Engineer.

2. Butt Hinges

a) Each panel of hinged doors shall be hung on two butts for doors 1.50 m. or less in height.

b) Three butts, over 1.50 m. high and not over 2.10 m. four butts above 2.10 m, in height.

c) Doors of a greater height than 2.10 m. unless otherwise specified shall be hung on additional one butt for each 65 centimeters or fraction thereof.

d) Where the size of the butt hinges is not sufficient to allow door to clear door trim in open position, same shall be increased.

3. Counters, Shelves, Cabinets, Lockers, etc.

a) Other hardware not covered by previous specifications for all wooden counters, shelves, cabinets, drawers, cabinet doors, closet doors, cupboard, or wall cabinets, glass showcases, storage shelves, work tables, lockers and all other woodwork and interior finishing of similar nature indicated on plans are included in this contract.

b) It shall be done in accordance with detail drawings and full size details which shall be requested by the Contractor from the supervising Architect or Engineer, well ahead of their installation.

c) The Contractor shall furnish and install all necessary hardware for all the above work, complete and suitable to the service required to fully equip then in very satisfactory of the Specifications and the applicable drawings.

d) All modifications in hardware required by reason of construction indicated, shall be made to provide specific operative functional requirements.

e) All hinges that are needed shall be steel brass plated and of the size suitable for the purpose. Use Hager, Stanley, Kwikset or Corbin or an approved equivalent.

f) All necessary hardware for all woodwork specified above such as bolts, automatic catches, cylinder locks, drawer pulls, cabinet and closet door pull knots, push or cover plates, strikes, holder, indicators, push or pull bars, drawer locks, etc., shall be cast bronze or brass chromium finished in accordance with the specifications.

g) Their sizes shall be suitable for the purpose approved by the Owner or in accordance with those shown and specified in the full size details.

h) Schedule of all hardware to be purchased by the Contractor shall be submitted first to the supervising Architect or Engineer for approval before ordering them.

i) All hardware shall be brought to the job in original package. Samples shall accompany schedules.

4. Butt Hinges Make

For all doors on Butt Hinges, unless otherwise specified use button stop butts, Hager, Sanley, Kwikset or approved equivalent highly polished and plated with non raising pin for door opening outside.

5. Bar Doors

Provide and fit a set "Lawson Universal" gravity pivot type hinges No. 4604 nickel polished finish for each bar door in all toilet rooms. Approved equivalent, locally made of this type will be acceptable.

6. Cabinet Door Catch and Pull

a) Each cabinet door sash shall be provided with a door pull, Corbin No. 4347, extruded brass, chrome finish, or approved equivalent.

b) Cabinet doors with locks shall be provided with elbow-catches, Corbin No. 01623 cast bronze or approved equal on the inactive sash.

c) Cabinet doors not provided with locks shall be provided and fitted with fraction catches.

d) Siding cabinet doors shall be provided with drawer pulls of the flush type, cast brass or bronze.

7. Drawer Pull and Locks

a) Each drawer shall be provided with pulls of the type specified for cabinet doors.

b) The contractor shall provide and set complete, ready for operation, one pin tumbler cylinder lock of the medium of standard type, for each door in accordance with the schedule below.

c) U.S. Standard finishes as specified shall apply to all locks used "*Russwin, Yale, Corbin, Weiser, Schlage"* Standard type, of the approved equivalent.

d) The trade mark and plate numbers given herein are to designate only the quality, type, operation, materials and style or design required.

e) Schedule of Lockets: (in this Item, specify the name of door lock as to the brand, serial number, color and what particular door is to be installed such as:main door, bed room, toilet, etc.)

8. Master Key and Grand Master Key

a) All door lock shall be Master keyed as stated on the above schedule of lockset and grand master keying for the whole building.

b) Before placing the purchase order for door locks, it shall comply with the manufacturers requirements regarding the master keying for the locks.

c) The keying for this project shall be in accordance with the requirement of the Owner:

Supply of Keys:

D- 1 Grand Master Key ---------- 6 each
D-2 Master Key ---------- 3 each
D-3 Keys for each lock ---------- 3 each

As specification writer, you can make your own specification as to the number, quality and type. This is only a guide on how you will prepare your specifications.

d) Other doors not included in this schedule, but necessary to leave the works complete, shall be provided and fitted complete, by the Contractor with one lockset suitable to the service required and depending under which type and finish of each door lock, shall be classified by the Architect or Engineer.

2.3 ALUMINUM GLASS DOORS AND WINDOWS

DOORS

SCOPE OF WORK

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

A. MATERIAL REQUIREMENTS FOR DOOR

1. Frames and panel members shall be furnished from extruded aluminum sections true to details with clean, straight, sharply defined profiles and free from defects impairing strength, durability and appearance.

2. Extruded aluminum sections shall conform to the specification requirements of ASTM B-211.

3. Screws, nuts, washers, bolts, rivets and other miscellaneous fastening devices shall be made of non-corrosive material such as aluminum and stainless steel.

4. Hardware for fixing and locking devices shall be closely matched to the extruded aluminum section and adaptable to the type and method of opening.

5. Vinyl weather strip shall be first class quality flexible vinyl forming an effective seal and without adverse deformation when installed.

6. Pile weather strip shall be silicon treated and free from residual wetting agents and made of soft fine hair as on wool, fur, etc.

7. Glazing shall conform to the requirement specified in Item Glass and Glazing Specifications.

B. CONSTRUCTION REQUIREMENTS

1. For all assembly and fabrication works, the cut ends shall be true to line and accurately joined, free of burrs and rough edges.

2. Cut-out recesses, mortising, grinding operation for hardware shall be accurately made and properly reinforced when necessary.

3. Main frame shall consist of head, sill and jamb stiles specifically designed and machined to inter-fit and be joined at corners with self-threading screws.

4. Frame sill shall be stepped and sloped with offset weep holes for efficient drainage to the exterior.

5. Door panel shall be accurately joined at corners assembled and fixed rigidly to the exterior.

6. Aluminum glass door and main frame shall be installed in a prepared opening to be set plumb, square, level and true details.

7. All joints between metal surface and masonry shall be fully caulked to ensure weather tightness.

8. Sliding type door panel shall be equipped with concealed roller overhead tracks with bottom guide.

9. Double action type door panel shall be equipped with heavy duty hinges that will control the door leaf in a close or open position.

10. Weather strip shall be furnished on edges at the meeting stiles of doors.

11. Where aluminum is to be in contact with steel, concrete, cinder, block, tile, plaster or other similar masonry construction, the aluminum surface shall be back painted before erection with a bituminous paint.

12. Exposed aluminum surface shall be electro type hard coats.

13. Protection

a) All aluminum parts shall be protected adequately to ensure against damaged during transit and construction operations.

b) Aluminum parts in contact with steel members shall be properly insulated by a coat of zinc chromate primer applied to the steel or by application of bituminous paint.

14. Cleaning

a) The Contractor shall protect all entrance units during construction and shall be responsible for removal of protection materials and cleaning of all aluminum surfaces.

b) Aluminum shall be thoroughly cleaned with plain water with kerosene or gasoline and then wipe surfaces using clean cotton fabric. No abrasive cleaning agents shall be permitted.

C. MEASUREMENT AND PAYMENT

1. Aluminum glass door, fully equipped with fixing accessories and locking devices shall be measured in square meters based on actual in place installed as shown on the Plans accepted to the satisfaction of the supervising Architect or Engineer Architect or Engineer.

2. The area in square meters of aluminum glass doors installed including main frame and ready for service as provided in this Specifications shall be the basis of payment based on the Unit Bid Price or Contract Price.

WINDOWS

SCOPE OF WORK

The scope of work under this item is the same as that of Aluminum Glass Doors and also the Material and construction Requirements of Section 11-1 and 11-2 of this chapter respectively.

A. MATERIAL REQUIREMENTS

1. Window Panel

Window Panel shall be connected at corners which miter joint fixed rigidly to ensure weather tightness.

2. Sliding Windows

a) Sliding windows shall be provided with nylon sheave.

b) Sliding panels shall be suspended with concealed roller overhead tracks with bottom guide pitch outward and slotted for complete drainage.

c) The sliding panels shall be provided with interior handles.

d) The locking devices shall be a spring loaded extruded latch that automatically engages special frame hips.

3. Casement Window

a) Casement window type shall be provided with two hinges fabricated from extruded aluminum alloy. They shall open on stay arms having adjustable sliding friction shoes to control window panel operations.

b) Locking device shall be one arm action handle for manual operations complete with strike plate.

c) All joints between metal surface and masonry shall be fully and neatly caulked.

d) Aluminum parts in contact with steel members shall be properly insulated by a coat of zinc chromate, primer/bituminous paint applied to the steel surface.

e) Weather strip shall be furnished on edges at the meeting stiles.

f) Exposed aluminum surfaces shall be electrotype hard coats such as anodize, satin, etc.

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

4. Cleaning

a) The Contractor does not only protect all entrance units during the construction phase but shall also be responsible for removal of protective materials cleaning the aluminum surface including glazing before work is accepted by the supervising Architect or Engineer.

b) Aluminum shall be thoroughly cleaned with kerosene or gasolines diluted with water and then wipe surface using clean cloth rugs.

c) No abrasive cleaning materials shall be permitted in cleaning aluminum surfaces.

B. MEASUREMENT AND PAYMENT

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

2. The area of aluminum glass window in square meters ready for service as provided in the Bill of Quantities shall be the basis of payment based on the Unit Bid Price which price and payment.

GLASS AND GLAZING

SCOPE OF WORK

This Item consists of furnishing all glass and glazing materials, labor, tools, plant and equipment required in undertaking the proper installation as shown on the Plans and in accordance with this Specifications.

1. MATERIAL REQUIREMENTS

All glass and glazing shall be delivered at jobsite with labels affixed indicating quality, make, type and thickness. Each glass in glazed position shall resist a design pressure of 244 kilograms per square meter.

1. Plate Glass

Plate glass shall be manufactured from float glass that is mechanically rounded and polished and sealed with a coating of silver and a uniform film of electrolytic copper plating, then applied with protective coating of paint to seal our moisture from the silver. Use where good vision is required.

2. Float Glass

These basic types of glass shall be manufactured by floating continuous ribbon of molten glass into a bath of molten tin where it is reheated to obtain a flat fire polished finish and annealed slowly to produce a transparent float glass eliminating grinding and polishing.

Variation of these basic types is:

Graded AA – Intended for use were superior quality is required.

Grade A – Intended for selected glazing.

Grade B –Intended for general glazing.

Greenhouse quality – Intended for greenhouse glazing where quality is not very important.

3. Glazing Materials

a) Glazing materials for glass installation may be:

i. Bulk compound such as mastic that are elastic and non skinning compound.

ii. Putties – wood sash putty, or metal sash quality.

iii. Sealant – shall be chemically compatible with setting blocks, edge blocks and sealing tapes.

b) Performed Sealant such as:

i. Synthetic polymer – shall be base sealant that is resilient or non-resilient type.

ii. Performed Gasket – shall be compression or structural type.

c) Setting and Edge Blocks shall be made of lead or neoprene, chemically compatible with sealant.

d) Accessories like glazing clips, shims spacer strips etc. shall be made from non-corroding metal accessories.

4. Schedule of Glass and Mirrors

a) Use 5.6 mm (7/32") thick sheet glass locally manufactured clear quality for the following: *(unless otherwise indicated on the Plans as frosted).*

i. Aluminum windows and doors, notwithstanding plate glass indicated elsewhere.

ii. Jalousie window glass salts.

iii. Fixed glass louvers.

iv. Glass panels for partitions and counter door panels, if any.

v. Sliding glass doors for cabinets.

b) All glass panels for cabinets, except sliding doors shall be clear glass of locally manufactured float glass quality, 4.7 mm (3/16") thick.

c) They shall be clear, except where indicated on the Plans as frosted, diffused or opaque. Same shall be used for wooden sashes.

d) Unless otherwise noted, clear glass that are locally manufactured shall be used for steel windows.

Use 3.1 mm – 1/8" thick for areas exceeding .60 m^2
Use 4.7 mm thick for areas exceeding .60 m^2

e) All comfort rooms whether shown or not, the Contractor shall provide and fit securely in place at the most convenient height above each lavatory one mirror, made from local glazing quality polished plate glass 6 mm thick with beveled edges and brass chromium plated frame 12 mm thick waterproof tanguile marine plywood backing, all in accordance with full size details. Sizes are as follows:

i. Over single lavatories - - - 60 cm. x 75 cm

ii. For two lavatories - - - - - 120 cm. x 75 cm

iii. For three lavatories - - - - 180 cm. x 75 cm

2. CONSTRUCTION REQUIREMENTS

a) Safety precaution and procedure shall be observed in determining the sizes and in providing the required clearances by measuring the actual opening to receive the glass.

b) Movable items or parts shall be kept in a closed and locked position until after the glazing compound has thoroughly set.

c) All glass sheets shall be bedded, back puttied, secured in place and face puttied. Secure glass in aluminum frame with non-corrosive clips except where glazing bead are required.

d) Apply putty in a uniformly straight lines, with accurately formed bevels and clean cut corners, then remove excess putty from glass frames.

e) Set glass in hollow metal doors and in metal frames of interior partitions in felt channel insets or bedded in putty to prevent any rattle.

i. Secure glass in wood doors and wooden frames in putty glazing stops.

ii. Secure stops on doors with screws.

f) Glass breakage caused in executing that work or by faulty installation shall be replaced by the Contractor without extra cost.

g) Improperly installed glass which does not fully meet the requirements of its grade, will not be accepted and shall be replaced without extra cost.

h) The contractor shall provide and install complete set ready or use mirrors in all comfort rooms and elsewhere shown the Plans. The size and location for each mirror shall be as indicated on the Plans or as directed by the Architect.

1. Workmanship

a) All glass shall be accurately cut to fit openings and set with equal bearing on the entire width of plane.

b) Putty shall be neatly run in straight lines parallel with inside of glazing rebate.

c) Corners shall be carefully made. All excess putty shall be removed and surfaces left clean.

d) Apply a thin layer of putty to rebate and set glass.

e) Place spring wire or angle glazing clips and run face putty. Remove excess putty from other side flush with edge of rebate.

2. Cleaning

Clean all glass both sides after putty has been applied completely. Do not disturb edge of putty with scraper. At completion of work leave glass and glazing works free from cracks and rattles and clean on both sides.

3. Samples

The Contractor shall submit for approval duplicate sample (15 cm. x 25 cm.) of each type of glass bearing manufacturer's label and a can of each type of putty.

C. MEASUREMENT AND PAYMENT

1. This Item shall be measured by actual area of glass sheets installed respective of the quality type and thickness in square meters.

2. The quantified unit of measurement shall be those accepted to the satisfaction of the Owner.

3. The quantities as measured shall be paid for the Unit Bid Price which payment constitute full compensation for all glass and glazing materials, labor and other facilities, and incidentals necessary to complete the work.

2.4 TILES

VINYL FLOOR TILES

SCOPE OF WORK

This item shall consist of furnishing all vinyl tiles and fitting accessories, adhesive materials, labor, tools, equipment and the satisfactory performance in undertaking the proper installation of vinyl tile flooring as shown on the Plans and in accordance with this Specifications.

A. MATERIAL REQUIREMENTS

1. Vinyl Tiles

Vinyl tiles shall be of first grade quality measuring 30 x 30 cm. x 3 mm thick, fully homogeneous, flexible, resilient and resistant to alkali moisture, grease and oil. The color and design pattern of vinyl tile shall be uniformly distributed throughout the thickness of the tile.

2. Adhesive

Adhesive shall be best suited for tropical application and compatible with the vinyl to be installed.

3. Seal Polish

Seal polish shall be plastic emulsion suited for the particular type of floor as recommended by the vinyl tile manufacturer.

B. CONSTRUCTION REQUIREMENTS

1. Installation

Installation of the tiles shall not commence until the work of other trade, including painting has been completed.

a) The contractor shall carefully examine all surfaces over which the tiles are to be set.

b) Floor surfaces that are to receive vinyl tile shall be clean, thoroughly dry; smooth; firm and sound; free from oil, paint, wax, dirt, and any other damaging materials.

2. Tile Laying Design

a) The tile design shall be indicated on Plans and in the colors selected and approved by the Architect for each area.

b) All joints shall be parallel to wall lines except otherwise indicated on plan.

c) Where line patterns of tile run perpendicular to lines of other tiles, they shall be laid truly at right angles.

3. Adhesive

a) Adhesive shall be applied in accordance with the adhesive manufacturer's printed directions unless specified or directed otherwise.

b) Smoking, the use of open flames, and other sources of ignitions are strictly prohibited in the area where solvent containing adhesives are being used or laid.

4. Application of the Tiles

a) Start in the center of the room or work area and work from the center towards the edges.

b) Keep tile lines and joints square, symmetrical, tight and even and keep each floor in a true, level plane, except where indicated as sloped.

c) Vary edge width as necessary to maintain full size tiles in the field but no edge tile shall be less than one half the field tile size, except where irregular shaped rooms make it impossible.

5. Cutting

a) Cut vinyl floor tile to fit around all permanent fixtures, pipes and outlets.

b) Cut edges, fit and scribe to walls and partition after flooring has been applied.

6. Edge Strips

a) Provide edging strips where flooring terminates at points higher at doorways where thresholds are provided.

b) Edge strip shall be extruded aluminum butt type and beveled at exposed edges.

c) The top surface of the metal strips shall be finished flush with the tiles.

d) Secure strips at the end and between at about 20 cm. apart with screws.

e) Submit samples of metal strips for approval before application and installation.

7. Cleaning and Waxing

After the vinyl tiles and accessories are laid and set, it shall be cleaner as recommended by the manufacturer and a coat of approved seal polish.

8. Protection

After the floor has been waxed, they shall be carefully protected against damage, either with heavy building paper or by keeping traffic off the floors until the area is ready for use.

C. MEASUREMENT AND PAYMENT

1. All works performed under this section shall be measured in square meters/linear meters or actual number of vinyl floor tiles installed completes with accessories and ready for service.

2. The actual area in square or linear meters or number of quantities shall be the basis of payment based on the Unit Bid or Contract Unit Price.

CERAMIC TILES

SCOPE OF WORK

This Item shall consist of furnishing all Ceramic Tiles and cementitious materials, tools and equipment including labor required in undertaking the proper installation of walls and floor tiles as shown on the Plans and in accordance with these Specifications.

A. MATERIAL REQUIREMENTS

1. Ceramic Tiles

a) Ceramic Tiles and trims shall be made of clay, or a mixture of clay and other materials which is called the body of the tile classified by ASTM C-242 as to their degree of water absorption.

b) Ceramic Tiles and trims are manufactured either by dust pressed process or by plastic in which the clays are made plastic by mixing with water, shaped by extrusion or in molds and then fired.

2. Glazed Tiles and Trim

a) Glazed tiles and trims shall have an impervious face of ceramic materials fused on to the body of the tiles and trims.

b) The glazed surface may be clear white or colored depending on the color scheme approved by the Architect.

c) Standard glaze may be bright (glossy) semi-matte (less glossy) matte (dull) or crystalline (mottled and textured) good resistance to abrasion.

d) Glazed tiles shall be used for walls. Crystalline glazed tiles may be used for floors provided that these are used as light duty floors.

3. Unglazed Tiles and Trims

a) Unglazed tiles shall be hard dense tile of homogeneous composition. Its color and characteristics are determined by the materials used in the body, the method of manufacture and the thermal treatment. Unless otherwise specified, used unglazed tiles for all floors as indicated on the Plan.

b) Trims are manufactured to match wall tile color, texture and to coordinate with it in dimension.

c) These are shaped in various ceramic trim units such as caps, bases, coves, bull-nose, corners, angles, etc. that are necessary for edging or making a transition between intersecting surfaces.

B. CONSTRUCTION REQUIREMENTS

Tile work shall not be started until roughing-ins for plumbing, electrical and other trades have been completed and tested. The work of all other trades shall be protected from any kind damages.

1. Surface Preparation

a) Mortar mix for scratch coat and setting bed shall consist of one part Portland cement ¼ part lime and 3 parts sand by volume.

b) Surface to receive tile must be level, true to elevation, dry, free from dirt, oil and other kinds of ointments.

c) Allow at least seven days curing of scratch coat and setting bed. Installation work shall not be allowed to proceed until satisfactory conditions are corrected.

d) Thoroughly dampen surfaces of masonry or concrete before scratch coat is applied.

e) On masonry surface apply first a thin coat with pressure, then bring it out sufficiently to compensate for the major irregularities of the surface to a thickness not less than 10 mm at any point.

f) Evenly rake the scratch coat to provide good mechanical key before the mortar mix has fully hardened.

2. Installation of Ceramic Glazed Wall Tiles

Ceramic tiles shall be soaked in cleaned water prior to installation for a minimum of one hour.

a) Determine and mark layout of ceramic tiles as to joint location, position of trims and fixtures so as to minimize cutting less than one half size of the tile.

b) Thoroughly dampen surface of wall but not to saturate the surface.

c) Apply a bond coat mix with consistency of cream paste 1.5 mm thick to the wall surface or to the back of the tile to be laid.

d) Lay the tiles true to profile then exert pressure and tamp tile surface before the bond coat mix has initially set.

e) Continue with the next full tile to be laid and pressed firmly upon the setting bed tamped until flush and in place of the other tiles.

f) Intersections and returns shall be formed accurately using the appropriate trim.

g) All lines shall be kept straight and true to profiles, plumbed and internal corners rounded using the appropriate trims.

3. Installation of Vitrified Unglazed Floor Tiles

a) Before tile is laid to the floor, surface shall be tested for levelness or uniformity of slope by flooding it with water. Area where water ponds are filled and leveled, shall be tested again before the setting bed is applied.

b) Establish the lines of borders and center of the walls at the field work in both directions to permit the pattern to be laid with a minimum cutting of tiles.

c) Clean concrete sub-floor then moisten but do not soak. Then, sprinkle dry cement over the surface and spread the mortar on the setting bed.

d) Apply and spread mortar mix for setting bed and tamp to assure good bond over the entire area to be laid with tile.

e) Pitch floor to drain as shown on Plans or as directed by the Architect or Engineer.

f) Allow the setting bed to set sufficiently, then spread a bond coat over the surface and lay the tile.

4. Grouting and Pointing

a) Before grouting joints, tiles shall have been laid in place for at least 24 hours. Grouting mortar shall be white Portland cement or blended with pigments to acquire the color appropriate for the ceramic tiles.

b) Grouting mortar shall be applied over the tile by float or squeegee stroked diagonally across the joints.

c) Remove excess mortar with a wet sponge stroked diagonally or in a circular motion after 12-15 minutes.

d) Follow with a barely damp or dry sponge to remove remaining haze while smoothing all grouted joints.

5. Cleaning

a) Clean ceramic tiles surface thoroughly as possible upon completion of grouting.

b) Remove all grout haze observing tile manufacturer's instructions as to the use of acid or chemical cleaners.

c) Rinse tile thoroughly with clean water before and using chemical cleaners.

d) Polish surface of tile with soft cloth.

6. Protection

a) Apply a protective coat of neutral cleanser solution diluted with water in the proportion of 1.4 or one liter cleanser concentrate to one gallon of water.

b) In addition, cover tile flooring with heavy duty non-staining construction paper, taped in place.

c) Just before final acceptance of the work, remove paper and rinse the protective coat of neutral cleaner from the tile surface.

d) Don not let protective paper get torn or removed.

C. MEASUREMENT AND PAYMENT

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

2. Ceramic tile work determined and provided in the Bill of Quantities shall be paid for based on the Unit Bid Price which price and payment constitute full compensation for furnishing all materials, tools, equipment and other incidentals necessary to complete this Item.

2.5 PAINTING AND VARNISHING

SCOPE OF WORK

This item shall consist of furnishing paints, enamels, varnishes and other products to be used including labor, tools and equipment required as shown on the Plans and in accordance with this Specification.

A. MATERIAL REQUIREMENTS

1. All paint materials shall meet the requirements of the Standard Specifications of the Standardization Committee on supplies.

2. All paint materials shall be delivered on the job site in their original containers with labels and seals unbroken.

3. Manufacture or brand of painting materials to be used shall either be Dutch Boy, Davies, Boysen or any equivalent approved by the designing Architect.

    a) Kind of Paint
    b) Tinting Color
    c) Patching Compound
    d) Natural Wood Paste Filler
    e) Wood Stain
    f) Varnish
    g) Lacquer
    h) Sanding Sealer
    i) Glazing Putty
    j) Concrete Neutralizer
    k) Silicon Water Repellant

B. CONSTRUCTION REQUIREMENTS

The Contractor prior to commencement of the work shall examine the surfaces to be applied with paints, enamels, varnishes, lacquers, sanding sealers and other related products in order not to jeopardize the quality and appearance of painting or finishing work.

1. SURFACE PREPARATION

a) Surface Examination.
b) Preparation
c) Interior Woodwork

d) Plaster or Masonry
e) Metals
f) Concrete and Brick Surface
g) Cleaning Methods
    i. Sun blasting – there are 3 general methods in used in sun blasting:

        Conventional Dry Sandblasting
        Vacuum Sandblasting
        Wet Sandblasting

    ii. Wire Brushing and Scraping
    iii. Power Tools
    iv. Water Blasting
    v. Acid-etching
    vi. Paint Remover
    vii. Alkali Cleaning

h) Surface Conditioning
i) Application
j) Workmanship
k) Mixing and Thinning
l) Storage
m) Cleaning

C. MEASUREMENT AND PAYMENT

1. The quantity to be paid shall be total area in Square Meters of the various concrete, word and metal surfaces painted complete as shown on the Plans as specified and accepted by the Architect or Engineer.

2. The accepted work shall be paid at the Unit Bid Price, which price and payment shall constitute full compensation for furnishing all materials, equipment, labor, tools and incidentals necessary to complete this Item.

3. ELECTRICAL

SCOPE OF WORK

The work under this Division consist of furnishing all materials, equipment, tools, labor and all other services necessary to complete and make ready for operation the Electrical Power and Lightning System described below and or indicated in the Electrical Plans in accordance with the latest edition of the Philippine Electrical Code and this Specifications and General Conditions of the Contract.

A. CONSTRUCTION REQUIREMENTS

1. Furnishing and installation of underground service entrance, conduits and conductors, and all items required by local utility power company's policy, rules and regulations.

2. Furnishing and installation of panel boards at location indicated on the plan and electrical riser layout, including all accessories required.

3. Furnishing and installation of feeder and branch circuit conductors with the necessary conduits, approved type of fittings and devices as indicated in the electrical plans.

4. Furnishing and installation of all types of utilization devices, outlets and wall switches with properly installed cover plate.

5. Furnishing of all lighting fixtures, conduits, including service entrance duct, terminal cabinet and utility boxes.

B. CODES, REGULATIONS AND STANDARDS

1. The installation and equipment shall conform to good engineering practices and in particular comply with the requirements laid down in the following documents or its equivalent which are mandatory and modified only by specific agreement.

   Philippine Electrical Code - - - - - - - - - - PEC
   Underwriter's Laboratory, Inc - - - - - - - - UL
   National Electric Manufacturers
   Association - NEMA
   Local Utility Power Company - - - - - - - - - LUPC

2. In addition to the requirements of these Codes and the Utility Power Company's requirements, local government regulations and suppliers Specifications if any, shall be followed.

C. DRAWING AND SPECIFICATIONS

1. The drawings and Specifications are meant to be complementary to each other, and what is called for by one shall be binding as if called for both.

2. Any apparent conflict between the drawings and specifications, and any controversial or unclear points in either shall be referred to the supervising Architect or Engineer for final interpretation and decisions.

3. On one copy of the plans, have a record showing all deviations that happened during the construction

4. Upon completion of work as described herein, the Contractor at his own expense shall furnish the Owner 6 copies of the "As Built" plan for future references and maintenance purposes.

D. CORRELATION OF WORK

1. The Electrical Contractor shall confer with the General Contractor and Architect to determine how and where his work fits with that of other crafts, after familiarizing himself with the plans and specifications.

2. This shall be done at the beginning of construction. Should there be any existing doubts at any point, ruling shall be secured from the supervising Architect or Engineer who shall be given time to inspect the work covering this point and to prepare a detail in the form of drawings and written instructions as required.

E. PERMITS AND INSPECTION

1. The Contractor shall obtain at his own expense, all the necessary permits and certificate of Electrical Inspection from the proper government authorities required for both the performance of his work involved and the proper operation of the system upon completion of the work.

2. The Contractor shall at his expense, reproduce the electrical plans for his work to the necessary requirements as required by the government authorities concerned in issuing permits and Certificate of Electrical Inspection.

F. EXAMINATION OF PREMISES

1. Prospective bidder is required to examine the architectural, structural, and electrical plans of the project, to visit the site and carefully take note of all the conditions thereat to have personal informed under which the electrical work is to be done.

2. No allowance will subsequently be made in his behalf of any error on his part. He will be deemed to have done this before submitting his proposal and no subsequent claims on the ground of inadequate or inaccurate information will be entertained.

G. LAYOUT OF WORK

1. Electrical system layout indicated on the drawings are generally diagrammatic and the location of outlets, devices, apparatus and equipment are only approximate.

2. The exact routing of conduits, location of outlets, devices apparatus and equipment shall be governed by structural and architectural conditions and limitations.

3. For the exact location, consult the supervising Architect or Engineer. This does not mean to permit redesigning of the systems. All outlets are to be interconnected as indicated in the drawings.

4. The Owner reserves the right to make any reasonable change in location of outlet and equipment prior to rough-in, without involving additional expense.

5. The Contractor shall be responsible and pay changes for cutting and patching for piping lines where sleeves or slots were not installed or where incorrectly located.

H. MATERIAL AND WORKMANSHIP

1. All materials to be installed shall be unused, brand new and shall conform with the standards of the Underwriters Laboratories, Inc. in every case where such a standard has been established for the particular type of materials to be used.

2. Only skilled workmen using proper tools and equipment shall be employed during the entire course of installation work.

3. All workmanship shall be of the best practices of the trade involved. The same job foreman shall be assigned and maintained at the job site during the entire course of the job.

I. UNDERGROUND SERVICE ENTRANCE

1. The Electrical Contractor shall furnish and install 220 volt current rating, 3- Phase line underground service entrance connection.

2. The service entrance conductors shall be thermoplastic type THW standard copper conductors, stranded, whose number and size are indicated on the plans and electrical riser diagram.

3. The underground service entrance shall be laid at least 60 cm. below the finish grade line and shall be installed to make the joints entirely watertight.

4. The conductor shall then be encased with concrete at least 8 centimeters thick.

J. SERVICE METERING FACILITIES

1. The Contractor shall furnish and install a concrete pedestal pole size 30 cm x 30 cm x 5.50 m in the location shown in the plan and electrical diagram including line accessories and hardware in accordance with the local power company's standards.

2. It shall be the duty of the Contractor to request the local power company to install a proper type and size of service metering instruments and all other necessary accessories, materials, equipment, devices and fittings.

K. PANEL BOARDS

1. The Contractor shall furnish and install the necessary panel boards multi-breaker type including the breakers as indicated in the drawings.

2. Circuit breakers shall be tropical of the magnetic thermal type with ratings and number of poles as indicated in the drawings.

3. All panel boards to be used shall be flush mounted when located in areas that are visible to the general public and may be surface mounted when located in machine room or areas where they are not visible to the public.

4. All panel boards shall be set plumb and symmetrical with the surrounding objects. Panel boards shall be installed in a perfectly fit cabinet of appropriate size provided with a stop in-door trim and good quality cylinder lock.

L. CONDUIT WORK

1. Standard PVC conduit pipe system is required for this project.

2. Conduit runs shall be concealed in drop ceiling and or embedded in concrete structure where concealment is not possible.

3. No conduit of less than 15 mm normal diameter shall be installed for this project. Two or more conduits shall not be installed in lieu of a larger size.

4. Conduit run shall be continuous from outlet and no running thread shall be in any conduit run. Conduit shall be cut square and properly reamed.

5. All joints shall be screwed enter knockouts of conduit boxes, pull boxes, panels and cabinet squarely. Lock-nuts shall be screwed tight to insure continuity of raceway grounding.

6. Bonds and offset shall be avoided where possible, but where necessary it shall be made with approved conduit bending apparatus.

7. Conduits which have been deformed or crushed in any manner should not be installed.

8. The Contractor shall plug with lead or closed with approved pipe caps the ends of all conduit boxes so as to prevent the entrance of white ants and dirt within the conduit system.

9. This lead or cap shall be placed that can be easily removed when so desired and at the same time serve the purpose intended.

10. Pull wire shall be inserted in the empty ducts before they are closed with lead or caps and shall be left therein for future use.

11. When not shown on the plans, conduit sizes shall correspond to the conduit sizes on tables of the Philippine Electrical Code latest edition.

M. FEEDERS AND FEEDER DUCTS

1. Feeder shall be laid out in accordance with the on-line diagram shown in the drawings.

2. Unless otherwise specified or shown on the drawings, type THW wires shall be used for feeder runs. The wires and conduit shown in the drawings shall be the minimum size to be used for feeder runs.

N. WIRING METHODS

1. Wiring for all systems shall be type THW or TW conductors using plastic conduit pipes. Other types of conductor shall be as indicated in the drawings.

2. Conduit shall be embedded in columns, walls and toppings of floors slabs to allow flush connection and lighting system which may be exposed between joints in case a drop ceiling is installed.

3. Proper fittings shall be provided at ends of conduits.

4. All conduit and conduit fittings shall be PVC and shall conform with the U.S. Underwriter's Laboratories Inc. Standard and Codes.

5. The minimum size of conduit to be used shall be 13 mm diameter. Sizes larger than 13 mm diameter shall be indicated in the drawings.

6. Smallest size of conductor to be used shall be 2.0 mm^2 type TW or THW. TW wire shall be indicated in the drawings.

7. Circuit homeruns for lighting shall be 3.5 mm^2 and 5.5 mm^2 for the power or otherwise indicated on the plans.

8. All splices, tape and junctions for all systems using conductor up to 14 mm^2 shall be accomplished by using electrical friction of rubber shapes.

9. Proper type of connections shall be employed to accommodate all splices and solder less type terminals to be used for connection to Busbar.

10. Taps and splices shall be properly protected with both plastic and friction electrical tapes to proper insulation and protection for 600 volts.

11. Wiring from ceiling outlets to lighting fixtures recessed in dropped ceilings shall be done using type TW conductors in RS or PVc conduits.

12. Proper size of boxes shall be used for switch and outlet receptacles

13. Necessary fittings such as bushing, locknuts and antishort fiber bushing shall be used at proper places required.\

14. When not shown on the Plans, conduit sizes shall correspond to the conduit sizes as prescribed in the Philippine Electrical Code table for "Size of Conduit Pipes".

O. OUTLETS AND SWITCHES

1. All boxes for outlets and switches shall be PVC or galvanized iron approved products of reputable manufacturers.

2. Enamel coating used in lieu of zinc coating shall not be permitted.

3. All ceiling outlet boxes intended for lighting outlets shall be of the 10 cm. octagonal box larger boxes when required shall be 5.3 cm deep.

4. Convenience and wall switch outlet boxes shall be of the 10 cm by 5.3 rectangular deep flush type or 100 square cm junction box with gang raised cover as required to accommodate the wires therein.

5. All junction boxes, pull boxes and blank boxes shall be fitted with standard flat metal or plastic box cover.

6. All boxes including junction and pull boxes shall be of sufficient size to provide free space for all conductors enclosed in the box, in addition to the fittings such as switch mechanism and receptacles that may be placed therein.

P. WALL SWITHCES AND RECEPTACLES

1. Suitable single pole, two-gang, three-gang and three-way switches of the flush tumbler type and receptacles with proper Bakelite cover plates shall be furnished and installed as indicated in the drawings.

2. Wall switches intended to control lights on the 230 volts system shall be rated 15 amp. 250 volts.

3. Convenience outlets shall be flushed duplex type rated 20 amperes 230 volts 60 Hz, AC.

Q. GROUNDING INSTALLATION

1. The Contractor shall furnish and install all ground cables, connection ground rods and all other materials required to provide a permanent effective grounding system.

2. Grounding, in general, shall conform with the provisions of the National Electrical Code and as recommended by the equipment manufacturer.

3. All enclosures for electrical equipment regardless of voltage shall be grounded, including metal frames of switchboard, motors, generators and steel poles. Each shall be grounded in a separate grounding system.

4. Grounding cables shall be bare, copper suitable size and of approved type. Ground rods shall be copper clad steel with diameter of 16 mm and length of 2.0 m.

5. Ground clamps shall be of high compression, solderless cast design frame of high copper alloy bronze with minimum thickness of 4.7 mm and hardware made from silicon bronze.

6. The clamps shall be of a shape and size to fit the points of application and type of conection to be made from cable to rod, pipe and curved or flat surfaces.

R. LIGHTING OUTLETS

All ceiling outlets shall be 10 cm x 5 cm octagonal boxes. Connection from fixtures to boxes shall be accomplished by using type TW conductors on a flexible conduit.

S. LIGHTING FIXTURES

All lighting fixtures shall be furnished and installation by the contractor. They shall be as shown on the drawings or specified on the schedule of lighting fixtures. For other details as to the types and model, consult the Architect or the Engineer.

T. TEST AND GUARANTEE

1. The Contractor shall furnish all apparatus to be used in making tests of all wiring system for shorts and grounds after the electrical work is completed.

2. The Contractor guarantees all work installed under the Contract to be free from all defects for a period of one year after acceptance of the works.

3. The Contractor also agree to repair and make good at his own expense any and all defects which may develop in his work during the time if said defects arise due to poor workmanship.

U. POWER LOAD CENTER

This Item shall consist of furnishing and installation of power load center unit substation or low voltage switch-gear and distribution panel boards at the location shown on the Plans complete with transformer, circuit breakers, cabinets and all accessories, completely wired and ready for service.

1. Material Requirements

All materials shall be brand new and shall be of the approved type. It shall conform with the requirements of the Philippine Electrical Code and shall bear the Philippine Standard Agency mark.

2. Power Load Center Unit Substation

The contractor shall furnish and install an indoor type power load center unit substation at the location shown on the approved Plans if required. It shall be totally metal enclosed dead front and shall consist of the following coordinated component parts. High Voltage Primary incoming line section consisting of the following parts and related accessories.

a) One air filled Interrupter Switch, 2- position (open-close) installed in a suitable air filled metal enclosure and shall have sufficient interrupting capacity to carry the electrical load. It shall provided with key interlock with the cubicle for the power fuses to prevent access to the fuse unless the switch is open.

b) Three power fuses mounted in separate compartments within the switch housing and accessible by hinged door.

c) One set of high voltage potheads or 3-conductor cable or three single conductor cables.

d) Lightning arresters shall be installed at the high voltage cubicle if required.

Note: Item 1 and 2 could be substituted with a power circuit breaker with the correct rating and capacity.

3. Transformer Section

a) The Transformer section shall consist of a power transformer with ratings and capacities as shown on the Plans.

b) It shall be oil liquid filled non-flammable type and designed in accordance with the latest applicable standards.

c) The transformers shall be provided with 4 approximately 2.5% rated KVA taps on the primary winding in most cases above and 3 below rated primary voltage to be changed by means of externally gang-operated manual tap changer only when the transformer is deenergized.

d) The following accessories shall be provided with the transformer, namely: drain valve, sampling, sampling device, filling connection, oil liquid level gauge, ground pad, top filter press connection, lifting lugs diagrammatic nameplate relief valve, thermometer and other necessary related accessories.

e) The high voltage and low voltage bushing and transition flange shall be properly coordinated to field connection to the incoming line section and low voltage switchboard section, respectively.

4. The Low Voltage Switchboard Section

The low voltage switchboard shall be standard modular unitized units, metal built dead front, safety type construction and shall consist of the following.

Switchboard Housing
Secondary Metering Sections
Main Circuit Breaker
Feeder Circuit Breakers
Low Voltage Switchgear
Grounding System
Panel Board and Cabinets

V. CONSTRUCTION REQUIREMENTS

The Contractor shall install the Power Load Center Unit Sub-station or Low Voltage Switchgear and Panel boards at the locations shown on the approved Plan.

W. METHODS OF MEASUREMENT

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

4. MECHANICAL

4.1 AIR CONDITIONINING

REFREGIRATION SYSTEM

SCOPE OF WORK

This Item shall consist of furnishing and installation of air conditioning, refrigeration and ventilation systems, inclusive of necessary electrical connections, ductworks, grilles, pipes and condensate drains and all other necessary accessories, ready for service.

A. MATERIAL REQUIREMENTS

The types, sizes, capacities, quantities and power characteristics of the compressor, evaporator, condenser water pump shall be as specified or as shown on the Plans.

1. Refrigerant Pipes

a) Refrigerant pipes shall be copper tubing, type L or K or black steel pipe, Schedule 40 for size of 10 cm diameter and smaller. Pipes over 10 cm diameter shall be black steel pipe schedule 40.

b) Black steel pipe shall be standard seamless, lap-welded or electric resistant welded for size 50 mm diameter and larger, screw type for size 38 mm diameter and smaller, fitting for copper tubing shall be cast bronze fitting designed expressly for bracing.

2. Pipes for Cooling Water

a) Chilled and condenser cooling water pipes shall be black steel pipe Schedule 40.

b) Pipes and fittings for size 50 mm diameter and smaller shall be screwed type. Pipes and fittings for 62 mm diameter and larger shall be welded or flanged type.

3. Pipe Insulation

a) Pipe insulation shall be pre-formed fiberglass or its equivalent. The insulating material shall be covered with 10 mm x 13 mm thick of polyethylene film which shall be overlapped not less than 50 mm.

b) Pipe insulation shall be adequately protected at point of support by means of suitable metal shield avoid damage from compression.

c) Insulated pipes, valves and fittings located outdoors shall be provided with metal jackets.

4. Duct Works

Duct shall be galvanized steel sheet of not less than the following gauges:

a) No. 26 for 300 mm wide and smaller
b) No. 24 for 350 mm to 750 mm wide.
c) No. 22 for 775 mm to 1500 mm wide
d) No. 20 for 1525 mm to 2250 mm wide.
e) No. 18 for 2275 mm to 2500 mm or larger
f) For aluminum sheets use one gauge higher.

Joints and Stiffeners of duct using slip joints shall be as follows:

a) 300 mm wide and smaller, without bracing.
b) 325 mm to 750 mm wide, brace with 25 mm x 25 mm x 3 mm steel angles.
c) 774 mm to 1500 mm, brace with 31 x 31 x 3 mm steel angles.
d) 1525 mm up, brace with 38 x 38 x 3 mm steel angles.

Stiffeners shall be located not more than 12.0 cm. from each joint.

5. Duct Work Insulation

a) The application insulation materials shall be rigid board made of styropor or equivalent 25 mm thick for ground and top floor, 13 mm thick for intermediate floor.

b) Galvanized metal bands shall be secured and spaced 30.0 cm minimum center to center distance and corners protected with galvanized metal angles.

6. Diffusers

a) The type, shape, capacity, size and location shall be as shown in the Plans. Diffusers shall be complete with frame and gasket, equalizing deflector and volume control as indicated or specified and shall have factory-applied prime coat of paint.

b) Samples of supply and return air diffusers shall be submitted for approval before mass fabrication and installation.

7. Dampers

a) Dampers shall be of same materials as duct, at least one gauge thicker and in accessible location complete with locking device for adjusting and locking damper in position.

b) Where necessary, splitters, butterflies and louvers damper deflecting vanes for control of air volume and direction and for balancing system shall be provided whether or not they are indicated on the Plans.

8. Fire Damper

a) Main duct shall be provided with proper fire dampers of fusible link actuated type.

b) Access door shall be provided in ductwork for renewal of fusible link and to reset damper.

9. Equivalent Foundation

a) Foundation shall be provided and shall conform to the recommendation of the manufacturer of the equipment. Equipment shall be leveled on foundation by means of jacks or steel wedges.

b) All spaces between equipment bases and concrete foundation shall be filled with cement mortar.

10. Electrical Works

a) Power supply shall be provided by the Contractor at the pull box installed inside the machine room and shall furnish and install the main circuit breaker and starter with suitable ratings and capacities, conduits, wirings, fittings, devices and all other equipment and electrical installation of the system.

b) All electrical works shall comply with the latest edition of the Philippine Electrical Code, with the applicable ordinance of the local government and all the rules and requirements of the local power company.

B. CONSTRUCTION REQUIREMENTS

a) The air conditionings system shall be entirely automatic in operation and shall not require the presence of an attendant except for periodic inspection for lubrication.

b) All equipment and materials shall be inspected upon delivery and shall be tested after installation.

c) Piping shall not be buried, concealed or insulated until it has been inspected, tested and approved.

d) Walls, floors and other parts of the building and equipment damaged by contractor in the prosecution of this mechanical work shall be replaced and restored to its original conditions as shown on the Plans.

1. Operating Tests

a) Refrigerating equipment shall be tested for 8 hours per day for 3 consecutive days or longer when so directed, under the supervisions of manufacturer's qualified and authorized representative, who will make necessary adjustments and instruct designated plant operating personnel for each operation maintenance of refrigerating equipment and controls.

b) Operating test of complete air conditioning system shall be 6 hours minimum for each system. Test of air flow, temperature and humidity shall be made to demonstrate that each unit complies with the requirements of the Plans and Specifications.

2. Guarantee and Service

All equipment, materials and workmanship shall be guaranteed for a period of one year from the date of acceptance at any time within the period of guarantee and upon notification; the Contractor shall repair and rectify the deficiencies, including replacement of parts or entire unit.

3. Miscellaneous

a) The Owner shall be provided with 3 bound copies of "As-Built" diagrams, shop drawings, part lists, serial number and inventory of equipment including manufacturer's operating and maintenance manuals.

b) All standard tools and equipment shall be furnished for proper and regular maintenance of installed equipment.

C. MEASUREMENT AND PAYMENT

1. The work under this Item shall be measured either by set, price, length, square meter actually placed and installed as shown on the Plans.

2. Compressor, condenser and evaporator shall be measured by set, grilles, diffusers and valve by piece, pipe by length, duct and insulation by square meter.

3. All work performed and measured shall be paid for the Unit Bid or Contract Price which payment constitute full compensation including labor, materials, tools and incidentals necessary to complete this item.

4.2 WATER PUMPING SYSTEM

SCOPE OF WORK

This Item consist of furnishing and installation of water pumping system, inclusive of all piping and pipe fitting connections, valves, controls, electrical wirings, tanks and all accessories ready for service in accordance with the approved Plans and Specifications.

A. MATERIAL REQUIREMENTS

1. Water Pump

The type, size, capacity, location, quantity and power characteristics shall be as specified or shown on the Plans.

2. Overhead Tank

Overhead tank shall be provided with manholes, cover, drain pipes, distribution pipe outlet, overflow pipes and air vent.

3. Pneumatic Tank

Tank shall be designed for twice the maximum total dynamic pressure required and shall have the following accessories.

a) Suitable pressure switch to stop pump if pressure required is attained.

b) Air volume control device to maintain correct air volume inside the tank.

c) Pressure relief valve should be installed on top of the tank.

d) Electrode to be connected in the motor pump control to control the water level.

e) Air compressor shall be provided for tank of 3.785 liters to maintain air pressure inside the tank.

4. Pipes and Fittings

All piping 10 cm and larger shall be welded or flanged while smaller sizes shall be screwed.

5. Valves

A gate valve followed by a check valve shall be placed between discharge of pump and tank to prevent back flow of water when pump is in stop.

B. CONSTRUCTION REQUIREMENTS

Exposed piping shall be provided with concrete saddle or steel clamps or hangers to secure them firmly to the building structures. Pipe threads shall be lubricated by white lead, red lead, Teflon tape or other approved lubrication before tightening.

C. MEASUREMENT AND PAYMENT

The work under this item shall be measured either by set, length and piece actually placed as indicated on the Plans Equivalent shall be measured by set, pipes by length, valves and fittings by piece.

4.3 AUTOMATIC WATER SPRINKLER

SCOPE OF WORK

This Item shall consist of furnishing and installation of Automatic Water Sprinkler System, inclusive of all piping and pipe fitting connections, valves, controls, electrical wiring connection and all other accessories ready for service in accordance with the Plans and Specifications.

A. MATERIAL REQUIREMENTS

1. Fire Pump

a) The type, size, capacity and quantity and power characteristics shall be specified or as shown on the Plans.

b) The fire pump shall be diesel engine driven and capable of delivering a minimum of residual pressure of 103 kPa at the top-most and remotest sprinkler.

c) The pump unit shall be supplied with relief valve, suction gauge and discharge pressure gauge. The diesel engine shall be designed specifically intended for an automatic water sprinkler protection system.

d) A drop in system pressure due to the operation of one sprinkler pressure shall be triggered a series of automatic operations that will result in the instantaneous operation of the engine to drive the fire pump with the aid of a battery automatic controller.

e) The required accessories are:
Tachnometer
Oil Pressure gauge
Temperature gauge and control panel

f) A diesel fuel day tank shall be provided to supply the engine for a minimum of 2 hours running time.

g) The fuel storage tank shall be asphalt coated with necessary piping and fittings for connection.

2. Jockey Pump

Jockey pump shall be electric motor driven, 220 v. 3-phase, 60 hertz Power connection. The capacity to be supplied shall not less than that indicated on the Plans.

3. Sprinkler Head

a) Type-spray unit, pendant and upright unit
b) Flow capacity, 83 LPM per head
c) Pressure Rating
d) Residual pressure – 103 kPa minimum
e) Maximum pressure – 1035 kPa
f) Temperature rating – fusing at 57.5^0 C to 74^0 C

g) Finish – chrome-pendant-chrome or brass upright
h) Pipe thread – 13 mm nominal
i) Stock of extra heads and tools required

4. Alarm Check Valve and Fire Alarm System

a) The alarm assembly shall be constructed and installed that any flow of water from the sprinkler system equal to or greater than that from the single automatic head shall result in an audible and visual signed in the vicinity of the building.

b) The alarm apparatus shall be substantially supported and so located and installed that all parts shall be readily accessible for inspection, removal and repair.

c) The actual water flow, through the use of a test connection, shall be employed to test the operation of the sprinkler alarm units as a whole.

d) An approved identification sigh shall be installed near the outdoor alarm device in a conspicuous positions.

5. Alarm and Supervisory System

The alarm and supervisory system of the automatic water sprinkler shall include the monitoring of the following:

a) Water flow switch of each floor of the building
b) Fire pump and jockey pump running condition and power supplies.
c) Level of water in the reservoir
d) Control valves

The water flow switches on each floor of the building shall be connected to the fire alarm system and annunciator in such a manner that the operation of any sprinkler system will activate the fire alarm system, with the location of the operating water flow switch simultaneously indicated in the annunciator panel.

6. Pipes and Fittings

a) Pipes shall be Black Iron Schedule 40
b) Screw fitting shall be used for inside piping
c) Welding and touch cutting shall not be allowed
d) Piping shall be painted with metal primer and red enamel paint.

7. Siamese Twin

The Siamese twin shall be 64 x 64 x 102 mm, 90º C female coupling national standard thread, swivel type, with protective coupling cap and joint lug.

8. Pipe Hangers

Pipe hangers shall be steel bars 3 mm minimum thickness, with corrosion protection.

a) *Anchorage in concrete* – expansion shield preferably be used in a horizontal position in the sides of concrete beams.

b) *Expansion shield in vertical position.*When pipes 1—mm and larger are supported entirely by expansion shield in the vertical position, the supports shall be spaced not more than 3.0 meters apart.

c) For pipe running through concrete beams use sleeves at least 2 sizes larger than the piping.

B. CONSTRUCTION REQUIREMETNS

1. Acceptance Tests

a) System operation and maintenance chart shall be submitted to the Owner upon completion of the Contract. This shall include the locations of control valves and care of the new equipment.

b) Marked instructions and identifications sign boars shall be made of NO. 14 gauge black iron sheet with baked enamel finish paint and letter instructions are shown on the Plans

c) Sign boards shall be mounted on the equipment or wall nearest the equipment easy identification and reading.

d) Additional sign boards as may be required and not specified herewith shall be furnished at no extra cost.

2. Conduct of Tests

a) Test shall be by the Sprinkle System conducted in the presence of an inspector or authority having jurisdiction.

b) Flushing of Underground Connections to remove foreign materials which may have entered the piping during installation of same as required before sprinkler piping is connected.

c) Hydraulic Test shall be conducted as follows:

i. **The Pressure** - all systems, including piping shall be tested hydrostatically at no less than 1378 kPa pressure for 2 hours or at 345 kPa in excess of the maximum static pressure when the maximum static pressure is in excess of 1033 kPa.

ii. **Operating Test** – all control valves shall be fully closed and opened under water pressure to insure proper operation. Use clean, non-corrosive water.

iii. **Fire Department Connection** – piping between the check valve in the fire department inlet pipe and the outside connection shall be tested the same as the balance of the system.

d) *Tests of Drainage Facilities* – Test of the drainage facilities shall be made while the control valve is wide open. The main drain valve shall be opened and remain open until the system pressure stabilizes.

e) *Test Certificate* – Upon completion of work, inspection and tests made by the Contractor and witnessed by the Owner's representative. A test certificate shall be filled out and signed by both representatives.

C. MAINTENANCE SERVICE

1. The Contractor shall provide free of charge, maintenance service of the system for a period of at least one year reckoned from the date of acceptance of the work.

2. Upon completion of the work and after all tests, the services of one or more qualified engineers shall be provided by the Contractor for a period of not less than 5 working days to instruct and train the representative of the Owner in the operation and maintenance of the fire protection system.

Guarantee and Service

All equipment, materials, and workmanship shall be guaranteed for a period of 1 year from the date of acceptance at any time within the period of guarantee and upon notification, the Contractor shall repair and rectify and deficiencies, including replacement of parts or entire units.

5. PLUMBING

SCOPE OF WORK

This Item shall consist of furnishing all materials, tools equipment and fixtures required as shown on the Plans for the satisfactory performance of the entire pluming system including installation in accordance with the latest edition of the National Plumbing Code, and these Specifications.

A. MATERIAL REQUIREMENTS

All piping materials, fixtures and appliances fitting accessories whether specifically mentioned or not but necessary to complete this Item shall be furnished and installed.

1. Plastic Pipes

a) Unless otherwise specified or shown on drawings all tube pipes to be use in this project shall be plastic or synthetic materials.

b) For rigid type of connections, the following shall be used: Polyvinyl Chloride (PVC); Chlorinated Polyvinyl Chloride (CPVC); Unplasticized Polyvinyl Chloride (uPVC); Acrylonitrile Butadiene Styrene (ABS); Polypropylene (PP) and Styrene Rubber Plastic (SR).

c) For flexible connections either of the following shall be used: Polyethylene (PE) and Polybutylene (PB).

d) The PE and PB tubes are in coil form available up to 150 meters long in coil form shall be used for underground water connections.

e) Plastic pipe shall be of quality made by reputable manufacturers free from defects, and shall be true, smooth and cylindrical, their inner and outer surfaces being as nearly concentric, their inner and outer surfaces being as nearly concentric as practicable.

f) They shall be in all aspect, sound and perfectly molded free from laps, pin holes or other imperfections and shall be neatly dressed with its end finished reasonably square to their axes.

g) Pipes and fittings for sanitary and potable water lines as approved alternate shall be unplasticized Polyvinyl Chloride Pipes and fittings (Upvc)

h) Pipes and fittings shall be made of virgin materials conforming to Specification requirements defined in ASTM D-2241 and PS 65: 1986.

i) Fittings shall be molded type and designed for solvent cement joint connection for water lines and rubber O-ring seal joint for sanitary lines.

2. Septic Tank

a) The septic tank shall be provided as shown on the Plans including all pipe vents and fittings.

b) Various construction materials such as concrete masonry work shall conform to the corresponding Items of this Specification.

c) Inlet and outlet pipes shall conform to the latest edition of the National Plumbing Code.

3. Plumbing Fixtures and Fittings

a) All fittings and trimmings for fixtures shall be chromium plated and polished brass unless otherwise approved.

b) Exposed traps and supply pipes for fixtures shall be connected to the roughing-in, piping system at the wall unless otherwise indicated on the Plans.

c) Built in fixtures shall be watertight with provision of water supply and drainage outlet, fittings and trap seal.

d) Unless otherwise specified, all plumbing fixtures shall be made of vitreous china complete with fittings.

4. Bathroom and Toilet Accessories

a) Shower head and fitting shall be movable, cone type with excutcheon arm complete with stainless steel shower valve and control lever. All exposed surface to be chromium finish.

b) Grab bars shall be made of tubular stainless steel pipe provided with safety grip and mounting flange.

c) Floor drains shall be made of stainless steel beehive type, measuring 10 cm x 10 cm. and provided with detachable stainless strainer, expanded metal lath type.

d) Toilet paper holder shall be vitreous china wall mounted. Color shall reconcile with the adjacent fixture and facing tiles.

e) Soap holder shall be vitreous china wall mounted. Color shall reconcile with the adjacent tile works.

f) Faucets shall be made of stainless steel for interior use.

g) Hose bibs shall be made of bronze cast finish.

5. Special Plumbing Fixtures

a) Kitchen sink shall be made of stainless steel self rimming, single compartment complete with supply fittings, strainer traps, dual control lever and other accessories.

b) Laboratory sink shall be made of cast iron metal with white porcelain finish with single compartment, flat rim edge, 75 x 53 cm. complete with supply fittings, strainer, trap ad other accessories,

c) Scrub up sink shall be made of cast iron white porcelain finish with 3 compartment X – ray processing tank, drain plug, open sanding drain 19 mm inlet spud complete with stand and mounting accessories.

d) Built in appliances such as urinal, lavatory and slope sink shall be installed as indicated on the Plans. Exposed surfaces to be tile wainscoating complete with fitting accessories required as practiced in this specialty trade.

e) Squat Bowl(s) shall be vitreous china, wash down with integral foot treads, pail flush type. Color, make and type to be approved by the designing Architect.

f) Grease Traps shall be made of cast bronze with detachable cover and mounting accessories.

6. Roof Drains, Overflow Pipes and Steel Grating

a) The Contractor shall provide fit and or install necessary drains with strainers where shown on the Plans.

b) Each drain with strainer shall fit the size of the corresponding downspout or roof leader over which it is to be installed and in conformity with the following schedule.

7. Fire Protection System

a) Fire house cabinets shall be locally available consisting of 38 mm diameter valve hose rack 30 mm nipple rubber hose cable with square nozzle 38 mm diameter brass, chromium plated.

b) Fire Standpipe system shall consists of risers and hose valves. Standpipe shall be extra strong black iron.

c) Valves to be used shall be high grade cast bronze mounted with standing 79.40 kg. working pressure.

d) Fire extinguisher shall be portable, suitable for Class A, B, C, fires, mounted inside the cabinet. Cabinet shall be full flush mounting door with aluminum trim for glass plate.

e) Frame and box shall be made of gauge 14 galvanized iron sheets with white interior and red exterior baked enamel finish over the well prepared primer.

f) Cabinet shall be wall mounted and size to accommodate the defined components.

g) Yard hydrant where shown on the Plans shall match the Integrated Fire Department requirements. Outlet shall be single 63 mm diameter gate valves with chain connected caps.

h) Built in appliances such as urinal, lavatory and slope sink shall be installed as indicated on the Plans. Exposed surfaces to be tile wainscoting complete with fitting accessories required as practiced in this specialty trade.

B. CONSTRUCTION REQUIREMENTS

The Contactor before any installation work is started shall carefully examine the Plans and investigate actual structural and finishing work condition affecting all his work. Where actual condition necessitates a rearrangement of the approved pipe layout, the Contractor shall prepare Plan(s) of the proposed pipe layout for approval by the supervising Architect or Engineer.

1. Installation of Soil, Waste, Drain and Vent Pipes

a) **Soil Pipe** – all soil and drainage pipes shall be sloped at 2% or 2 cm. per 1.0 meter run but in no case flatter than one (1%) percent.

b) **Horizontal lines** shall be supported by well secured heavy strap hangers.

c) **Vertical lines** shall be secured strongly by hooks to the building frame a suitable brackets or chairs shall be provided at the floor from which they start.

d) All main **Vertical Soil** and **Waste Stacks** shall be extended full size to and above the roof line to act as vents, except otherwise indicated on the Plans.

e) **Vent Pipes** in roof spaces shall be run as close as possible to underside of roof with horizontal piping slope down to stacks without forming traps. Vertical vent pipes may be connected into one main vent riser above the highest vented fixtures.

f) Where an end or circuit vent pipe from any fixtures is connected to a vent line serving other fixtures, the connections shall be at least 120 cm. above the floor on which the fixtures are located.

g) Horizontal waste line receiving the discharge from two or more fixtures shall be provided with end vents unless separate venting of fixtures is note 1 on the Plan.

h) All changes in pipe sizes such as soil and waste lines shall be made with reducing fittings or recessed reducers.

i) All changes in directions shall be made by appropriate use of 45^0 degrees Y; half Y; long sweep; quarter bends or elbows for soil and waste lines where the change in direction of flow is form the horizontal to the vertical and discharges from water closet.

j) Where it is becomes necessary to use short radius fittings in other locations, the approval of the supervising Architect or Engineer shall be obtained prior to installation of said fittings.

k) **Cleanouts** at the bottom of each soil stack, waste stack, interior downspout, and where else indicated shall be the same size as the pipe lines.

l) **Vent pipes** shall be flashed and made water tight at the roof with ferrule as the pipe lines.

m) **Trap** – Each fixtures and place of equipment requiring connection to the drainage system except fixtures and continuous water shall be equipped with a trap. Each trap shall be placed as near to the fixtures as possible.

2. Water Pipes, Fittings and Connections

a) The water supply piping shall be extended to all fixtures, outlets, and equipment from the gate valves installed in the branch near the riser.

b) The cold water system shall be installed with a slope towards a main shutoff valve and drain. Ends of pipe and outlets shall be capped or plugged and left ready for future connections.

c) All pipes shall be cut accurately to measurements and shall be worked into place without springing or forcing.

d) All piping above the ground shall be run parallel with the lines of the building unless otherwise indicated on the Plan.

e) All service pipes, valves and fittings shall be kept at sufficient distance from other work to permit finished covering not less than 12 mm from such work or from finished covering on the different service.

f) No water piping shall be buried in floors, unless specifically indicated on the Plan. Changes in pipe directions shall be made with reducing fittings.

g) Pipe drain indicated on the drawings shall consist of 12 mm globe valve with renewable disc and installed at low points on the cold water piping so that all piping shall slope 10 cm in 30 meters.

h) All pipes to be threaded shall be reamed before threading. All screw joints shall be made with graphite and oil or with an approved graphite compound applied to make threads only.

3. Fire Standpipe System

Fire standpipe system shall consist of risers and hose valve. Standpipe shall be extra strong black iron. Valves shall be of high grade cast bronze quality approved by the Underwriter's specifications.

4. Valves and Hose Bibs

Valves shall be provided in all supplied fixture as herein specified.

a) The cold water connections to the domestic hot water heater shall be provided with gate valves and the return circulation connection shall have gate and check valve.

b) All connection to domestic hot water heaters shall be equipped with unions between valve and tanks.

c) Valve shall not be installed with its stem below the horizontal elevation. All valves shall be gate valves unless otherwise indicated on the plans.

d) Valves up to 50 mm diameter shall be threaded ends, rough bodies and finish trimmings, except those on chromium plated brass pipe.

e) Valves 63 mm in diameter and larger shall have iron bodies, brass mounted and shall have either screws or flange ends.

f) Hose bibs shall be made of brass with 12 mm inlet threads hexagonal shoulders and 19 mm male.

5. Fixtures, Equipment and Fastening

a) All fixtures and equipment shall be supported and fastened in a safe and satisfactory workmanship as practiced.

b) All fixtures required to be wall mounted on concrete or concrete hollow block wall shall be fasten with brass expansion bolts.

c) Expansion bolts shall be 6 mm diameter with 20 mm threads into solid concrete, fitted with tubing sleeves of proper length to acquire extreme rigidity.

d) Inserts shall be rigidly secured, anchored and properly concealed and flushed into the walls.

e) Bolts and nuts shall be horizontally mounted and exposed. It shall be provided with washers and chromium plate finish.

6. Pipe Hangers, Inserts and Supports

a) Pipe hangers shall be wrought iron malleable iron pipe spaced not more than 1.50 meters apart for horizontal runs of pipe.

b) Chains, straps, perforated turn-buckles or other approved means of adjustment except the turn-turn-buckles may be omitted for hangers on soil or waste lines or individual toilet rooms to maintain stacks when spaced does not permit.

c) Trapeze hangers may be used in lieu of separate hangers on pipe running parallel to and closed to each other.

d) Inserts shall be cast steel of the type to receive machine bolt or nut after installation. Insert permit adjustment of the bolts in one horizontal direction and shall be installed before the pouring of concrete.

e) Wrought iron clamps or collars to support vertical runs of pipe shall be spaced not more than 3.0 m apart or as indicated on the Plan.

7. Plates and Flashing

a) Plates to cover exposed pipes passing through floor finished, walls, or ceiling shall be fitted with chromium plated cast brass plates or chromium plated cast iron or steel plates on ferrous pipes.

b) Plates shall be large enough to cover and close the hole around the area where pipes passes. It shall be properly installed to insure permanence.

c) Roof areas penetrated by vent pipes shall be rendered water tight by lead sheet flashing and counter flashing. It shall extend at least 15 cm. above the pipe and 30 cm along the roof.

8. Protection and Cleaning

a) During installation of fixtures and accessories and until final acceptance, fixtures shall not be protected with strippable plastic or other approved means to maintain fixtures in perfect conditions.

b) All exposed metal surface shall be polished clean and free of grease, dirt or other foreign materials after the completion.

c) Upon completion, thoroughly clean all fixtures and accessories to leave the work in a polished condition.

9. Inspection, Warranty Test and Disinfection

All pipes, fittings, traps, fixtures, appurtenances and equipment of the plumbing and drainage system shall be inspected and approved by the supervising Architect or Engineer to assure compliance with all requirements of applicable Codes and Regulations referred to in these Specifications.

10. Drainage System Test

a) The entire drainage and venting system shall have all the necessary openings which can be plugged to permit the entire system to be filled with water to the level of the highest stack vent above the roof.

b) The system shall hold this water for a full 30 minutes during which time there shall be no drop greater than 10 mm.

c) Where only a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system.

d) If and when the Architect or Engineer decides that an additional test is needed, such as air to smoke test on the drainage system, the Contractor shall perform such test without any additional cost.

11. Water Test on System

a) Upon completion of the rough-in and before connecting fixtures, the entire cold water piping system shall be tested at a hydrostatic pressure 1-1/2 times the expected working pressure in the system during operation and remained tight and leak proofed.

b) Where piping system is to be concealed, the piping system shall be separately in manner similar to that described for the entire system and in the presence of the Architect or Engineer or his duly designated representative.

12. Defective Work

a) All defective work, materials replaced and tested will be repeated until satisfactory performance is attained.

b) Any material replaced for the satisfactory performance of the system made shall be at the expense of the Contractor.

c) Caulking of screwed joints or holes will not be permitted.

13. Disinfection

a) The entire water distribution system shall be thoroughly flushed and treated with Chlorine before it is operated for human use.

b) Disinfection materials shall be liquid Chlorine or Hypochlorite and shall be introduced in a manner approved as practiced for water distribution system.

c) After contact period of not less than 16 hours, heavily chlorinated water shall be flushed from the system with portable water.

d) Valves for the water distribution system shall be opened and closed several times during the 16 hours Chlorination treatment period.

14. As-Built Drawings

a) Upon completion of the work, the Contractor shall submit two sets of prints with all As-Built changes shown on the drawings in a neat workmanship manner.

b) Such points shall show changes or actual installation and conditions of the plumbing system in comparison with the original drawings.

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 either Rapid Curing (RC) Cut-back or Emulsified Asphalt, whichever is called for in the Bill of Quantities. 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 Engineer, 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 either the Rapid Curing Cut-back or the Emulsified Asphalt shall be within the range of 0.2 to 0.7 litre/m^2, the exact rate as determined by the Engineer.

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 Engineer.

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 resprayed 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.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
302	Bituminous Tack Coat	
302(1)	RC – Cut-back Asphalt	Tonne
302 (2)	Emulsified Asphalt	Tonne

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 either Medium Curing (MC) Cut-back Asphalt or Asphalt Cement, whichever 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 Engineer 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	

ITEM 100 – CLEARING AND GRUBBING

100.1 Description

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

100.2 Construction Requirements

100.2.1 General

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

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

100.2.2 Clearing and Grubbing

All surface objects and all trees, stumps, roots and other protruding obstructions, not designated to remain, shall be cleared and/or grubbed, including mowing as required, except as provided below:

(1) Removal of undisturbed stumps and roots and nonperishable solid objects with a minimum depth of one (1) meter below subgrade or slope of embankment will not be required.

(2) In areas outside of the grading limits of cut and embankment areas, stumps and nonperishable solid objects shall be cut off not more than 150 mm (6 inches) above the ground line or low water level.

(3) In areas to be rounded at the top of cut slopes, stumps shall be cut off flush with or below the surface of the final slope line.

(4) Grubbing of pits, channel changes and ditches will be required only to the depth necessitated by the proposed excavation within such areas.

(5) In areas covered by cogon/talahib, wild grass and other vegetations, top soil shall be cut to a maximum depth of 150 mm below the original ground surface or as designated by the Engineer, and disposed outside the clearing and grubbing limits as indicated in the typical roadway section.

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

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

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

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

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

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

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

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

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

100.2.3 Individual Removal of Trees or Stumps

Individual trees or stumps designated by the Engineer for removal and located in areas other than those established for clearing and grubbing and roadside cleanup shall be

removed and disposed off as specified under Subsection 100.2.2 except trees removed shall be cut as nearly flush with the ground as practicable without removing stumps.

100.3 Method of Measurement

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

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

2. Lump-Sum Basis. When the Bill of Quantities contains a Clearing and Grubbing lump-sum item, no measurement of area will be made for such item.

3. Individual Unit Basis (Selective Clearing). The diameter of trees will be measured at a height of 1.4 m (54 inches) above the ground. Trees less than 150 mm (6 inches) in diameter will not be measured for payment.

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

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

100.4 Basis of Payment

The accepted quantities, measured as prescribed in Section 100.3, shall be paid for at the Contract unit price for each of the Pay Items listed below that is included in the Bill of Quantities, which price and payment shall be full compensation for furnishing all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
100 (1)	Clearing and Grubbing	Hectare
100 (2)	Clearing and Grubbing	Lump Sum
100 (3)	Individual Removal of	Each
100 (4)	Individual removal of	Each

ITEM 101 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

101.1 Description

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

101.2 Construction Requirements

101.2.1 General

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

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

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

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

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

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

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

101.2.3 Removal of Pipes Other than Pipe Culverts

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

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

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

(1) Broken into pieces and used for riprap on the project, or

(2) Broken into pieces, the size of which shall not exceed 300 mm (12 inches) in any dimension and stockpiled at designated locations on the project for use by the Government, or

(3) Otherwise demolished and disposed off as directed by the Engineer.When specified, ballast, gravel, bituminous materials or other surfacing or pavement materials shall be removed and stockpiled as required in Subsection 101.2.1, otherwise such materials shall be disposed off as directed.

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

101.3 Method of Measurement

When the Contract stipulates that payment will be made for removal of obstructions on lump-sum basis, the pay item will include all structures and obstructions encountered within the

roadway. Where the contract stipulates that payment will be made for the removal of specific items on a unit basis, measurement will be made by the unit stipulated in the Contract.

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

101.4 Basis of Payment

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

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
101 (1)	Removal of Structures and Obstruction	Lump Sum
101 (2)	Removal of	Each
101 (3)	Removal of	Square Meter
101 (4)	Removal of	Linear Meter

ITEM 102 – EXCAVATION

102.1 Description

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

102.1.1 Roadway Excavation

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

(1) Unclassified Excavation. Unclassified excavation shall consist of the excavation and disposal of all materials regardless of its nature, not classified and included in the Bill of Quantities under other pay items.

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

(3) Common Excavation.Common excavations shall consist of all excavation not included in the Bill of Quantities under "rock excavation" or other pay items.

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

102.1.2 Borrow Excavation

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

(1) Borrow, Case 1

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

(2) Borrow, Case 2

Borrow Case 2 will consist of material obtained from sources provided by the Contractor.

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

102.2 Construction Requirements

102.2.1 General

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

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

102.2.2 Conservation of Topsoil

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

102.2.3 Utilization of Excavated Materials

All suitable material removed from the excavation shall be used in the formation of the embankment, 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 material shall be disposed off as shown on the Plans or as directed without delay to the Contractor.

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

All excess material, including rock and boulders that cannot be used in embankments

shall be disposed off as directed.

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

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

102.2.4 Prewatering

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

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

102.2.5 Presplitting

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

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

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

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

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

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

102.2.6 Excavation of Ditches, Gutters, etc.

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

102.2.3.

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

Furrow ditches shall be formed by plowing a continuous furrow along the line staked by the Engineer. Methods other than plowing may be used if acceptable to the Engineer. The ditches shall be cleaned out by hand shovel work, by ditcher, or by some other suitable method, throwing all loose materials on the downhill side so that the bottom of the finished ditch shall be approximately 450 mm (18 inches) below the crest of the loose material piled on the downhill side. Hand finish will not be required, but the flow lines shall be in satisfactory shape to provide drainage without overflow.

102.2.7 Excavation of Roadbed Level

Rock shall be excavated to a depth of 150 mm (6 inches) below 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 (6 inches) and the moisture content increased or reduced, as necessary, to bring the material throughout this 150 mm layer to the moisture content suitable for maximum compaction. This layer shall then be compacted in accordance with Subsection 104.3.3.

102.2.8 Borrow Areas

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

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

102.2.9 Removal of Unsuitable Material

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

Where excavation to the finished graded section results in a 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.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
102 (1)	Unsuitable Excavation	Cubic Meter
102 (2)	Surplus Common Excavation	Cubic Meter
102 (3)	Surplus Rock Excavation	Cubic Meter
102 (4)	Surplus Unclassified Excavation	Cubic Meter

ITEM 104 – EMBANKMENT

104.1 Description

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

104.2 Material Requirements

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

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

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

2. Unsuitable Material – Material other than suitable materials such as:

   (a) Materials containing detrimental quantities of organic materials, such as grass, roots and sewerage.

   (b) Organic soils such as peat and muck.

   (c) Soils with liquid limit exceeding 80 and/or plasticity index exceeding 55.

   (d) Soils with a natural water content exceeding 100%.

   (e) Soils with very low natural density, 800 kg/m^3 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 placing and compacting of approved material within roadway areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits, and other depressions within the roadway area.

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

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

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

104.3.2 Methods of Construction

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

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

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

within 900 mm (36 inches) of the subgrade, such old road surface shall be scarified to a depth of at least 150 mm (6 inches) whenever directed by the Engineer. This scarified materials shall then be compacted as provided in Subsection
104.3.3.

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

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

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

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

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

Each layer shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments of earth. Lifts of material containing more than 25 mass percent of rock larger than 150 mm in greatestdimensions shall not be constructed above an elevation 300 mm (1 2 inches) below the finished subgrade. The balance of the embankment shall be composed of suitable material smoothed and placed in layers not exceeding 200 mm (8 inches) in loose thickness and compacted as specified for embankments.

Dumping and rolling areas shall be kept separate, and no lift shall be covered by another until

compaction complies with the requirements of Subsection 104.3.3.

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

104.3.3 Compaction

Compaction Trials

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

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

Earth

The Contractor shall compact the material placed in all embankment layers and the material scarified to the designated depth below subgrade in cut sections, until a uniform density of not less than 95 mass percent of the maximum dry density determined by AASHTO T99 Method C, is attained, at a moisture content determined by Engineer to be suitable for such density. Acceptance of compaction may be based on adherence to an approved roller pattern developed as set forth in Item 106, Compaction Equipment and Density Control Strips.

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

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

Rock

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

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

104.3.4 Protection of Roadbed During Construction

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

104.3.5 Protection of Structure

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

104.3.6 Rounding and Warping Slopes

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

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

104.3.7 Finishing Roadbed and Slopes

After the roadbed has been substantially completed, the full width shall be conditioned by removing any soft or other unstable material that will not compact properly or serve the intended purpose. The resulting areas and all other low sections, holes of 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 ditchline 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 drawings or as established by the Engineer.Material shall contain no frozen material, roots, sod, or other deleterious materials. Contractor shall take precaution to prevent material from escaping over the embankment slope. Shoulder surface beneath berm will be roughened to provide a bond between the berm and shoulder when completed. The Contractor shall compact the material placed until at least 90 mass percent of the maximum density is obtained as determined by AASHTO T 99, Method C.The cross-section of the finished compacted berm shall reasonably conform to the typical cross- section as shown on the Plans.

Uncompacted Berm

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

104.4 Method of Measurement

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

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

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

104.5 Basis of Payment

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

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
104 (1)	Embankment	Cubic Meter
104 (2)	Selected, Borrow for topping, Case 1	Cubic Meter
104 (3)	Selected Borrow for topping, Case 2	Cubic Meter
104 (4)	Earth Berm	Meter

Item 105 – SUBGRADE PREPARATION

105.1 Description

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

105.2 Material Requirements

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

105.3 Construction Requirements

105.3.1 Prior Works

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

105.3.2 Subgrade Level Tolerances

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

Permitted variation from design LEVEL OF SURFACE	+ -	20 mm 30 mm
Permitted SURFACE IRREGULARITY MEASURED BY 3-m STRAIGHT EDGE		30 mm
Permitted variation from design CROSSFALL OR CAMBER	±	0.5 %
Permitted variation from design LONGITUDINAL GRADE over 25 m length	±	0.1 %

105.3.3 Subgrade in Common Excavation

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

Where material has been removed from below subgrade level, the resulting surface shall be compacted to a depth of 150 mm and in accordance with other requirements of Subsection104.3.3.

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

105.3.4 Subgrade in Rock Excavation

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

105.3.5 Subgrade on Embankment

After the embankment has been completed, the full width shall be conditioned by removing any soft or other unstable material that will not compacted properly. The resulting areas and all other low sections, holes, or depressions shall be brought to grade with suitable material. The entire roadbed shall be shaped and compacted to the requirements of Subsections 104.3.3. 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 cross-sections shown on the Plans.

105.3.6 Subgrade on Existing Pavement

Where the new pavement is to be constructed immediately over an existing Portland Cement concrete pavement and if so specified in the Contract the slab be broken into pieces with greatest dimension of not more than 500 mm and the

existing pavement material compacted as specified in Subsection 104.3.3, as directed by the Engineer. The resulting subgrade level shall, as part pavement construction be shaped to conform to the allowable tolerances of Subsection 105.3.2 by placing and compacting where necessary a leveling course comprising the material of the pavement course to be placed immediately above.

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

105.3.7 Protection of Completed Work

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

105.3.8 Templates and Straight-edges

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

105.4 Method of Measurement

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

1. The compaction of existing ground below subgrade level in cuts of common material as specified in Subsection 105.3.3.

2. The breaking up or scarifying, loosening, reshaping and recompacting of existing pavement as specified in Subsection 105.3.6. The quantity to be paid for shall be the area of the work specified to be carried out and accepted by the Engineer.

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

105.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 105.4, shall be paid for at the appropriate contract unit price for Pay Item listed below that is included in the Bill of Quantities which price and payment shall be full compensation for the placing or removal and disposal of all materials including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
105 (1)	Subgrade Preparation (Common Material)	Square Meter
105 (2)	Subgrade Preparation (Existing Pavement)	Square Meter
105 (3)	Subgrade Preparation (Unsuitable Material)	Square Meter

ITEM 200 – AGGREGATE SUBBASE COURSE

200.1 DESCRIPTION

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

200.2 MATERIAL REQUIREMENTS

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

The subbase material shall conform to Table 200.1, Grading Requirements

Table 200.1 – Grading Requirements

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

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

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

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

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

200.3 CONSTRUCTION REQUIREMENTS

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

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

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

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

200.3.3 Spreading and Compacting. When uniformly mixed, the mixture shall be spread to the plan thickness, for compaction.

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

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

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

thoroughly with approved tampers or compactors.

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

Compaction of each layer shall continue until a field density of at least 100 percent of the maximum dry density determined in accordance with AASHTO T180, Method D has been achieved. In-place density determination shall be made in accordance with AASHTO T 191.

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

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

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

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

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

Permitted variation from design THICKNESS OF LAYER	± 20 mm
Permitted variation from design LEVEL OF SURFACE	+10 mm 20 mm

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

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

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

Payment will be made under:

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

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 Specificaton 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 or crushed or natural gravel and filler of natural or crushed sand or other finely divided mineral matter. The composite material shall be free from vegetable matter and lumps or balls of clay, and shall be of such nature that it can be compacted readily to form a firm, stable 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 (3/4 inch) 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 (MDD) as determined by AASHTO T 180, Method D.

If filler, in addition to that naturally present, is necessary for meeting the grading requirements or for satisfactory bonding, it shall be uniformly blended with the 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, shall be 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 in-place 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.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
201	Aggregate Base Course	Cubic Meter

ITEM 206 – PORTLAND CEMENT TREATED PLANT MIX BASE COURSE

206.1 Description

This Item shall consist of a foundation for surface course composed of aggregate, Portland Cement and water in proper proportions, mixed by a travel plant or in a central plant and spread and compacted on a prepared subgrade/subbase in one or more layers, in accordance with this Specification and the lines, grades, thickness and typical cross-sections shown on the Plans or as established by the Engineer.

206.2 Material Requirements

Same as Subsections 204.2.1 through 204.2.5

206.3 Construction Requirements

206.3.1 Weather Limitations

Portland Cement shall not be applied during windy, rainy or impending bad weather. In the event rain occurs, work shall be promptly stopped and the entire section shall be reconstructed in accordance with this Specification.

206.3.2 Travel Plant Method

The salvaged or new soil-aggregate shall be pulverized until at least 80 mass percent of all material other than stone or gravel will pass a 4.75 mm (No. 4) sieve.

Any material retained on a 50 mm (2 inches) sieve and other unsuitable material shall be removed. If additional material is specified, it shall be blended with the existing material. All butt joints at existing pavements or other structures shall be cleaned prior to mixing.

The subgrade/subbase shall support all equipment required in the construction of the base course. Soft or yielding areas shall be corrected prior to mixing.

The soil-aggregate to be treated shall be placed in a uniform windrow and spread to a uniform thickness to the required width. The specified quantity of Portland Cement shall be applied uniformly in a trench on top of the windrows or spread uniformly over the soil-aggregate. Spread cement that has been lost shall be replaced, without additional compensation, before mixing is started.

Mixing shall be accomplished by means of a mixer that will thoroughly blend the cement with the soil-aggregate. The mixer shall be equipped with a water metering device that will

introduce the required quantity of water during the mixing cycle. The cement soil-aggregate mixture shall be sufficiently blended to prevent the formation of cement balls when water is applied.

A maximum time of 2 hours shall be permitted for wet mixing, laydown, and finishing when this method is used.

206.3.3 Central Plant Method

The soil-aggregate shall be proportioned and mixed with cement and water in a central mixing plant. The plant shall be equipped with feeding and metering devices which will introduce the cement, soil-aggregate, and water into the mixer in the quantities specified. Mixing shall continue until a uniform mixture has been obtained.

206.3.4 Spreading, Compacting and Finishing

The mixture shall be spread on a prepared and moistened subgrade/subbase in a uniform layer by an approved equipment. Not more than 60 minutes shall elapse between the start of mixing and the time of starting compaction of the spread mixture.

After spreading, the mixture shall be compacted and finished conforming to the procedures/requirements specified under Subsection 203.3.6, Spreading, Compacting and Finishing.

The compaction and finishing shall be completed within 2 hours of the time water is added to the mixture.

206.3.5 Protection, Curing and Maintenance

The completed cement treated base shall be cured with a bituminous curing seal applied as soon as possible after the completion of final rolling. The surface shall be kept moist until the seal is applied.

The rate of application shall be between 0.5 L/m^2 to 1.00 L/m^2 of surface. The exact rate will be determined by the Engineer. Curing seal will be applied in sufficient quantity to provide a continuous film over the base. The film shall be maintained at least 5 days unless the treated base is protected by a subsequent course.

The Contractor shall be responsible for adequate maintenance of the base at all times as specified under Subsection 203.3.7, Protection, Curing and Maintenance.

206.3.6 Trial Sections

Same as Subsection 203.3.8.

206.3.7 Tolerances

Same as Subsection 203.3.9.

206.3.8 Traffic

Same as Subsection 203.3.10.

206.4 Method of Measurement

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

206.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 206.4, shall be paid for at the contract unit price for Portland Cement Treated Plant Mix Base Course which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
206	Portland Cement treated Plant Mix Course, (New or Salvaged) oil-Aggregate	Cubic Meter

ITEM 311 – PORTLAND CEMENT CONCRETE PAVEMENT

311.1 DESCRIPTION

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

311.2 MATERIAL REQUIREMENTS

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

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

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

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

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

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

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

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

Table 311.1 – Grading Requirements for Fine Aggregate

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

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

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

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

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

If the slag is used, its density shall not be less than 1120 kg/m^3 (70 lb./cu. ft.). The gradation of the coarse aggregate shall conform to Table 311.2.

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

Table 311.2 – Grading Requirement for Coarse Aggregate

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

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

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

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

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

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

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

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

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

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

311.2.8 Curing Materials

Curing materials shall conform to the following requirements as specified;

a) Burlap cloth - AASHTO M 182

b) Liquid membrane forming compounds - AASHTO M 148

c) Sheeting (film) materials - AASHTO M 171

Cotton mats and water-proof paper can be used.

311.2.9 Calcium Chloride/Calcium Nitrate. It shall conform to AASHTO M 144, if specified or permitted by the Engineer, as accelerator.

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

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

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

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

It is the intent of this Specification to require at least 364 kg of cement per cubic meter of concrete to meet the minimum strength requirements.The Engineer shall determine from laboratory tests of the materials to be used, the cement content and the proportions of aggregate and water that will produce workable concrete having a slump of between 40 and 75 mm (1-1/2 and 3 inches) if not vibrated or between 10 and 40 mm (1/2 and 1-1/2 inches) if vibrated, and a flexural strength of not less than 3.8 MPa (550 psi) when tested by the third-point method or 4.5 MPa (650 psi) when tested by the mid-point method at fourteen (14) days in accordance with AASHTO T97 and T177, respectively; or a compressive strength of 31.0 MPa (4500 psi) for cores taken at fourteen (14) days and tested in accordance with AASHTO T24. Slump shall be determined using AASHTO T119.

The designer shall consider the use of lean concrete (econocrete) mixtures using local materials or specifically modified conventional concrete mixes in base course and in the lower course composite, monolithic concrete pavements using a minimum of 75 mm (3 inches) of conventional concrete as the surface course.

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

311.3 CONSTRUCTION REQUIREMENTS

311.3.1 Quality Control of Concrete

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

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

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 nonresettable 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 ing 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 of base has been placed and compacted to the required density, the areas which will support the paving machine and the grade on which the pavement is to be constructed shall be trimmed to the proper elevation by means of a properly designed machine extending the prepared work areas compacted at least 60 cm beyond each edge of the proposed concrete pavement. If loss of density results from the trimming operations, it shall be restored by additional compaction before concrete is placed. If any traffic is allowed to use the prepared 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 bv 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 over than one (1) percent. Unless the water is to be weighed, the water-measuring equipment shall include an auxiliary tank from which the measuring tank shall be equipped with an outside tap and valve to provide checking the setting, unless other means are provided for readily and accurately determining the amount of water in the tank. The volume of the auxiliary tank shall be at least equal to that of the measuring tank.

311.3.7 Mixing Concrete. The concrete may be mixed at the site of the work in a central-mix plant, or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time will be measured from the time all materials, except water, are in the drum. Ready-mixed concrete shall be mixed and delivered in accordance with requirements of AASHTO M 157, except that the minimum required revolutions at the mixing speed for transit-mixed concrete may be reduced to not less than that recommended by the mixer manufacturer.

The number of revolutions recommended by the mixer manufacturer shall be indicated on the manufacturer's serial plate attached to the mixer. The Contractor shall furnish test data acceptable to the Engineer verifying that the make and model of the mixer will produce uniform concrete conforming to the provision of AASHTO M 157 at the reduced number of revolutions shown on the serial plate.

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

Four (4) seconds shall be added to the specified mixing time if timing starts at the instant the skip reaches its maximum raised positions. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

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

The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic 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 non-agitating trucks, nor ninety (90) minutes when hauled in truck mixers or truck agitators, except that in hot weather or under other conditions contributing to quick hardening of the concrete, the maximum allowable time may be reduced by the Engineer.

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

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

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 90^0F (32^0C)

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.Retempering of concrete or mortar which has partially hardened, that is remixing with or without additional cement, aggregate, or water, shall not be permitted.

In order that the concrete may be properly protected against the effects of rain before the

concrete is sufficiently hardened, the Contractor will be required to have available at all times materials for the protection of the edges and surface of the unhardened concrete.

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

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

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

Concrete shall be deposited as near as possible to the expansion and contraction joints without disturbing them, but shall not be dumped from the discharge bucket or hopper into a joint assembly unless the hopper is well centered on the joint assembly. Should any concrete material fall on or be worked into the surface of a complete slab, it shall be removed immediately.

311.3.10 Test Specimens. As work progresses, at least one (1) set consisting of three (3) concrete beam test specimens, 150 mm x 150 mm x 525 mm or 900 mm shall be taken from each 330 m^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 AASHTO T 23 and T 97.

311.3.11 Strike-off of Concrete and Placement of Reinforcement. Following the placing of the concrete, it shall be struck off to conform to the cross-section shown on the Plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement will be at the elevation shown on the Plans. When reinforced concrete pavement is placed in two (2) layers, the bottom layer shall be struck off and consolidated to such length and depth that the sheet of fabric or bar mat may be laid full length on the

concrete in its final position without further manipulation.

The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off and screeded.

Any portion of the bottom layer of concrete which has been placed more 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, or in lieu of bent tie bars, approved two-piece connectors may be used.

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

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

Longitudinal sawed joints shall be cut by means of approved concrete saws to the depth, width and line shown on the Plans. Suitable guide lines or devices shall be used to assure cutting the longitudinal joint on the true line.

The longitudinal joint shall be sawed before the end of the curing period or shortly thereafter and before any equipment or vehicles are allowed on the pavement.The sawed area shall be thoroughly cleaned and, if required, the joint shall immediately be filled with sealer.

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

2. Transverse Expansion Joint. The expansion joint filler shall be continuous from form to form, shaped to subgrade and to the keyway along the form.

Preformed joint filler shall be furnished in lengths equal to the pavement width or equal to the width of one lane.Damaged or repaired joint filler shall not be used. The expansion joint filler shall be held in a vertical position.

An approved installing bar, or other device, shall be used if required to secure preformed expansion joint filler at the proper grade and alignment during placing and finishing of the concrete.

Finished joint shall not deviate more than 6 mm from a straight line.If joint fillers are assembled in sections, there shall be no offsets between adjacent units. No plugs of concrete shall be permitted anywhere within the expansion space.

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

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

b. Formed Groove. It shall be made by depressing an approved tool or device into

the plastic concrete. The tool or device shall remain in place at least until the concrete has attained its initial set and shall then be removed without disturbing the adjacent concrete, unless the device is designed to remain in the joint.

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

After each joint is sawed, it shall be thoroughly cleaned including the adjacent concrete surface.

Sawing of the joint shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive 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 (1/4 inch), of the dowel, with a watertight closed end and with a suitable stop to hold the end of the sleeves at least 25 mm (1 inch) from the end of the dowel.

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

311.3.13 Final Strike-off (Consolidation and Finishing)

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

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

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

After the concrete has been placed and vibrated adjacent to the joints as required in Subsection 311.3.9, the finishing machine shall be brought forward, operating in a manner to avoid damage or misalignment of joints. If uninterrupted operation of the finishing machine, to over and beyond the joints causes segregation of concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the front screed is approximately 20 cm (8 inches) from the joint.Segregated concrete shall be removed from in front of and off the joint. The front screed shall be lifted and set directly on top of the joint and the forward motion of the finishing machine resumed. When the second screed is close enough to permit the excess mortar in front of it to flow over the joint, it shall be lifted and carried over the joint. Thereafter, the finishing machine may be run over the joint without lifting the screeds, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

3. Machine Finishing

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

During the first pass of the finishing machine, a uniform ridge of concrete shall be

maintained ahead of the front screed in its entire length.

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

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

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

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

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

The screed for the surface shall be at least 60 cm (2 feet) longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and constructed either of metal or other suitable material shod with metal.

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

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

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

a. **Hand Method**. The hand-operated longitudinal float shall be not less than 365 cm (12 feet) in length and 15 cm (6 inches) in width, properly stiffened to prevent flexibility and warping. The longitudinal float, operated from foot bridges resting on the side forms and spanning but not touching the concrete, shall be worked with a sawing motion while held in a floating position parallel to the road center line, and moving gradually from one side of the pavement to the other. Movement ahead along the center line of the pavement shall be in successive advances of not more than one-half the length of the float. Any excess water or soupy material shall be wasted over the side forms on each pass.

b. **Mechanical Method**. The mechanical longitudinal float shall be of a design approved by the Engineer, and shall be in good working condition. The tracks from which the float operates shall be accurately adjusted to the required crown. The float shall be accurately adjusted and coordinated with the adjustment of the transverse finishing machine so that a small amount of mortar is carried ahead of the float at all times. The forward screed shall be adjusted so that the float will lap the distance specified by the Engineer on each transverse trip. The float shall pass over each 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 (5 feet) in length and 15 cm (6 inches) in width may be used to smooth and fill in open- textured areas in the pavement. Long-handled floats shall not be used to float the entire surface of the pavement in lieu of, or supplementing, one of the preceding methods of floating. When strike off and consolidation are done by the hand method and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of the long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance shall be removed from the surface of the pavement by a 3-m straight-edge or more in length. Successive drags shall be lapped one-half the length of the blade.

6. Straight-edge Testing and Surface Correction. After the floating has been completed and the excess water removed, but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a 300 cm long straight-edge. For this purpose, the Contractor shall furnish and use an accurate 300-cm straight-edge swung from handles 100 cm (3 feet) longer than one-half the width of the slab. The straight-edge shall be held in contact with the surface in successive positions parallel to the road center line and the whole area gone over from one side of the slab to the other as necessary. Advances along the road shall be in successive stages of not more than one-half the length of the straight- edge. Any depressions found shall be immediately filled with freshly mixed concrete, struck off, consolidated and refinished. High areas

shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straight-edge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straight-edge and the slab conforms to the required grade and cross-section.

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

If the surface texture is belt finished, when straight-edging is complete and water sheen has practically disappeared and just before the concrete becomes non-plastic, the surface shall be belted with 2- ply canvass belt not less than 20 cm wide and at least 100 cm longer than the pavement width. Hand belts shall have suitable handles to permit controlled, uniform manipulation. The belt shall be operated with short strokes transverse to the center line and with a rapid advances parallel to the center line.

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

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

Any area or section so removed shall be not less than 1.5 m in length and not less than the full width of the lane involved.When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 1.5 m in length, shall also be removed and replaced.

311.3.15 Curing. Immediately after the finishing operations have been completed and the concrete has sufficiently set, the entire surface of the newly placed concrete shall be cured in accordance with either one of the methods described herein.

Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or the lack of water to adequately take care of both curing and other requirements, shall be a cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than ½ hour between stages of curing or during the curing period.

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

1. Cotton 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 m^2 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 shapesand concrete surface exposed by the removal of forms will be permitted. Curing compound shall not be applied to the inside faces of joints to be sealed, but approved means shall be used to insure proper curing at least 72 hours and to prevent the intrusion of foreign material into the joint before sealing has been completed.The curing compound shall be of such character that the film will harden within 30 minutes after application.Should the film be damaged from any cause within the 72 hour curing period, the damaged portions shall be repaired immediately with additional compound.

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. After forms for concrete shall remain in place undisturbed for not less than twenty four (24) hours after concrete pouring.In the removal of forms, crowbars should be used in pulling out nails and pins.Care should be taken so as not to break the edges of the pavement.In case portions of the concrete are spalled, they shall be immediately repaired with fresh mortar mixed in the proportion of one part of Portland Cement and two parts fine aggregates.

Major honeycomb areas will be considered as defective work and shall be removed and replaced at the expense of the Contractor. Any area or section so removed shall not be less than the distance between weakened plane joint nor less than the full width of the lane involved.

311.3.17 Sealing Joints. Joints shall be sealed with asphalt sealant soon after completion of the curing period and before the pavement is opened to traffic, including the Contractor's equipment.Just prior to sealing, each joint shall be thoroughly cleaned of all foreign materials including membrane curing compound and the joint faces shall be clean and surface dry when the seal is applied.

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

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

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

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

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

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

311.3.19 Concrete Pavement – Slip Form Method

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

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

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

The concrete shall be held at a uniform consistency, having a slump of not more than 40 mm (1-12/ inches).The slip form paver shall be operated with as nearly as possible a

continuous forward movement and that all operations of mixing, delivering and spreading concrete shall be coordinated so as to provide uniform progress with stopping and starting of the paver held to a minimum.If, for any reason, it is necessary to stop the forward movement of the paver the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

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

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

5. Joints. All joints shall be constructed in accordance with Subsection 311.3.12.

6. Protection Against Rain. In order that the concrete may be properly protected against rain before the concrete is sufficiently hardened, the Contractor will be required to have available at all times, materials for the protection of the edges and surface of the unhardened concrete. Such protective materials shall consist of standard metal forms or wood planks having a nominal thickness of not less than 50 mm (2 inches) and a nominal width of not less than the thickness of the pavement at its edge for the protection of the pavement edges, and covering material such as burlap or cotton mats, curing paper or plastic sheeting materials for the protection of the surface of the pavement.When rain appears imminent, all paving operations shall stop and all available personnel shall begin placing forms against the sides of the pavement and covering the surface of the unhardened concrete with the protective covering.

311.3.22 Acceptance of Concrete

The strength level of the concrete will be considered satisfactory if the averages of all sets of three (3) consecutive strength test results equal or exceed the specified strength, f_c' and no individual strength test result is deficient by more than 15% of the specified strength, f_c'.

Concrete deemed to be not acceptable using the above criteria may be rejected unless the Contractor can provide evidence, by means of core tests, that the quality of concrete represented by failed test results is acceptable in place. At least three (3) representative cores shall be taken from each member or area of concrete in place that is considered deficient.

The location of cores shall be determined by the Engineer so that there will be at least impairment of strength of the structure.The obtaining and testing of drilled cores shall be in accordance with AASHTO T 24.

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

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

Deficiency in Strength of Concrete Specimens, Percent (%)	Percent (%) of Contract Price Allowed
Less than 5	100
5 to less than 10	80
10 to less than 15	70
15 to less than 20	60
20 to less than 25	50
25 or more	0

311.3.23 Opening to Traffic

The Engineer will decide when the pavement may be opened to traffic. The road will not be opened to traffic until test specimens molded and cured in accordance with AASHTO T 23 have attained the minimum strength requirements in Subsection 311.2.11. If such tests are not conducted prior to the specified age the pavement shall not be operated to traffic until 14 days after the concrete was placed. Before opening to traffic, the pavement shall be cleaned and joint sealing completed.

311.3.24 Tolerance and Pavement thickness

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

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

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

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

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

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

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

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

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

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

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

311.4 Method of Measurement

The area to be paid for under this Item shall be the number of square meters (m^2) of concrete pavement placed and accepted in the completed pavement. The width for measurements will be the width from outside edge to outside edge of completed pavement as placed in accordance with the Plans or as otherwise required by the Engineer in writing. The length will be measured horizontally along the center line of each roadway or ramp. Any curb and gutter placed shall not be included in the area of concrete pavement measured.

311.5 Basis of Payment

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

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
311 (1)	PCC Pavement (Plain)	Square meter
311 (2)	PCC Pavement (Reinforced)	Square meter

ITEM 400 – PILING

400.1 Description

400.1.1 Scope

This Item shall consist of piling, furnished, driven or placed, cut and spliced in accordance with this Specification and in reasonably close conformity with the Plans.

The Contractor shall furnish the piles in accordance with an itemized list, which will be provided by the Engineer, showing the number and lengths of all piles. When cast-in-place concrete piles are specified on the Plans, the Engineer will not furnish the Contractor an itemized list showing the number and length of piles.

When test piles and load tests are required in conformance with Sub- section 400.1.2 and 400.1.3, respectively, the data obtained from driving test piles and making test loads will be used in conjunction with other available sub-soil information to determine the number and lengths of piles to be furnished. The Engineer will not prepare the itemized list of piles for any portion of the foundation area until all specified loading tests in the Contract representative of the portion have been completed.

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

400.1.2 Test Piles

For his own information, the Contractor may drive at the location of the regular piles indicated on the Plans such test piles as he may consider necessary in addition to the test piles specified in the Contract and shall be considered as regular piles. When called for in the Bill of Quantities, a pile if required to be subjected to load test shall conform to the provision as provided in Subsection 400.1.3, Load Tests. The Contractor shall furnish and drive test piles of the dimensions and at the locations designated by the Engineer. They shall be of the material shown in the Bill of Quantities and shall be driven to refusal or to such tip elevation or approximate bearing value as the Engineer may request. Test piles shall be driven with the same hammer that is used for driving foundation piles.

When the Engineer requests a load test to determine a bearing value, the first load test pile shall be driven to the specified bearing value as determined by the applicable formula in Subsection 400.1.4 for Timber Pile Bearing Value by Formula. Subsequent test piles to be load-tested shall be driven to the specified bearing value as determined by the applicable formula modified by the results of prior test loads and foundation data.The ground at

each test pile shall be excavated to the elevation of the bottom of the footing before the pile is driven.

400.1.3 Load Tests

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

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

400.1.3.1 Static Testing

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

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

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

Each load increment shall be held for an interval of two and one-half minutes. Each succeeding increment shall be as directed by the Engineer or as shown on the Plans and shall be applied immediately after the two and one-half minute interval readings have been made.

When a load-settlement curve obtained from these data shows that the pile has failed; i.e., the load can be held only by the constant pumping and the pile or shaft is being driven into the ground, pumping shall cease. Gross settlement readings, loads and other data shall be recorded immediately after pumping has ceased and again after an interval of two

and one-half minutes for a total period of five (5) minutes. All loads shall then be removed and the member allowed to recover. Gross settlement readings shall be made immediately after all loads have been removed and at each interval of two and one-half minutes for a total period of five (5) minutes.

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

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

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

400.1.3.2 Pile Testing

Pile testing shall be done by Low-Strain Dynamic Method, High-Strain Dynamic Method or Cross-Hole Sonic Logging Method as required in the plans or as directed by the Engineer.

400.1.3.2.1 Low-Strain dynamic Method

Pile integrity testing by Low-Strain Dynamic Method shall conform to ASTM D-5882-96. It is a so-called Low Strain Method, since it requires the impact of only a small hand-held hammer, and also referred to as a Non-Destructive Method.

400.1.3.2.2 High-Strain Dynamic Testing

Pile Integrity testing by High-Strain Dynamic Method shall conform to ASTM D4945-97. High-Strain Dynamic Method shall be applied to confirm the design parameters and capacities assumed for the piles as well as to confirm the normal integrity of testing of the piles. It is considered supplemental to the low- strain and sonic-type integrity testing of the cast-in-place piles. It is a non- destructive relatively quick test and it is intended that the test shaft be left in a condition suitable for use in production. The shaft used for the test will be instrumented and tested by the testing specialist, as approved by the Engineer, meeting requirements in accordance to ASTM D4945-97.

400.1.3.2.3 Cross-Hole Sonic Logging of Bored Holes

By sending ultrasonic pulses through concrete from one probe to another (probes located in parallel tubes), the Cross-hole Sonic Logging (CSL) procedure inspects the drilled shaft structural integrity, and extent and location of defects, if any.At the receiver probe, pulse arrival time and signal the concrete affects strength. For equidistant tubes, uniform concrete yields consistent arrival times with reasonable pulse wave speed and signal strengths. Non – uniformities such as contamination, soft concrete, honey combing, voids, or intrusions of foreign objects exhibit delayed arrival time with reduced signal strength.

400.1.4 Timber Pile Bearing Value by Formula

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When load tests are called for in the Bill of Quantities and when diesel or other hammers to be calibrated are used, the minimum number of hammer blows per unit of pile penetration needed to obtain the specified bearing value of piles shall be determined by load tests, as provided in Subsections 400.1.2 and

400.1.3. In the absence of load tests, the safe bearing value of each timber pile shall be determined by whichever of the following approximate formulas is applicable:

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

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

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

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

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

For diesel or steam hammers on very heavy piles,

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

Where:

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

The above formula are applicable only when:

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

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

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

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

400.1.5 Concrete and Steel Pile Bearing Values

The bearing values for concrete and steel pile will be determined by the

Engineer using the following formulas:

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

$$Ru = \frac{2WH\,(W)}{(S+K)\,(W+Wp)}$$

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

Where:

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

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

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

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

Where:

Ru = ultimate capacity of pile (KN)
Ra = capacity of pile (KN)

Ef	=	efficiency of hammer (refer to table)
W	=	weight of ram (KN)
Wp	=	weight of pile (KN)
H	=	height of fall of ram (mm)
S	=	average penetration for last ten blows (mm)
C1	=	temporary compression allowance for pile head and cap (refer to table)
C2	=	RuL/AEp
C3	=	range from 2.54mm to 5.08mm (0.1" to 0.2") for resilient soil to 0 for hard pan (rock, very dense sand and gravel)
L	=	length of pile
A	=	cross-sectional area of pile
Ep	=	modulus of elasticity of pile
N	=	coefficient of restitution (refer to table)
FS	=	factor of safety (min. = 3)

Required minimum penetration of all piles shall be six (6) meters. However, for exposed piles, the embedded length shall be equal or greater than the exposed length but not less than 6.0m**.**

Note:

Formula for other pile hammers with suggested factor of safety should be as provided/recommended by their respective manufacturer.

Values of C1 for Hiley Formula

Temporary Compression Allowance C1 for Pile Head and Cap

Materials to which blow is applied	Easy Driving: P1 = 3.45 MPa (500 psi) on Pile Butt If	Medium Driving: P1 = 6.90 MPa (1000 psi) on Head or Cap. mm (in.)	Hard Driving: P1 = 10.34 MPa (1500 psi) on Head or Cap. mm (in.)	Very Hard Driving: P1 = 13.88 MPa (2000 psi)
Head of timber pile	1.27 (0.05)	2.54 (0.10)	3.81 (0.15)	5.08 (0.20)
76–100mm (3-4 in.) packing inside cap on head of precast concrete piles Concrete Pile	1.27 + 1.778[b] (0.05 + 0.07)[b]	2.54 + 3.81[b] (0.10 + 0.15)[b]	3.81 + 5.588[b] (0.015 + 0.22)[b]	5.08 + 7.62[b] (0.20 + 0.30)[b]
Steel-covered cap. containing wood packing but steel piling at pipe	0.635 (0.025)	1.27 (0.05)	1.905 (0.075)	2.54 (0.10)
4.76mm (3/16 in.) red electrical tuber disk between two 10mm (3/8") steel plates, for use with severe driving on	1.016 (0.04)	2.032 (0.08)	3.048 (0.12)	4.064 (0.16)

[b] The first figure represent the compression of the cap and wood dolly or packing above the cap, whereas the second figure represent the compression of the wood packing between the cap and the pile head.

P1 = Ru/A

Values of Efficiency of Hammer, ef

Hammer Type	ef
Drop Hammer released by trigger	1.00
Drop Hammer actuated by rope and friction winch	0.75
McKiernan-Terry Single-acting hammers	0.85
Warrington-Vulcan Single –acting hammers	0.75
Differential-acting hammers	0.75
McKiernan-Terry, Industrial B. Ownhoist, National and Union double-acting hammers	0.85
Diesel Hammers	1.00

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

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

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

400.1.6 Safe Loads

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

400.1.7 Jetted Piles

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

400.2 Material Requirements

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

400.2.1 Untreated Timber Piles

Timber shall conform to the requirements of Item 713, Treated and Untreated Timber. The specie shall be specified on the Plans. Unless otherwise noted on the Plans or Special Provisions, only the best grade shall be used. It shall be free from loose knots, splits, wormholes, decay, warp, ring separation or any defect which will impair its strength or render it unfit for its intended use. Any specie specified on the Plans may be used for untreated timber and if the specie is not available, a specie of equivalent strength and durability may be used if authorized by the Engineer.

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

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

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

The pile sizes shall conform to the dimensions shown in Table 400.1.

Table 400.1 – Dimension of Piles

Length of Pile	Diameter (1 metre from the Butt)		Minimum Tip Diameter, mm
	Minimum mm	Maximum mm	
Less than 12 metres	300	450	200
12 to 18 metres	320	450	180
More than 18 metres	350	500	150

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

possible.

Square piles shall have the dimensions shown on the Plans.

400.2.2 Treated Timber Piles

Timber shall conform to the requirements of Item 713, Treated and Untreated Timber. Treatment shall consist of the forcing of either creosote oil or creosote petroleum oil mixture into the outer fibers of the timber by a heat and pressure process. The process shall be in accordance with ASTM D-1760 Standard Specification for Pressure Treatment of Timber Products, but with such changes as temperatures, pressures, duration of treatment and other factors affecting the final treatment that experience has shown to be necessary in the treatment of structural timbers sawn from woods native to the Philippines. The treatment shall be so regulated that the curing process will not induce excessive checking. The minimum penetration of the preservative into the surface of the timber shall be 20 mm. All piles shall retain the minimum amount of preservative specified in Table 400.2.

Table 400.2 – Minimum Preservative Per Cubic Metre of Wood

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

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

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

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

400.2.3 Concrete Piles

Concrete shall conform to the requirements of Item 405, Structural Concrete. Concrete shall be Class "C" unless otherwise specified in the Plans.

Concrete shall be proportioned to achieve a range of 6"-8" (150 mm to 200 mm) slump, self-compacting mix.

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

Reinforcing steel shall conform to the requirements of Item 404, Reinforcing Steel. Prestressing reinforcing steel shall be high-tensile steel wire conforming to AASHTO M 204 or other high-tensile metals conforming to AASHTO Standards.

400.2.4 Steel Shells

1. Shells Driven Without a Mandrel

Unless otherwise called for on the Plans or Special Provisions, shells for cast-in-place concrete piles shall have a minimum 305mm diameter at cut off and a minimum 203mm diameter at tip: made from not less than 4.55mm in thickness plate stock conforming to AASHTO M 183. Shells may either be spirally welded or longitudinally welded and may either be tapered or constant in section. Tips shall be sealed as shown on the Plans.

2. Shells Driven With a Mandrel

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

400.2.5 Steel Pipes

Filled Steel Pipes (filled with concrete) shall conform to the requirements of ASTM A 252, Grade 2, Welded and Seamless Pipe Piles. Closure Plates for closed piles shall conform to the requirements of AASHTO M 183.

Unfilled Tubular Steel Piles shall conform to the requirements of ASTM A 252, Grade 2, with chemical requirements meeting ASTM Designation A 53, Grade B. The wall thickness shall not be less than 4.76mm.

400.2.6 Steel H-Piles

Steel H-Piles shall be rolled steel sections of the weight and shape called for on the Plans. They shall be structural steel meeting the requirements of AASHTO M 183 provided that, where the Special Provisions called for copper-bearing structural steel, the steel shall not contain less than one-fifth percent nor more than zero point thirty five percent (0.35%) of copper, except that steel manufactured by the acid-bessemer process shall not be used.

400.2.7 Sheet Piles

Steel sheet piles shall meet the requirements of AASHTO M 202 (ASTM A 328), or AASHTO M 223. All other sheet piles shall meet the requirements prescribed above the particular material specified. The joints shall be practically water-tight when the piles are in place.

400.2.8 Pile Shoes

Pile shoes shall be as called for on the Plans.

400.2.9 Splices

Material for pile splices, when splicing is allowed, shall be of the same quality as the material used for the pile itself and shall follow the requirements given on the Plans.

400.2.10 Paint

It shall conform to Item 709, Paints.

400.3 Construction Requirements

400.3.1 Location and Site Preparation

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

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

400.3.2 Determination of Pile Length

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

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

1. Piles in sand and gravel shall be driven to a bearing power determined by the use of the pile driving formula or as decided by the Engineer.
2. Piles in clay shall be driven to the depth ordered by the Engineer. However, the bearing power shall be controlled by the pile driving formula if called for by the Engineer.
3. Piles shall be driven to refusal on rock or hard layer when so ordered by the Engineer.

The Contractor shall be responsible for obtaining the correct pile length and bearing capacity according to the criteria given by the Engineer.

400.3.3 Pile Driving

All piles shall be driven as shown on the Plans or as ordered in writing by the Engineer. They shall be driven within an allowed variation of 20mm per metre of pile length from the vertical or batter as shown on the Plans. The maximum allowable variation at the butt end of the pile shall be 75mm in any direction from the location shown on the Plans or as directed by the Engineer. Each pile shall, after driving, be within 150mm from the theoretical location underneath the pile cap or underneath the superstructure in case of pile bents. All piles pushed up by the driving of adjacent piles or any other cause shall be redriven.

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

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

The plant and equipment furnished for steam hammers shall have sufficient capacity to maintain, under working condition, the pressure at the hammer specified by the manufacturer. The boiler or pressure tank shall be equipped with an accurate pressure gauge and another gauge shall be supplied at the hammer intake to determine the drop in pressure between the gauges. When diesel hammers or any other types requiring calibration are used, they shall be calibrated with test piling and/or test loads in accordance with Subsection 400.1.2, Test Piles.

Water jets shall be used only when permitted in writing by the Engineer. When water jets are used, the number of jets and the nozzle volume and pressure shall be sufficient to erode freely the material adjacent to the pile. The plant shall have sufficient capacity to deliver at all time a pressure equivalent to at least 690 KPa at two 19 mm (3/4 inch) jet nozzles. The jets shall be shut off before the required penetration is reached and the piles shall be driven solely by hammers to final penetration as required by the Engineer.

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

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

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

Full length piles shall be used where practicable. Splicing of piles when permitted, shall be in accordance with the provisions of Subsection 400.3.7 and 400.3.8. All piles shall be continuously driven unless otherwise allowed by the Engineer.

Piles shall not be driven within 7 m of concrete less than 7 days old.

400.3.4 Timber Piles

Piles shall be strapped with three metal straps: one about 450mm from the butt,

one about 600mm from the butt, and the third, about 300mm from the tip. Additional straps shall be provided at about 4.5m on centers between tip and butt. Strapping should encircle the pile once and be tensioned as tightly as possible. Straps shall be 38mm wide, 0.8mm thick, cold rolled, fully heat treated, high tensile strapping, painted and waxed.

Treated piles shall be strapped after treatment.

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

400.3.5 Timber Pile Bents

Piles for any one bent shall be carefully selected as to size, to avoid undue bending or distortion of the sway bracing. Care shall be exercised in the distribution of piles of various sizes to obtain uniform strength and rigidity in the bents of any given structure.

Cut offs shall be made accurately to insure full being between caps and piles of bents.

400.3.6 Precast Concrete Piles

Precast concrete piles shall be of the design shown on the Plans. Prestressed concrete piles shall be prestressed as prescribed in Item 406, Prestressed Concrete Structures. The piles shall be cast separately and concrete in each pile shall be place continuously. The completed piles shall be free from stone pockets, honeycombs, or other defects, and shall be straight and true to the form specified. The forms shall be true to line and built of metal, plywood or dressed lumber. A 25mm chamfer strip shall be used in all corners. Form shall be water-tight and shall not be removed until at least twenty-four (24) hours after the concrete is placed.

Piles shall be cured and finished in accordance with Items 405, Structural Concrete and 406, Prestressed Concrete Structures.

Cylinder specimens shall be made and tested in accordance with Item 405. Piles shall not be moved until the tests indicate that the concrete has attained a compressive strength of at least 80 percent (80%) of the design 28-day compressive strength and they shall not be transported or driven until the design

28-day compressive strength has been attained.

If testing equipment is not available, as in isolated areas, piles shall not be moved

until after fourteen (14) days after casting and shall not be transported or driven prior to 28 days after casting. If high early strength cement is used, piles shall not be moved, transported or driven prior to 7 days after casting.

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

400.3.7 Cast-in-place Concrete Piles

1. Drilled Holes

All holes for concrete piles cast in drilled holes shall be drilled dry to tip elevation shown on the Plans. All holes will be examined for straightness and any hole which on visual inspection from the top shows less than one-half the diameter of the hole at the bottom of the hole will be rejected. Suitable casings shall be furnished and placed when required to prevent caving of the hole before concrete is placed.

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

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

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

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

2. Steel Shells and Pipes

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

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

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

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

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

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

3. Drilled Shafts

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

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

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

Effects of ground and ground water conditions on shaft construction operations should be considered and delineated, when necessary, the general method of construction to be followed to ensure the expected performance. Because shafts derive their capacity from side and tip resistance which are a function of the condition of the materials in direct contact with the shaft, it is important that the construction procedures be consistent with the material conditions assumed in the design. Softening, loosening or other changes in soil and rock conditions caused by the construction method could result in a reduction in shaft capacity and an increase in

shaft displacement. Therefore, evaluation of the effects of shaft construction procedure on load capacity must be considered an inherent aspect of the design.

Drilled shafts are normally sized in 15.24cm (6-inch diameter increments with a minimum diameter of 45.72cm (18”). The diameter of a shaft socketed into rock should be a minimum of 15.24cm (6”) larger than the socket diameter. If a shaft must be inspected by the entry of a person, the shaft diameter shall not be less than 76.20cm (30”).

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

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

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

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

a. The construction of the pile or shaft in a wet condition while the walls of the excavation are stabilized by hydrostatic pressure of water or a mineral slurry until the concrete is placed by tremie methods for the full length of the pile.

Mineral slurry used in the drilling process shall have both a mineral grain size that will remain in suspension and sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system. The percentage and specific gravity of the material used to make the suspension shall be sufficient to maintain the stability of

the excavation and to allow proper concrete placement. The level of the slurry shall be maintained at a height sufficient to prevent caving of the hole.

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

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

Range of Values (At 20^{O} [68^{O}F])

Property (Units)	Time of Slurry Introduction	Time of Concreting (In Hole)	Test Method
Density (KN/m^3) (pcf)	10.10 to 10.86 64.3 to 69.1	10.10 to 11.79 64.3 to 75.0	Density Balance
Viscosity (sec. per quart)	28 to 45	28 to 45	Marsh Cone
pH	8 to 11	8 to 11	pH Paper or Meter

Note:

a) Increase density values by 0.314 KN/m^3 (2 pcf) in salt water.

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

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

Prior to placing shaft concrete, slurry samples shall be taken from the bottom and at intervals not exceeding 3.05m (10 feet) for the full height of slurry. Any heavily contaminated slurry that has accumulated at the bottom of the shaft shall be eliminated. The mineral slurry shall be within specification requirements immediately

before shaft concrete placement.

Excavation Inspection

The Contractor shall provide equipment for checking the dimensions and alignment of each shaft excavation. The Contractor under the direction of the Engineer shall determine the dimensions and alignment of the drilled shaft. Final shaft depth shall be measured after final cleaning.

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

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

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

Casing, if used in operation, shall be metal, smooth, clean, watertight, and of ample strength to withstand both handling and driving stresses and the pressure of both concrete and the surrounding earth materials. The outside diameter of casing shall not be less than the specified size of the shaft. It shall conform to AASHTO M 270 (ASTM A 709) Grade 36 unless otherwise specified.

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

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

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

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

Reinforcing Steel Cage Construction and Placement

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

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

The reinforcing steel in the hole shall be tied and supported so that the reinforcing steel will remain within allowable tolerances until the concrete will support the reinforcing steel. When concrete is placed by suitable tubes, temporary hold-down devices shall be used to prevent uplifting of the steel cage during concrete placement. Concrete spacers or other approved noncorrosive spacing devices shall be used at sufficient intervals not exceeding 1.50 meters along the shaft to insure concentric location of the cage within the shaft excavation. When the size of the longitudinal reinforcing steel exceeds 25mm, such spacing shall not exceed 3.0 meters.

Concrete Placement, Curing and Protection

Concrete shall be placed as soon as possible after reinforcing steel cage placement. Concrete placement shall be continuous in the shaft to the top elevation of the shaft. Placement shall continue after the shaft is full until good quality concrete is evident at the top of the shaft. Concrete shall be placed through a suitable tube.

For piles less than 2.5 meters in diameter, the elapsed time from the beginning of concrete placement in the shaft to the completion of placement shall not exceed 2 hours. For piles 2.50 meters and greater in diameter, the concrete placing rate shall not be less than 9.0 meters of pile height per each 2-hour period. The concrete mix shall be of such design that the concrete remains in a workable plastic state throughout the 2-hour placement limit.

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

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

After placement, the temporarily exposed surfaces of the shaft concrete shall

be cured in accordance with the provision in Sub-section 407.3.8 – Curing Concrete.

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

Construction Tolerances:

The following tolerances shall be maintained in constructing drilled shaft.

a. The drilled shaft shall be within 7.62cm (6") of the plan position in the horizontal plane at the plan elevation for the top of the shaft.

b. The vertical alignment of the shaft excavation shall not vary from the plan alignment by more than 20.83 mm/m (1/4 inch per foot) of depth.

c. After all the shaft concrete is placed, the top of the reinforcing steel cage shall be no more than 15.24 cm (6") above and no more than 7.62 cm (3") below plan position.

d. When casing is used, its outside diameter shall not be less than the shaft diameter shown on the plans. When casing is not used, the minimum diameter of the drilled shaft shall be the diameter shown on the plans for diameters 60.96 cm (24") or less, and not more than 2.54 cm (1 inch) less than the diameter shown on the plans for diameters greater than 60.96 cm (24").

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

f. The top elevation of the shaft shall be within 2.54 cm (1 inch) of the plan top of shaft elevation.

g. The bottom of the shaft excavation shall be normal to the axis of the shaft within 62.5 mm/m (3/4 inch per foot) of shaft diameter.

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

400.3.8 Steel H-Pile

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

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

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

400.3.9 Unfilled Tubular Steel Piles

The tubular steel piles should be or as specified by the Engineer.

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

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

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

400.3.10 Splicing

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

1. Precast Concrete Piles

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

   b. By cutting away the concrete at the end of the pile, leaving the reinforcing steel exposed for a length of 40 bar diameters for corrugated or deformed bars and 60 bar diameters for plain bars. The final cut of the concrete shall be perpendicular to the axis of the pile. Reinforcement of the same size as that used in the pile shall be spliced to the projecting steel in accordance with Item 404, Reinforcing Steel, and the necessary formwork shall be placed, care being taken to prevent leakage

along the pile. The concrete shall be of the same quality as that used in the pile. Just prior to placing concrete, the top of the pile shall be wetted thoroughly and covered with a thin coating of neat cement, retempered mortar, or other suitable bonding material to the satisfaction of the Engineer. The forms shall remain in place not less than seven (7) days. The pile shall not be driven until the safe design has been reached.

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

2. Prestressed Piles

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

3. Steel Piles, Shells or Pipes

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

400.3.11 Cutting Off and Capping Piles

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

Concrete piles shall, when approved by the Engineer, be cut off at such a level that at least 300mm of undamaged pile can be embedded in the structure above. If a pile is damaged below this level, the Contractor shall repair the pile to the satisfaction of the Engineer. The longitudinal reinforcement of the piles shall be embedded in the structure above to a length equal to at least 40 times the diameter of the main reinforcing corrugated bars (60 diameters for plain bars). The distance from the side of any pile to the nearest edge of the cap shall not be less than 200mm.

When the cut off elevation for a precast pile or for the steel shell or pile for a cast in place concrete pile is below the elevation of the bottom of the pile cap, the pile may be built-up from the butt of the pile to the elevation of the bottom of the cap by

means of reinforced concrete extension constructed in accordance with Subsection 400.3.10 or as approved by the Engineer.

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

400.3.12 Defective Piles

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

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

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

3. The pile shall be spliced or built-up as otherwise provided herein on the underside of the footing lowered to properly embed the pile.

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

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

400.3.13 Protecting Untreated Timber Trestle Piles

The heads of untreated piles shall be treated as follows:

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

400.3.14 Protecting Treated Timber Trestle Piles

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

400.3.15 Painting Steel Piles

Unless otherwise provided, when required steel piles extend above the ground surface or water surface, they shall be protected by paint as specified for cleaning and painting metal surfaces in accordance with Item 403, Metal Structures. This protection shall extend from the elevation shown on the Plans to the top of the exposed steel.

400.3.16 Pile Records

The Contractor shall keep records of all piles driven or installed. A copy of the record shall be given to the Engineer within two (2) days after each pile is driven. The record form to be used shall be approved by the Engineer. The pile records shall give full information on the following:

Driven Piles	Cast-in-Place Piles
1. Pile type and dimension	1. Date of boring or driving (For steel shell) & casting
2. Date of casting and concrete quality (for concrete piles)	2. Pile type and nominal dimension
3. Date of driving	3. Length of finished pile and tip elevation
4. Driving equipment: type, weight & efficiency of hammer, etc.	4. Details of penetration during boring or driving of steel shell (driving records as for driven piles)
5. Description of cushion on pile head	5. Concrete quality and consistency
6. Depth driven and tip elevation	6. Time interval between boring or driving and concreting

7. Final set for the last 20 blows (for every 10 piles and when the Engineer so requires the penetration along the whole depth driven shall be recorded)

8. For gravity and single-acting hammers: the height of drop

9. For double acting-hammers --- the frequency of blows

10. Details of any interruption in driving

11. Level of pile top immediately after driving and the level when all piles in the group are driven

12. Details of re-driving

7. Volume of concrete placed in concrete

400.4 Method of Measurement

400.4.1 Timber, Steel and Precast Concrete Piles

1. Piles Furnished

The quantity to be paid for will be the sum of the lengths in metres of the piles of the several types and lengths ordered in writing by the Engineer, furnished in compliance with these Specifications and stockpiles in good condition at the project site by the Contractor and accepted by the Engineer.The length to be paid for will include test and tension piles ordered by the Engineer, but not those furnished by the Contractor at his option. No allowance will be made for piles, including test piles, furnished by the Contractor to replace piles previously accepted by the Engineer that are subsequently lost or damaged while in stockpile, or during handling or driving, and are ordered by the Engineer to be removed from the site of work.

In case extensions of piles are necessary, the extension length will be

included in the length of pile furnished, except for cut off lengths used for extensions and already measured for payment.

2. Piles Driven

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

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

400.4.2 Cast-In-Place Concrete Piles

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

400.4.3 Pile Shoes

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

400.4.4 Load Tests

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

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

400.4.5 Splices

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

400.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 400.4 shall be paid for at the contract unit price for each of the particular item listed below that is included in the Bill of Quantities, which price and payment shall be full compensa- tion for furnishing and placing all materials, including all labor, equipment tools and incidentals as well as temporary works, staging areas or craneway necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
400 (1)	Untreated Timber Piles, furnished	Meter
400 (2)	Treated Timber Piles, preservative, furnished	Meter
400 (3)	Steel H-Piles, furnished	Meter
400 (4)	Precast Concrete Piles, furnished	Meter
400 (5)	Precast, Prestresssed Concrete Piles, furnished	Meter
400 (6)	Structural Steel Sheet Piles, furnished	Meter
400 (7)	Precast Concrete Sheet Piles, furnished	Meter
400 (8)	Untreated Timber Piles, driven	Meter
400 (9)	Treated Timber Piles, driven	Meter
400 (10)	Steel H-Piles, driven	Meter
400 (11)	Steel Pipes Piles	Meter
400 (12)	Structural Steel Sheet Piles, driven	Meter
400 (13)	Precast Concrete Sheet Piles, driven	Meter
400 (14)	Precast Concrete Piles, driven	Meter
400 (15)	Precast, Prestresssed Concrete Piles, driven	Meter
400 (16)	Test Piles, furnished and driven	Meter
400 (17)	Concrete Piles cast in Drilled Holes	Meter
400 (18)	Concrete Piles cast in Steel Shells	Meter
400 (19)	Concrete Piles cast in Steel Pipes	Meter
400 (20)	Pile Shoes	Each
400 (21)	Splices	Each
400 (22)	Load Tests	Each
400 (23)	Bored Piles (dia. _____m)	Meter
400 (24)	Permanent Casing (dia. ____m)	Meter

ITEM 500 – PIPE CULVERTS AND STORM DRAINS

500.1 Description

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

500.2 Material Requirements

Material shall meet the requirements specified in the following specifications:

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

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

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

Rubber gaskets	AASHTO M 198

Oakum – Oakum for joints in bell and spigot pipes shall be made from hemp (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 bending but before backfilling. The vertical elongation shall be maintained by means of sills and struts or by horizontal ties shall be used on paved invert pipe.

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

These construction specifications shall also apply in the case of 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 150 mm (compacted) on both sides to an elevation 300 mm above the top of the conduit. Care shall be exercised to thoroughly compact the backfill under the haunches of the conduit. The backfill shall be brought up evenly on both sides of the conduit for the full required length. Except where negative projecting embankment-type installation is specified, the backfill material shall be placed and compacted for the full depth of the trench.

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

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

All conduits after being bedded and backfill as specified in this Subsection shall be protected by one 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 metre 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 complete in place and accepted, measured in final position between limits as follows:

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

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

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

500.5 Basis of Payment

The accepted quantities of conduit, determined as provided in Section

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

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

Concrete for Class A bedding will be paid for under Item 405, Structural Concrete.

When the Bid Schedule does not contain as estimated quantity for "Furnishing and Placing Backfill Material, Pipe Culvert" payment for placing backfill material around pipe culverts will be considered as included in the payment for excavation of the backfill material.

Payment will be made under:

Payment Item Number	Description	Unit of Measurement
500 (1)	Pipe Culverts, - mm Class -	Linear Meter
500 (2)	Storm Drain, - mm Class -	Linear Meter

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 D_{15} of the filter is at least 4 times the size D_{85} for the embankment material, where D_{15} 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 Concrete, 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 504.2.3, mortar. Sufficient mortar shall be used to completely fill all voids, 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 and abutments shall be provided with weepholes. Unless otherwise shown on the Plans or 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 the bed, 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.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
505 (1)	Riprap, Class A	Cubic Meter
505 (2)	Riprap, Class B	Cubic Meter
505 (3)	Riprap, Class C	Cubic Meter
505 (4)	Riprap, Class D	Cubic Meter
505 (5)	Grouted Riprap, Class A	Cubic Meter
505 (6)	Grouted Riprap, Class B	Cubic Meter
505 (7)	Grouted Riprap, Class C	Cubic Meter
505 (8)	Grouted Riprap, Class D	Cubic Meter
505 (9)	Filter layer of granular material	Cubic Meter

ITEM 509 – SHEET PILES

509.1 Description

This shall consist of furnishing, driving and cutting off of sheet piling covered by this Specification.

509.2 Material Requirements

509.2.1 Timber Sheet Piles

The timber, unless otherwise definitely noted on the Plans or in the Special Provisions, may consist of any species which will satisfactorily stand driving. It shall be sawn or hewn with square corners and shall be free from worm holes, loose knots, wing shakes, decay or unsound portions or other defects which might impair its strength or tightness.

509.2.2 Concrete Sheet Piles

Concrete, reinforcement, and manufacture of concrete sheet piles shall conform to the requirements of Item 400, Piling, Subsection 400.2.3, Concrete Piles.

509.2.3 Steel Sheet Piles

Steel sheet piles shall be of the type, weight and Section Modulus indicated on the Plans or Special Provisions, and shall conform to the requirement of Item 400, Piling, Subsection 400.2.7, Sheet Piles, Painting shall conform to the requirements for Item 411, Paint, Subsection 411.6.2, Painting Structural Steel.

509.3 Construction Requirements

Sheet piles shall be driven to elevation shown on the Plans or as directed by the Engineer. Where impractical to drive to plan elevation due to subsurface conditions, the driving of piles may be stopped at a higher elevation with the written permission of the Engineer. However, before granting such permission, the Engineer shall ascertain that the Contractor has adequate equipment for the required driving and that the piles can be driven to the plan elevation with the proper use of this equipment.

The top of the piling shall be driven or cut-off to a straight line at the elevation indicated on the Plans.

The requirements governing the installation of sheet piling shall conform in general to those governing bearing piles as set forth under Item 400, Piling.

509.4 Method of Measurement

Sheet piling will be measured by the linear meter of sheet piling as shown on the Plans or as directed in writing by the Engineer, complete in place and accepted. However, measurement of piling which has been delivered to plan length and cannot be driven according to plan or directed elevation because of subsurface condition shall be measured as if driven to that elevations.

509.5 Basis of Payment

Payment of steel piles as determined in Section 509.4, Method of Measurement, shall be made at the contract unit price per linear meter. Such payment shall be considered full compensation for furnishing all materials, labor, equipment, tools, paint, bolts, wales and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
509 (a)	Sheet Piles (Timber)	Linear Meter
509 (b)	Sheet Piles (Steel) Sheet Piles (Concrete)	Linear Meter
509 (c)		Linear Meter

ITEM 511 – GABIONS AND MATTRESSES

511.1 Description

This Item shall consist of furnishing, forming wire mesh baskets, and placing rocks installed at the locations designated, in accordance with this Specification and in conformity with the lines, grades, dimensions, and arrangements shown on the Plans or as directed by the Engineer.

511.2 Material Requirements

511.2.1 General

Gabions shall be constructed of wire mesh and shall be supplied in various lengths and heights. A double twisted wire mesh container of variable sizes, uniformly partitioned into internal cells, interconnected with other similar units, and filled with stones at the project site to form flexible, permeable, monolithic structures such as retaining walls, sea walls, channel linings, revetments and weirs for erosion control. The lengths shall be multiples of 2, 3 or 4 times the width of the gabion and heights shall be 0.50 m to 1.00 m or as shown on the plans. The horizontal width shall not be less than one meter. Gabion furnished shall be of uniform width.

The width, height and length of the gabion as manufactured shall not differ more than □5% from the ordered size prior to filling.

Mattresses are double twisted wire mesh container uniformly partitioned into internal cells with relatively small height in relation to other dimensions, having smaller mesh openings than the mesh used for gabions. Mattresses are generally used for riverbank protection and channel linings. The length shall be

3.00 m to 6.00 m, the width shall be 2.00 m and the height shall be 0.17 m, 0.23 m or 0.30 m or as shown on the Plans.

The width and length of the revet mattress as manufactured shall not differ more than □5%, and the height shall not differ more than □10% from the ordered size prior to filling.

511.2.2 Wire

The wire used in the manufactured of double-twisted mesh for use in gabions and mattresses shall conform to the specifications as shown below as appropriate for the style ordered.

511.2.2.1 Style 1 double-twisted mesh shall be manufactured from zinc-coated steel wire conforming to Specification ASTM A 641, Class 3 coating, soft temper.

511.2.2.2 Style 2 double-twisted mesh shall be manufactured from Zn-5A1-MM- coated steel wire conforming to Specification ASTM A 856/A 856 M, Class 3 coating, soft temper.

511.2.2.3 Style 3 double-twisted mesh shall be manufactured from the same type of metallic-coated steel wire as style 1 with an additional PVC coating extruded into the metallic-coated steel wire. The PVC coating shall conform to the following requirements:

		Test Method
1. Specific Gravity	1.30 to 1.35	D 792
2. Tensile Strength, min	20.6 MPa	D 412
3. Modulus of Elasticity, min	18.6 MPa	D 412
4. Hardness, shore "D"	between 50 & 60	D.2240
5. Brittleness Temp, max	9^0C (15^0F) or lower temp.	D 746
6. Resistance to Abrasion, % weight loss, max.	12%	D 1242

The PVC coating shall not show cracks or breaks after the wires are twisted in the fabrication of the mesh.

511.2.2.4 Style 4 double-twisted mesh shall be manufactured from aluminum- coated steel wire conforming to Specification ASTM A 809, soft temper.

511.2.3 Lacing Wire and Stiffener

Lacing wire and stiffeners shall be made of wire having the same coating material as the double-twisted wire mesh conforming to Specification ASTM A 641, A 856/A 856 M or A 809 with a tensile strength in accordance with subsection 509.2.7.

511.2.4 Fasteners made from zinc-coated steel wire, zinc - 5% aluminum mischmetal alloy-coated steel wire and aluminum-coated steel shall conform to specification A 764, Type A, B, or C, Table 2 or Table 3.

511.2.5 Gabion and mattresses shall be manufactured with all components mechanically connected at the production facility with the exception of the mattresses lid which is produced separately from the base. All gabions and mattresses shall be supplied in the collapsed form, either folded and bundled or rolled, for shipping**.**

511.2.6 Dimensions

The minimum size of the galvanized and PVC coated wire to be used in the fabrication of the gabion and mattresses shall be as follows:

	Diameter, mm			
	Gabion		Mattresses	
	Metallic Coated	PVC Coated	Metallic Coated	PVC Coated
Body Wire	3.05	2.70	2.20	2.20
Selvedge or Perimeter Wire	3.80	3.40	2.70	2.70
Tying and Connecting Wire	2.20	2.20	2.20	2.20

Diameter Tolerances for Galvanized Wire to be used in the fabrication of gabion and mattress shall be □ .10.

The nominal and the minimum thickness of PVC coating shall be0.50 mm and 0.38 mm, respectively.

511.2.7 Mechanical Properties

Tensile Strength – The tensile strength of Zinc-coated wire used in the fabrication of gabion and mattresses when tested in accordance with Test Methods ASTM A 370, shall be as follows:

	Strength, max, Mpa	
	Gabion	Mattresses
Body Wire	485	515
Selvedge or Perimeter Wire	485	485
Tying and Connecting Wire	515	515

511.2.8 Weight of Coating

The minimum weight of zinc per unit area of uncoated wire surface shall be in accordance with ASTM A 975 or as follows:

Wire Diameter, mm	Class 3 or A Coating, g/m^2, ASTM A 641
Over 1.90 to 2.30	220
Over 2.30 to 2.70	230
Over 2.70 to 3.10	240
Over 3.10 to 3.50	260
Over 3.50 to 3.90	270

511.2.9 Rock Fill

Rock used in the gabions and mattresses shall consist of hard, durable rock pieces that will not deteriorate when submerged in water or exposed to severe weather conditions. Rock pieces shall be generally uniformly graded in sizes ranging from 100 mm to 200 mm. Filled gabions shall have a minimum density of 1,400 kg/m^3. Voids shall be evenly distributed.

No rock size shall exceed 2/3 the mattress depth and at least 85% by weight of the stone shall have a size greater than 80 mm. No stones shall be able to pass through the mesh.

The rock shall meet the requirements of AASHTO M 63 except that the sodium sulphate soundness loss shall not exceed 9% after 5 cycles.

511.2.10 Filter Fabric

Filter cloth shall consist of 70% polypropylene and 30% polyethylene.

511.3 Construction Requirements

511.3.1 Fabrication

1. Gabions and mattresses shall be in the form of rectangular baskets of the required dimensions and shall be manufactured from wire as specified in Subsection 509.2.2. Gabions shall be made of steel wire double twisted forming a uniform hexagonal mesh type 8 x 10 having a nominal mesh openings of 83 by 114 mm. Mattresses shall be made of steel wire double twisted forming a uniform hexagonal mesh type 6 x 8 having a nominal mesh openings of 64 by 83 mm. Tolerances on the hexagonal, double-twisted wire mesh opening shall not exceed □10% on the nominal dimension D values, 64 mm for mattresses and 83 mm for gabions. The edges shall be formed into a securely connected selvedge adequate to prevent raveling.

Individual basket ties and connections shall be made by using a quantity of wire not less than 8% of the weight of each basket.

2. When the gabion length exceeds its width, it shall have securely tied diaphragms connected at all edges to form individual cells of equal length and width.

Gabions shall be fabricated in such a manner that the sides, ends, lids and diaphragms can be assembled at the construction site into rectangular baskets of the specified sizes. Gabions shall be of single unit construction, base, lids, ends and sides shall be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that the strength and flexibility at the point of connection is at least equal to that of the mesh.

The gabion shall be equally divided by diaphragms, placed at not more than 1.0 m intervals, and of the same mesh and gauge as the body of the gabions, into cells the length of which does not exceed the horizontal width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this junction will be necessary.

3. Four cross-connecting wires shall be provided in each cell having a height of one half the width or less, and eight cross-connecting wires shall be provided in each cell having a height greater than one half the width.

All perimeter edge of the mesh forming the gabion shall be securely selvedged so that the joints, by tying the selvedges, have at least the same strength as the body of the mesh.

Selvedge wire used through all the edges (perimeter wire) shall not be less than 3.80 mm diameter and shall meet the same specifications as the wire mesh.

511.3.2 Assembly and Construction:

1. Gabions shall be installed in a workmanlike manner. The gabions shall be placed on a smooth foundation. Final line and grade shall be approved by the Engineer.

Each gabion unit shall be assembled by binding together all vertical edges with wire ties on approximately 152 mm (6 inches) spacing or by a continuous piece of connecting wire stitched around the vertical edges with a coil every 102 mm (4 inches). Empty gabion units shall be set to line and grade as shown on the Plans or as described by the Engineer. Wire ties or connecting wires shall be used to join the units together in the same manner as described

above for assembling. Internal tie wires shall be uniformly spaced and securely fastened in each cell of the structure.

A standard fence stretcher, chain fall, or iron rod may be used to stretch the wire baskets and hold alignment.

2. When possible the subgrade of the mattress and gabion shall be properly compacted to a depth of 150 mm. The Contractor shall consider the cost of subgrade preparation in the unit prices. Filter fabric as beds of gabions and mattresses forming the structure shall be suitably leveled and shall be securely connected along the complete length of all contact edges by means of the above specified tying and connecting wire.

3. Before the filling material is placed, the gabions and mattresses shall be carefully selected for uniformity of size, and the pieces shall be handplaced to provide a neat appearance as approved by the Engineer.

The gabions shall be filled with stone carefully placed by hand or machine to assure alignment and avoid bulges with a minimum voids. Alternate placing of rock and connection wires shall be performed until the gabion is filled. After a gabion has been filled, the lid shall be bent over until it meets the sides and edges. The lid shall then be secured to the sides, ends and diaphragms with the wire ties or connecting wire in the manner described for assembling.

The vertical joints of gabions and mattress baskets shall be staggered as in running bond in brickwork.

4. The cells in any row shall be filled in stage so that local deformation may be avoided. That is at no time shall the cell be filled to a depth exceeding 30 cm more than the adjoining cell.

5. Filter fabric shall be placed between earth surface and gabion or mattress structures. Filter fabric shall be rolled out into a flat non- rutted surface free from sharp objects, weighing down the edges. Construction equipment shall not be allowed into unprotected fabric. Jointing is normally affected by overlapping not less than 300 mm, but it is preferable to joint by sewing or industrial stapling. Joint edges should be facing downwards to avoid protruding through the surface material.

511.4 Method of Measurement

The quantities to be paid for shall be the number of cubic meter of gabions and mattresses and the area of filter cloth completed and accepted.

511.5 Basis of Payment

Quantities determined as provided above shall be paid for at the appropriate contract unit price per unit of measurement for the Pay Item shown in the Bid Schedule, which price and payment shall constitute full compensation for all necessary excavation, subgrade preparation, for furnishing, placing wire baskets and fill materials and for all labor, equipment accessories, tools, and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
511 (1)	Gabions	Cubic Meter
511 (2)	Mattresses	Cubic Meter
511 (3)	Filter Cloth	Square Meter

ITEM 606 – PAVEMENT MARKINGS

606.1 Description

This item shall consist of placing markings on the finished pavement. T
he work shall include the furnishing of premixed reflectorized traffic paint or reflectorized pavement marking paint conforming to the requirements of AASHTO M 248, whichever is called for in the Contract, sampling and packing, preparing the surface, and applying the paint to the pavement surface, all in accordance with this Specification.

The paint shall be applied to the size, shape and location of the markings shown on the Plans, or as required by the Engineer.

606.2 Premixed Reflectorized Traffic Paints

Premixed reflectorized traffic paint is a paint in which the glass beads are mixed in the paint during the process of manufacture, so that upon application and drying, the paint line is capable of retroreflection of the light beams.

Premixed reflectorized traffic paints which are available in both white and yellow are paints that provide reflective marking for concrete, bituminous, bricks or stone surface of highways, bridges, tunnels, streets, parking lots and airports.

606.2.1 Classification

Premixed reflectorized traffic paint shall be classified according to the following types based on the vehicles used:

Type I – Alkyd

Type II – Chlorinated Rubber Alkyd

606.2.2 Material Requirements

The paint shall consist of pigments, vehicles and glass beads so combined as to produce a paint that will conform to the following requirements.

a. Condition in container – The packaged material shall be free from lumps and mixed readily to a smooth homogenous state.

b. Skinning – The packaged material shall not skin within 48 hours in a ¾ filled, tightly closed container.

c. Appearance of Dried Film – The paint film shall dry to a smooth uniform finish. d.

Flexibility – The dried paint film shall not show cracking or flaking after being bent about 180 degrees over a 12.7 mm mandrel.

e. Resistance to Water – The dried paint film shall not show blistering, peeling, wrinkling and discoloration when immersed in water for 18 hours.

f. The paint shall also conform to the physical properties specified in Table 1.

Table 1 – Physical Properties

Properties	Type I and Type II	
	Minimum	Maximum
Specific Gravity	1.5	-
Drying Time, No Pick Up,		
Minutes	-	40
Consistency (Kreb Units) at 20 C	65	95

g. Premixed reflectorized traffic paint composition shall conform to the requirements given in Table 2.

Table 2 – Composition Requirements

Paint Composition	Requirements			
	Type I		Type II	
	Minimum	Maximum	Minimum	Maximum
Total Dry Solids, percent By weight	60	-	60	-
Titanium Dioxide, Rutile Percent by weight	16.0	-		-
Medium Chrome Yellow, Percent by weight	12.0	-		-
Extenders, percent by wt., White		13.0	-	13.0

Non-volatile Content (based on the vehicle) percent by weight	40	-	41	-
Glass Beads, percent by Weight	31.0	35.0		35.0

h. Glass Spheres or Beads Requirements:

Quantity: The amount of glass beads to be mixed with the paint shall be 500 grams per liter of paint.

Beads Diameter: The percentage of beads that will pass through the US Standard Sieves shall be as follows:

Sieve No. (um)	Mass Percent Passing
70 (212 – um) – 0.850	100
80 (186 – um) – 0.600	85-100
140 (106 – um) – 0.300	15-55
230 (63 – um) – 0.150	0-10

Index of Refraction: The index of refraction of the beads shall be within the range of 1.50 to 1.60 when tested by the liquid immersion method at 29^{O}C.

Appearance: The glass beads shall be transparent, colorless and the sum of particles that are fused, plane, angular and colored and contains bubble shall not exceed

20 percent

606.2.3 Construction Requirements

The painting of lane markers and traffic strips shall include the cleaning of the pavement surfaces, the application, protection and drying of the paint coatings, the protection of pedestrians, vehicular or other traffic, the protection of all parts of the road structure and its appurtenances against disfigurement by spatters, splashes or smirches of paints or of paint materials, and the supplying of all tools, labor and traffic paint necessary for the entire work.

The paint shall not be applied during rain or wet weather or when the air is misty, or when in the opinion of the Engineer, conditions are unfavorable for the work. Paint

shall not be applied upon damp pavement surfaces, or upon pavement which has absorbed heat sufficient to cause the paint to blister and produce a porous film of paint.

The application of paint shall preferably be carried out by a machine specially made for this purpose but where brushes are used, only round or oval brushes not exceeding 100 mm in width will be permitted. The paint shall be so applied as to produce a uniform, even coating in close contact with the surface being painted.

Traffic paint shall be applied to the pavement at the rate of 0.33 L /m^2 and shall dry sufficiently to be free from cracking in from 15 to 30 minutes.

All markings shall present a clean cut, uniform and workmanlike appearance. Markings that fail to have a uniform, satisfactory appearance either by day or night, shall be corrected by the Contractor in a manner acceptable to the Engineer and at no cost to the Government.

606.2.4 Sampling

The paint shall be sampled in accordance with PNS 484/ISO 1512 or other Philippine Standard Method of Sampling Paints and Varnishes.

606.2.5 Test Methods

The paints shall be tested in accordance with the methods specified in PNS 461 or other Philippine Standard Method of Tests for Paints and Varnishes.

606.2.6 Packing, Packaging and Marking

The paints shall be packed, packaged and marked in accordance with PNS 140.

606.3 Method of Measurement

The quantity of pavement markings to be paid for shall either be the length as shown on the Plans of painted traffic line of the stated width or the area as shown on the plans of symbols, lettering, hatchings, and the like, completed and accepted. Separate items shall be provided for premixed reflectorized traffic paint and reflectorized thermoplastic pavement markings.

606.4 Basis of Payment

The quantities measured as determined in Section 606.4, Method of Measurement, shall be paid for at the appropriate contract unit price for the Pay Items shown in the Bid Schedule which price and payment shall constitute full compensation for furnishing and placing all materials, sampling and packing, for the preparation of the

surface, and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
606 (1)	Pavement markings (Premixed Reflectorized)	Square Meter
606 (2)	Pavement markings (Reflectorized Thermoplastic)	Square Meter

ITEM 610 – SODDING

610.1 Description

This Item shall consist of furnishing and laying of live sod on the shoulders, slopes, ditches, or other locations as designated, construction of sod ditch checks or similar appurtenances, as shown on the Plans or as ordered and laid out in the field by the Engineer, all in accordance with this Specification.

610.2 Material Requirements

The sod shall consist of healthy, dense, well-rooted growth of permanent and desirable grasses indigenous to the general locality where it is to be used and shall be free from weeds or undesirable grasses. At the time the sod is cut, the grass on the sod shall have a length of approximately 50 mm (if longer, the grass shall be cut to approximately this length) and the sod shall have been raked free from debris.

The sod shall be cut into uniform squares approximately 300 mm x 300 mm, but not larger than is convenient for handling and transporting.

The thickness of the sod shall be uniform as possible approximately 40 mm or more depending on the nature of the sod, so that practically all of the dense root system of the grasses will be retained, but exposed, in the sod strip and that the sod can be handled without undue tearing or breaking.

In the event the sod to be cut is in a dry condition as to cause scrumbling or breaking during cutting operations, the Contractor, at his own expense, shall apply water in sufficient quantities at least 12 hours before cutting to provide a well- moistened condition of the sod to the depth to which it is to be cut. Sods shall be subject to the approval of the Engineer.

610.3 Construction Requirements

610.3.1 Preparation of the Earth Bed

The area to be sodded shall be constructed to the required cross-section and contour, and the tops and bottoms of the slopes shall be rounded as shown in the typical roadway sections.

The areas to be sodded shall be free from stones, roots or other undesirable foreign materials.

The soil on the area to be sodded shall be loosened and brought to a reasonably fine texture to a depth of not less than 30 mm by means of equipment on hand methods adapted for the purpose.

610.3.2 Placing the Sod

The earth bed upon which the sod is to be placed shall be moistened to the loosened depth,

if not naturally sufficiently moist, and the sod shall be placed thereon within 24 hours after the same has been cut.

Unless otherwise required, the sod on slopes shall be laid on horizontal strips beginning at the bottom of the slope and working upwards. When placing sod in ditches, or in the construction of sod ditch checks or similar appurtenances, the length of the strips shall be laid at right angles to the direction of the flow of the water.

Sod shall be laid so that the joints caused by abutting ends of sod strip are not continuous. Each sod strip shall be so laid as to abut snugly against the strip previously laid.

As the sod is being laid it shall be lightly tamped with suitable wooden or metal tampers sufficiently to set or press the sod into the underlying soil.

At points where it is anticipated that water may flow over a sodded area, the upper edges of the sod strips shall be turned into the soil to be below the adjacent area and a layer of earth place over this juncture and thoroughly compacted. At the limits of sodded areas, the end strips shall be turned in and treated similarly.

610.3.3 Staking the Sod

On all slopes steeper than one vertical to four horizontal, sod shall be pegged with stakes 200-300 mm in length, spaced as required by the nature of the soil and steepness of slope. Stakes shall be driven into the sod at right angles to the slope until flush with the bottom of the grass blades.

610.3.4 Top Dressing

After staking has been completed, the surface shall be cleared of loose sod, excess soil or other foreign material, whereupon a thin layer of topsoil shall be scattered over the sod as a top dressing and the areas shall then be thoroughly moistened by sprinkling with water.

610.3.5 Watering

The Contractor shall regularly water and maintain sodded areas in a satisfactory condition for the duration of the Contract and until final acceptance of the work by the Engineer.

610.4 Method of Measurement

Sodding shall be measured by the square meter and the quantity to be measured for payment shall be the actual number of square meters of area on which sod has been placed in accordance with this Specification and within the limits of construction as designated on the Plans or as ordered by the Engineer.

610.5 Basis of Payment

The quantity as determined in Subsection 610.4, Method of Measurement, shall be paid for at Contract unit price per square meter for Sodding which price and payment shall be full

compensation for preparing the earth bed, for furnishing, placing, staking, top dressing and watering the sod, and for all labor, equipment, tools and incidentals necessary to complete the Item.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
610	Sodding	Square Meter

Section VII. Drawings

[Insert here a list of Drawings. The actual Drawings, including site plans, should be attached to this section, or annexed in a separate folder.]

Section VIII. Bill of Quantities

Bill of Quantities, Summary of Bid Proposal & Detailed Estimate should be submitted together with the Annex "C" Form 4 to 7 in pages 462 to 465.

Non-attachment of Annex "C" Form 1 to 7 shall be automatically disqualified.

{ATTACH COMPANY LETTERHEAD/LOGO}

SUMMARY OF BID PROPOSAL

PROJECT: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021** (Construction of Control Tower Building, Administration Building, Powerhouse, Transformer Yard and Site Development)

LOCATION: Catbalogan Airport, Catbalogan City, Samar

ITEM NO.	DESCRIPTION OF WORK	QUANTITY	UNIT	UNIT PRICE (Pesos)	AMOUNT (Pesos)
SPL-1	*MOBILIZATION AND DEMOBILIZATION*	*1.00*	*lot*		
I	*CONSTRUCTION OF ADMINISTRATION BUILDING*				
1.01	CIVIL/STRUCTURAL WORKS				
1.01.01	Site Works	226.96	cu.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
1.01.02	Pile Driving Works	1,152.00	li.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
1.01.03	Concrete Works	125.51	cu.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
1.01.04	Masonry Works	508.62	sq.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
1.01.05	Steel Works	4,388.48	kgs.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
1.01.06	Moisture and Thermal Protection Work	188.00	l.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				

1.02	ARCHITECTURAL WORKS				
1.02.01	Tile Works	516.01	sq.m.		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
1.02.02	Painting Works	652.72	sqm		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
1.02.03	Ceiling Works	368.50	sq.m		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
1.02.04	Carpentry Works	221.42	sqm.		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
1.02.05	Doors and Windows	41.00	sets		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
1.02.06	Miscellaneous	1.00	lot		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
1.02.07	Toilet Partition, Concrete Countertop and Accessories	11.18	sq.m.		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				

1.03	ELECTRICAL WORKS				
1.03.01	Lighting and Power Conduits and Fittings	501.00	li.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.03.02	Wires and Cables	10.00	rolls		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.03.03	Electrical Wiring Devices	98.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.03.04	Lighting Fixtures	104.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.03.05	Boxes and Pullboxes	232.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.03.06	Feeder/Sub-Feeder Conductor Conduit and Fittings	132.00	li.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.03.07	Feeder/Sub-Feeder Conductor	520.00	li.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.03.08	Panelboard & Circuit Breaker	3.00	assy		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.03.09	Structured Cabling System	300.00	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.03.10	Termination Accessories	1.00	lot		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				

1.04	MECHANICAL WORKS				
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.04.01	Air Conditioning Unit and Pipings	10.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.04.02	Ventilation Equipment and Accessories	73.59	sq. m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.04.03	Hangers and Supports	5.11	sq. m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.04.04	FDAS and Fire Extinguisher	308.68	sq. m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.05	PLUMBING WORKS				
1.05.01	Site works	210.06	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.05.02	Sewer Line System	108.10	li.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.05.03	Waterline System	133.65	li.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.05.04	Storm Drainage System	81.90	li.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				

1.05.05	Septic Tank and Catch Basin	11.83	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1.05.06	Fixtures and Accessories	1.00	lot		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
II	*CONSTRUCTION OF CONTROL TOWER*				
2.01	CIVIL/STRUCTURAL WORK				
2.01.01	Site Works	1,454.00	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.01.02	Pile Driving Works	3,402.00	Li.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.01.03	Concrete Works	967.00	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.01.04	Masonry Works	1,396.52	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.01.05	Steel Works	9,352.86	kgs.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.01.06	Moisture and Thermal Protection Works	109.00	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				

2.02	ARCHITECTURAL WORKS				
2.02.01	Carpentry Works				
1A	Ceiling Finishes	817.20	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
1B	Wall Finishes	344.98	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.02.02	Tile Works	1,031.87	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.02.03	Raised Floor and Precast Wall Works	31.00	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.02.04	Painting Works	4,940.04	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.02.05	Doors and Windows	99.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.02.06	Toilet Partition, Concrete Countertop and Accessories	16.88	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.03	ELECTRICAL WORKS				
2.03.01	Lighting and Power Conduits and Fittings	1,008.00	lm		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				

2.03.02	Wires and Cables	23.00	rolls		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.03.03	Electrical Wiring Devices	187.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.03.04	Lighting Fixtures	146.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.03.05	Boxes and Pullboxes	393.00	pcs.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.03.06	Panel Board/Circuit Breaker/Circuit Protection/Gutter	14.00	assy		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.03.07	Feeder Conductors	375.00	lm		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.03.08	Feeder wires, conduits and fittings	81.00	lm		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.03.09	Access Control System	1.00	lot		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
2.03.10	CCTV System	16.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				

2.03.11	Back-up Power Supply	1.00	assy		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
2.03.12	Lightning Protection & Grounding System	1.00	lot		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
2.03.13	Auxiliary Units	602.00	sq.m.		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
2.03.14	Termination Accessories	1.00	lot		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
2.04	MECHANICAL WORKS				
2.04.01	Air-Conditioning Units, Pipings and Support	27.00	sets		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
2.04.02	Ventilation Equipment, Accessories, Hangers and Support	104.44	sq. m.		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
2.04.03	FDAS and Fire Extinguisher	901.80	sq. m.		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
2.04.04	Passenger Elevator	1.00	unit		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				
2.05	PLUMBING WORKS				
2.05.01	Site Works	462.78	cu.m.		
	*Pesos*_____ *Amount in Words* _____ _____*and*_____ _____ *centavos*				

2.05.02	Sewerline System	424.91	li.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
2.05.03	Waterline System	246.06	li.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
2.05.04	Storm Drainage System	141.45	li.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
2.05.05	Septic Tank and Catch Basin	15.39	cu.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
2.05.06	Fixtures and Accessories	1.00	lot		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
III	*POWERHOUSE AND TRANSFORMER YARD*				
	POWERHOUSE				
3.01	CIVIL/STRUCTURAL WORKS				
3.01.01	Site Works	227.00	cu.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
3.01.02	Concrete Works	75.63	cu.m		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
3.01.03	Masonry Works (including Plastering)	190.03	sq.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
3.01.04	Steel Works	702.78	kgs		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				

3.01.05	Waterproofing Works	117.56	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.02	ARCHITECTURAL WORKS				
3.02.01	Tile Works	28.88	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.02.02	Painting Works	295.11	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.02.03	Ceiling Works	12.00	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.02.04	Doors and Windows	13.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.03	ELECTRICAL WORKS				
3.03.01	Lighting and Power Conduits and Fittings	153.00	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.03.02	Electrical Wiring Devices	17.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.03.03	Lighting Fixtures	28.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.03.04	Boxes	48.00	pcs		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				

3.03.05	Air conditioning Unit Power Supply Conduit and Fittings	12.00	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.03.06	Lighting and Power Wires & Cables	4.00	rolls		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.03.07	Grounding System	70.00	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.03.08	Panelboard/Circuit Breaker	4.00	assy		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.03.09	Feeder/Sub Feeder Conductor	1,474.00	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.03.10	Feeder/Sub Feeder Conductor Conduit and Fittings	210.00	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.03.11	Power Supply	1.00	assy		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.04	MECHANICAL WORKS				
3.04.01	Air Conditioning Unit and Piping System	1.00	set		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.04.02	Ventilation Equipment and Accessories	2.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				

3.04.03	Hangers and Supports , Fire Extinguisher	2.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.05	PLUMBING WORKS				
3.05.01	Fixtures	10.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.05.02	Waste Water Line	9.00	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.05.03	Cold Water Line	20.00	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.05.04	Storm Drainage Pipe	81.00	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.05.05	Catch Basin	9.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.05.06	Septic Tank	5.52	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
	TRANSFORMER YARD				
3.06	CIVIL/STRUCTURAL WORKS				
3.06.01	Site Works	31.02	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				

3.06.02	Concrete Works	19.05	cu.m		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.06.03	Masonry Works (including Plastering)	14.04	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
3.06.04	Steel Works	701.53	kgs		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
IV	*SITE DEVELOPMENT*				
	COVERED PATHWALK (160.15 ln.m.)				
4.01.01	Site Works	39.37	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.01.02	Concrete Works	28.48	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.01.03	Steel Works (including Painting Works)	3,557.39	kgs.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.01.04	Pavement Blocks	238.50	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.01.05	Electrical Works				
4.01.05A	Lighting and Power Conduits and Fittings	234.00	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.01.05B	Lighting and Power Wires & Cables	6.00	rolls		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				

4.01.05C	Electrical Wiring Devices	2.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.01.05D	Lighting Fixtures	27.00	sets		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.01.05E	Boxes	29.00	pcs		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.01.05F	Hangers, Supports and Termination Accessories	150.00	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.02	TYPE IV SECURITY FENCE WITH GATES (255.40 ln.m.)				
4.02.01	Site Works	50.52	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.02.02	Concrete Works	28.67	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.02.03	Masonry Works (including plastering)	232.00	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.02.04	Steel Works (including Painting Works)	255.40	ln.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.03	PERIMETER CHB FENCE (70 ln.m.)				
4.03.01	Site Works	33.16	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				

4.02.02	Concrete Works	23.92	cu.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
4.02.03	Masonry Works (including plastering)	164.50	sq.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
4.03.04	Steel Works (including Painting Works)	70.00	ln.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
4.04	VEHICULAR PARKING AREA CONCRETE PAVEMENT (1,008.75 sq.m.)				
105(1)a	Subgrade Preparation	1,008.75	sq.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
P-154-5.1	Aggregate Subbase Course	302.62	cu.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
P-501-8.1b.1	Cement Concrete Pavement, 250mm thick	1,008.75	sq.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
4.05	LANDSCAPING WORKS	2,112.30	sq.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
4.06	CONCRETE CURBS (317.63 ln.m.)				
4.06.01	Site Works	104.82	cu.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				
4.06.02	Concrete Works	80.76	cu.m.		
	Pesos_____ Amount in Words *_____and_____* *_____ centavos*				

4.07	VPA Painting Works	128.89	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.08	EXTERIOR DRAINAGE SYSTEM				
4.08.01	Site Works	601.81	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.08.02	Concrete Works (Manhole and Trench Drain)	23.72	cu.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.08.03	Steel Works (Manhole and Trench Drain)	3,737.96	kgs.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.08.04	Masonry Works (Manhole and Trench Drain)	242.64	sq.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
4.08.05	Pipe Culverts and Storm Drainage	207.50	li.m.		
	Pesos_____ Amount in Words _____ _____*and*_____ _____ *centavos*				
SPL-2	*TEMPORARY FACILITY*	*1.00*	*lot*		
	TOTAL AMOUNT				

Submitted by:

Signature: _____
Printed Name: _____
Position: _____
Name Company: _____
Date: _____

{ATTACH COMPANY LETTERHEAD/LOGO}

SUMMARY OF BID PROPOSAL

PROJECT: CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021 (Construction of Control Tower Building, Administration Building, Powerhouse, Transformer Yard and Site Development)
LOCATION: Catbalogan Airport, Catbalogan City, Samar

ITEM NO.	DESCRIPTION OF WORK	QUANTITY	UNIT	ESTIMATED DIRECT COST	MARK-UPS IN PERCENT		TOTAL MARK-UP		VAT	TOTAL INDIRECT COST	TOTAL COST	UNIT COST
					OCM	Profit	%	VALUE				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) (5) x (8)	(10) 5% [(5) + (9)]	(11) (9) + (10)	(12) (5) + (11)	(13) (12)/(3)
SPL-1	*MOBILIZATION AND DEMOBILIZATION*	*1.00*	*lot*									
I	*CONSTRUCTION OF ADMINISTRATION BUILDING*											
1.01	CIVIL/STRUCTURAL WORKS											
1.01.01	Site Works	226.96	cu.m.									
1.01.02	Pile Driving Works	1,152.00	li.m.									
1.01.03	Concrete Works	125.51	cu.m.									
1.01.04	Masonry Works	508.62	sq.m.									
1.01.05	Steel Works	4,388.48	kgs.									
1.01.06	Moisture and Thermal Protection Work	188.00	l.m.									
1.02	ARCHITECTURAL WORKS											
1.02.01	Tile Works	516.01	sq.m.									
1.02.02	Painting Works	652.72	sqm									
1.02.03	Ceiling Works	368.50	sq.m									
1.02.04	Carpentry Works	221.42	sqm.									
1.02.05	Doors and Windows	41.00	sets									
1.02.06	Miscellaneous	1.00	lot									
1.02.07	Toilet Partition, Concrete Countertop and Accessories	11.18	sq.m.									
1.03	ELECTRICAL WORKS											
1.03.01	Lighting and Power Conduits and Fittings	501.00	li.m.									
1.03.02	Wires and Cables	10.00	rolls									
1.03.03	Electrical Wiring Devices	98.00	sets									
1.03.04	Lighting Fixtures	104.00	sets									
1.03.05	Boxes and Pullboxes	232.00	sets									
1.03.06	Feeder/Sub-Feeder Conductor Conduit and Fittings	132.00	li.m.									
1.03.07	Feeder/Sub-Feeder Conductor	520.00	li.m.									
1.03.08	Panelboard & Circuit Breaker	3.00	assy									
1.03.09	Structured Cabling System	300.00	sq.m.									
1.03.10	Termination Accessories	1.00	lot									

1.04	MECHANICAL WORKS											
1.04.01	Air Conditioning Unit and Pipings	10.00	sets									
1.04.02	Ventilation Equipment and Accessories	73.59	sq. m.									
1.04.03	Hangers and Supports	5.11	sq. m.									
1.04.04	FDAS and Fire Extinguisher	308.68	sq. m.									
1.05	PLUMBING WORKS											
1.05.01	Site works	210.06	cu.m.									
1.05.02	Sewer Line System	108.10	li.m.									
1.05.03	Waterline System	133.65	li.m.									
1.05.04	Storm Drainage System	81.90	li.m.									
1.05.05	Septic Tank and Catch Basin	11.83	cu.m.									
1.05.06	Fixtures and Accessories	1.00	lot									
II	*CONSTRUCTION OF CONTROL TOWER*											
2.01	CIVIL/STRUCTURAL WORK											
2.01.01	Site Works	1,454.00	cu.m.									
2.01.02	Pile Driving Works	3,402.00	Li.m.									
2.01.03	Concrete Works	967.00	cu.m.									
2.01.04	Masonry Works	1,396.52	sq.m.									
2.01.05	Steel Works	9,352.86	kgs.									
2.01.06	Moisture and Thermal Protection Works	109.00	sq.m.									
2.02	ARCHITECTURAL WORKS											
2.02.01	Carpentry Works											
1A	Ceiling Finishes	817.20	sq.m.									
1B	Wall Finishes	344.98	sq.m.									
2.02.02	Tile Works	1,031.87	sq.m.									
2.02.03	Raised Floor and Precast Wall Works	31.00	sq.m.									
2.02.04	Painting Works	4,940.04	sq.m.									
2.02.05	Doors and Windows	99.00	sets									
2.02.06	Toilet Partition, Concrete Countertop and Accessories	16.88	sq.m.									

2.03	ELECTRICAL WORKS											
2.03.01	Lighting and Power Conduits and Fittings	1,008.00	lm									
2.03.02	Wires and Cables	23.00	rolls									
2.03.03	Electrical Wiring Devices	187.00	sets									
2.03.04	Lighting Fixtures	146.00	sets									
2.03.05	Boxes and Pullboxes	393.00	pcs.									
2.03.06	Panel Board/Circuit Breaker/Circuit Protection/Gutter	14.00	assy									
2.03.07	Feeder Conductors	375.00	lm									
2.03.08	Feeder wires, conduits and fittings	81.00	lm									
2.03.09	Access Control System	1.00	lot									
2.03.10	CCTV System	16.00	sets									
2.03.11	Back-up Power Supply	1.00	assy									
2.03.12	Lightning Protection & Grounding System	1.00	lot									
2.03.13	Auxiliary Units	602.00	sq.m.									
2.03.14	Termination Accessories	1.00	lot									
2.04	MECHANICAL WORKS											
2.04.01	Air-Conditioning Units, Pipings and Support	27.00	sets									
2.04.02	Ventilation Equipment, Accessories, Hangers and Support	104.44	sq. m.									
2.04.03	FDAS and Fire Extinguisher	901.80	sq. m.									
2.04.04	Passenger Elevator	1.00	unit									
2.05	PLUMBING WORKS											
2.05.01	Site Works	462.78	cu.m.									
2.05.02	Sewerline System	424.91	li.m.									
2.05.03	Waterline System	246.06	li.m.									
2.05.04	Storm Drainage System	141.45	li.m.									
2.05.05	Septic Tank and Catch Basin	15.39	cu.m.									
2.05.06	Fixtures and Accessories	1.00	lot									

III	*POWERHOUSE AND TRANSFORMER YARD*											
	POWERHOUSE											
3.01	CIVIL/STRUCTURAL WORKS											
3.01.01	Site Works	227.00	cu.m.									
3.01.02	Concrete Works	75.63	cu.m									
3.01.03	Masonry Works (including Plastering)	190.03	sq.m.									
3.01.04	Steel Works	702.78	kgs									
3.01.05	Waterproofing Works	117.56	sq.m.									
3.02	ARCHITECTURAL WORKS											
3.02.01	Tile Works	28.88	sq.m.									
3.02.02	Painting Works	295.11	sq.m.									
3.02.03	Ceiling Works	12.00	sq.m.									
3.02.04	Doors and Windows	13.00	sets									
3.03	ELECTRICAL WORKS											
3.03.01	Lighting and Power Conduits and Fittings	153.00	ln.m.									
3.03.02	Electrical Wiring Devices	17.00	sets									
3.03.03	Lighting Fixtures	28.00	sets									
3.03.04	Boxes	48.00	pcs									
3.03.05	Air conditioning Unit Power Supply Conduit and Fittings	12.00	ln.m.									
3.03.06	Lighting and Power Wires & Cables	4.00	rolls									
3.03.07	Grounding System	70.00	ln.m.									
3.03.08	Panelboard/Circuit Breaker	4.00	assy									
3.03.09	Feeder/Sub Feeder Conductor	1,474.00	ln.m.									
3.03.10	Feeder/Sub Feeder Conductor Conduit and Fittings	210.00	ln.m.									
3.03.11	Power Supply	1.00	assy									

3.04	MECHANICAL WORKS											
3.04.01	Air Conditioning Unit and Piping System	1.00	set									
3.04.02	Ventilation Equipment and Accessories	2.00	sets									
3.04.03	Hangers and Supports , Fire Extinguisher	2.00	sets									
3.05	PLUMBING WORKS											
3.05.01	Fixtures	10.00	sets									
3.05.02	Waste Water Line	9.00	ln.m.									
3.05.03	Cold Water Line	20.00	ln.m.									
3.05.04	Storm Drainage Pipe	81.00	ln.m.									
3.05.05	Catch Basin	9.00	sets									
3.05.06	Septic Tank	5.52	sq.m.									
	TRANSFORMER YARD											
3.06	CIVIL/STRUCTURAL WORKS											
3.06.01	Site Works	31.02	cu.m.									
3.06.02	Concrete Works	19.05	cu.m									
3.06.03	Masonry Works (including Plastering)	14.04	sq.m.									
3.06.04	Steel Works	701.53	kgs									
IV	*SITE DEVELOPMENT*											
4.01	COVERED PATHWALK (160.15 ln.m.)											
4.01.01	Site Works	39.37	cu.m.									
4.01.02	Concrete Works	28.48	cu.m.									
4.01.03	Steel Works (including Painting Works)	3,557.39	kgs.									
4.01.04	Pavement Blocks	238.50	sq.m.									
4.01.05	Electrical Works											
4.01.05A	Lighting and Power Conduits and Fittings	234.00	ln.m.									
4.01.05B	Lighting and Power Wires & Cables	6.00	rolls									
4.01.05C	Electrical Wiring Devices	2.00	sets									
4.01.05D	Lighting Fixtures	27.00	sets									
4.01.05E	Boxes	29.00	pcs									
4.01.05F	Hangers, Supports and Termination Accessories	150.00	ln.m.									

4.02	TYPE IV SECURITY FENCE WITH GATES (255.40 ln.m.)											
4.02.01	Site Works	50.52	cu.m.									
4.02.02	Concrete Works	28.67	cu.m.									
4.02.03	Masonry Works (including plastering)	232.00	sq.m.									
4.02.04	Steel Works (including Painting Works)	255.40	ln.m.									
4.03	PERIMETER CHB FENCE (70 ln.m.)											
4.03.01	Site Works	33.16	cu.m.									
4.02.02	Concrete Works	23.92	cu.m.									
4.02.03	Masonry Works (including plastering)	164.50	sq.m.									
4.03.04	Steel Works (including Painting Works)	70.00	ln.m.									
4.04	VEHICULAR PARKING AREA CONCRETE PAVEMENT (1,008.75 sq.m.)											
105(1)a	Subgrade Preparation	1,008.75	sq.m.									
P-154-5.1	Aggregate Subbase Course	302.62	cu.m.									
P-501-8.1b.1	Cement Concrete Pavement, 250mm thick	1,008.75	sq.m.									
4.05	LANDSCAPING WORKS	2,112.30	sq.m.									
4.06	CONCRETE CURBS (317.63 ln.m.)											
4.06.01	Site Works	104.82	cu.m.									
4.06.02	Concrete Works	80.76	cu.m.									
4.07	VPA Painting Works	128.89	sq.m.									
4.08	EXTERIOR DRAINAGE SYSTEM											
4.08.01	Site Works	601.81	cu.m.									
4.08.02	Concrete Works (Manhole and Trench Drain)	23.72	cu.m.									
4.08.03	Steel Works (Manhole and Trench Drain)	3,737.96	kgs.									
4.08.04	Masonry Works (Manhole and Trench Drain)	242.64	sq.m.									
4.08.05	Pipe Culverts and Storm Drainage	207.50	li.m.									
SPL-2	*TEMPORARY FACILITY*	*1.00*	*lot*									
TOTAL AMOUNT												

Submitted by:

Signature: _____

Printed Name: _____

Position: _____

Name Company: _____

Date: _____

{ATTACH COMPANY LETTERHEAD/LOGO}

BILL OF MATERIALS & COST ESTIMATES

NAME OF PROJECT : **CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**

LOCATION : Catbalogan Airport, Catbalogan City, Samar

				QUANTITY	UNIT
SUBJECT	**Bill of Quantities**			1.00	lot
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
SPL-1	**MOBILIZATION AND DEMOBILIZATION**				
C	**Equipment**	1.00	lot		
			Equipment Cost		
C	**EQUIPMENT COST**				
D	**TOTAL DIRECT COST**				
	I N D I R E C T C O S T S				
1. OCM (0% of TDC)					
2. CONTRACTOR's PROFIT (0% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.01	**CIVIL/STRUCTURAL WORKS**			226.96	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.01.01	**Site Works**				
	Excavation *(Labor only)* - 128.91 cu.m.				
	Backfill *(Labor only)* - 76.05 cu.m.				
A	**Materials**				
	Gravel Base, G1		cu.m		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR. (DAYS)	RATE/DAY	
	Backhoe Crawler, 0.80cu.m.				
	Payloader, 1.50 cu.m.				
	Dump Truck, 12 yd³				
	Tamping Rammer (16kN)				
			Equipment Cost	. . . . .	
A	**Site Works Material Cost**				
B	**Site Works Labor Cost**				
C	**Site Works Equipment Cost**				
D	**Site Works Total Direct Cost**				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.01	**CIVIL/STRUCTURAL WORKS**			1,152.00	l.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.01.02	**Pile Driving Works**				
A	**Material**				
	0.35m x 0.35m x 18m Precast Concrete Pile - 5000psi		l.m.		
	Oxygen & Acetylene		set		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR. (DAYS)	RATE/DAY	
	Truck Mounted Crane, (41-45 MT)				
	Diesel Pile Hammer, DSL - 10.5 ton				
	Drop Hammer				
	Oxy-Acetylene Cutting Torch / Welding Outfit				
	Jack Hammer				
	Air Compressor (355-450 cfm)				
			Equipment Cost	. . . . .	
A	**Pile Driving Works Material Cost**				
B	**Pile Driving Works Labor Cost**				
C	**Pile Driving Works Equipment Cost**				
D	**Pile Driving Works Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.01	**CIVIL/STRUCTURAL WORKS**			125.51	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.01.03	**Concrete Works**				
A	**Material**				
	Portland Cement 40kg/bag		bags		
	Sand		cu.m.		
	Gravel 3/4		cu.m.		
	25mmØ x 6m DRSB Grade 60		pcs.		
	20mmØ x 6m DRSB Grade 60		pcs.		
	16mmØ x 6m DRSB Grade 60		pcs.		
	12mmØ x 6m DRSB Grade 40		pcs.		
	10mmØ x 6m DRSB Grade 40		pcs.		
	#16 GI Tie Wire		kgs.		
	1/2" x 4' x 8' ordinary plywood		pcs.		
	Coco Lumber 2" x 2"		bdft.		
	Coco Lumber 2" x 3"		bdft.		
	Coco Lumber 2" x 4"		bdft.		
	CWN assorted		kgs.		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR. (DAYS)	RATE/DAY	
	One Bagger Concrete Mixer				
	Concrete Vibrator				
			Equipment Cost	. . . . .	
A	**Concrete Works Material Cost**				
B	**Concrete Works Labor Cost**				
C	**Concrete Works Equipment Cost**				
D	**Concrete Works Total Direct Cost**				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.01	**CIVIL/STRUCTURAL WORKS**			508.62	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.01.04	**Masonry Works**				
A	**Material**				
	6" CHB		pcs.		
	4" CHB		pcs.		
	Portland cement		bags		
	Sand		m^3		
	10mmØ x 6m DRSB Grade 40		pcs.		
	12mmØ x 6m DRSB Grade 40		pcs.		
	#16 GI Tie Wire		kgs.		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR. (DAYS)	RATE/DAY	
	One Bagger Concrete Mixer				
			Equipment Cost	. . . . .	

A	**Masonry Works Material Cost**	
B	**Masonry Works Labor Cost**	
C	**Masonry Works Equipment Cost**	
D	**Masonry Works Direct Cost**	

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.01	**CIVIL/STRUCTURAL WORKS**			4,388.48	kgs.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.01.05	**Steel Works**				
A	**Material**				
	50x50x3mm x 6m Square Steel Tube		pcs.		
	150x50x6mm x 3m Tubular Steel		pcs.		
	MS Plate 2'x4' x 6mm		pc		
	50x25x3mmx3m Extruded Aluminum Bracket		pcs.		
	Ø10mm High Tensile Structural Anchor Bolt		pcs.		
	4mm Aluminum Composite Panel		sq.m		
	1/2" Backer Rod		l.m.		
	Silicon Weather Sealant		gals.		
	50 x 50 x 6.0mm thk x 6.0m Angle Bar		pcs.		
	50 x 50 x 3.00mm thk x 6.0m Angle Bar		pcs.		
	25x25x3mm thk x 6.0m Angle Bar		pcs.		
	C-Channel 150 x 50 x 1.6mm x 6m		pcs.		
	6m x 50mmØ SS Pipe		pcs.		
	6m x 25mmØ SS Pipe		pcs.		
	6m x 40mmØ SS Pipe		pcs.		
	6m x 20mmØ SS Pipe		pc		
	1.2m x 2.4m x 3mm thk. SS Checkered Steel Sheet		pcs.		
	150mm x75mm x3mm x6m Tubular Steel		pcs.		
	C-Channel 50mm x75mm x1.8mm x 6m		pc		
	4'x8'x12mm thk base plate		pc		
	Ø12mm High Tensile Structural Anchor Bolt		pc		
	6m-16mmØ cross bracing		pcs		
	6m-12mm sag rods		pcs		
	16mm Turnbuckle		pcs		
	SS Welding Rod		kgs		
	Welding Rod E6011		boxes		
	Oxygen & Acetylene		sets		
	Rust Converter		gals.		
	Epoxy Primer		gals.		
	Quick Drying Enamel		gals.		
	4" Paint Brush		pcs.		
	2" Paint Brush		pcs.		
	Paint Thinner		gals.		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
C	**Equipment**	QTY	DUR. (DAYS)	RATE/DAY	
	Welding Machine 200 amp				
	Oxy-Acetylene Cutting Torch/Welding Outfit				
	51-100kW, Generator Set				
			Equipment Cost	. . . . .	

A	**Steel Works Material Cost**	
B	**Steel Works Labor Cost**	
C	**Steel Works Equipment Cost**	
D	**Steel Works Total Direct Cost**	

INDIRECT COSTS			
1. OCM (0% - 8% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.01	**CIVIL/STRUCTURAL WORKS**			188.00	l.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.01.06	**Moisture and Thermal Protection Work**				
A	**Material**				
	Roofing Works				
	0.6mm Long Span Rib-Type Pre-painted roofing		l.m.		
	0.60mmthk Capping		l.m.		
	0.60mm thk SS Gutter (316)		l.m.		
	Tekscrew (12x 75mm)		pcs		
	Type S (12 x 25mm)		pcs		
	Blind Rivets 5-3		pcs		
	Silicone Rubber Sealant		tubes		
	Concrete Nails (1 1/2")		pcs		
	Touch-up paint		cans		
	1m x 50m x 10mm thk. Double Sided Aluminum Foam Insulation		rolls		
	Welded wire mesh		rolls		
	Transparent tape		rolls		
	Blind Rivets 5-6		pcs		
	Straps		pcs		
	4" Dome Shape Strainer		pcs.		
	Water Proofing Membrane(Roof Deck,Comfort Room)- 23.0 sq.m.				
	Portland Cement		bags		
	Sand		cu.m.		
	Elastomeric Brushable Waterproofing Membrane		gals.		
	Wire Mesh(2mm.thk.x1.20x2.40m.)		pcs.		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Moisture and Thermal Protection Works Material Cost**				
B	**Moisture and Thermal Protection Works Labor Cost**				
D	**Moisture and Thermal Protection Works Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.02	**ARCHITECTURAL WORKS**			516.01	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.02.01	**Tile Works**				
A	**Materials**				
	Floor Tiles				
	600mm x 600mm Homogenous Synthetic Granite Tiles (Polished)		pcs.		
	600mm x 600mm Homogenous Synthetic Granite Tiles (Matte)		pcs.		
	600mm x 600mm Homogenous Synthetic Granite Tiles (Rustic)		pcs.		
	600mm x 600mm Homogenous Wall Tiles(polished finish)		pcs.		
	600mm x 600mm Homogenous Floor Tiles with Pre-Cut Nosing		pcs		
	Portland Cement		bags		
	Sand		cu.m.		
	Tile Grout (2kgs./bag)		bags		
	Cutting Disk (4")		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (Days)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Tile Works Material Cost**				
B	**Tile Works Works Labor Cost**				
D	**Tile Works Works Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.02	**ARCHITECTURAL WORKS**			652.72	sqm
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.02.02	**Painting Works**				
A	**Material**				
	Exterior and Interior Walls				
	Elastomeric Sealer		gals		
	Concrete Putty		gals		
	Elastomeric Base		gals		
	Topcoat(Elastomeric)		gals		
	Paint Thinner		gals		
	Concrete Neutralizer		gals.		
	Flat Latex Paint		gals.		
	Semi-gloss Latex Paint		gals.		
	Acri-color		ltrs.		
	Calsomine Powder		kgs.		
	Paint Roller with pan 9"		pcs		
	Paint Brush 4"		pcs		
	Rugs		kgs.		
	Abrasive Sand Paper #100 for masonry		pcs		
			Material Cost	. . . . .	
B	**Labor**		DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**Painting Works Total Material Cost**	
B	**Painting Works Total Labor Cost**	
D	**Painting Works Total Direct Cost**	
	INDIRECT COSTS	
1. OCM (0% - 10% of TDC)		
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		
E. TOTAL OCM & PROFIT		
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P		
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit		
TOTAL ESTIMATED COST (D + G), P		
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit		

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.02	**ARCHITECTURAL WORKS**			368.50	sq.m
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.02.03	**Ceiling Works**				
A	**Material**				
	2400mm x 1200mm x 6mm Fibercement Ceiling Board		pcs		
	Main Runner - 3600mm x 24mm x 38mm		pcs		
	Cross Tee - 1200mm x 24mm x 25mm		pcs		
	Wall Angle, 25mm x 25mm x 6.0m, t=0.003m		pcs		
	Suspension Clip		pcs		
	Rod Joiner		pcs		
	Steel Angle 1.2mm thk x 1" x 1"		pcs		
	Drivepin, nailhead		pcs		
	Hanger Rod #8		pcs		
	Blind Rivets, ⅛ x ⅜ (4-4)		pcs		
	Concrete Nail		pcs		
	Flat Latex Paint		gals		
	Acrylic Water Base Latex Paint		gals		
	Calsomine Powder		kgs.		
	4" Paint Brush		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**Ceiling Works Total Material Cost**
B	**Ceiling Works Total Labor Cost**
D	**Ceiling Works Total Direct Cost**

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.02	**ARCHITECTURAL WORKS**			221.42	sqm.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.02.04	**Carpentry Works**				
A	**Material**				
	Drywall Partition				
	12mmthk. x 1.2m x 2.4m Fibercement Board		pcs.		
	76mm x 1.2mm thk. vertical studs		pcs.		
	76mm x 1.2mm thk. horizontal tracks		pcs.		
	Screw		pcs.		
	Blind Rivets		pcs.		
	Flat Latex Paint		gals		
	Semi-Gloss Latex Paint		gals		
	Acri-color		L		
	Calsomine Powder		kgs.		
	4" Paint Brush		pcs.		
	0.1m thk Modular Partition		m^2		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Carpentry Works Total Material Cost**				
B	**Carpentry Works Total Labor Cost**				
D	**Ceiling Works Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.02	**ARCHITECTURAL WORKS**			41.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.02.05	**Doors and Windows**				
A	**Material**				
	Doors				
	D1 1.60m x 2.10m, aluminum framed double swing glass door with 8mm thk	1.00	set		
	D2 0.80m x 2.10m, aluminum framed double swing glass door with 8mm thk	4.00	sets		
	D3 0.80m x 2.10m, solid wood panel door in 2" x 6" kd. Wood door jambs ar	4.00	sets		
	D4 0.70m x 2.10m, hollow core flush door in 2" x 6" kd wood door jambs and	3.00	sets		
	D5 0.90m x 2.10m , PVC Door type with louvers in PVC Jambs and Headers	1.00	set		
	D6 0.70m x 2.10m , PVC Door type with louvers in PVC Jambs and Headers	4.00	sets		
	D7 0.60m x 2.10m , PVC Door type with louvers in PVC Jambs and Headers	1.00	set		
	D8 0.80m x 2.10m, pre-painted metal door type with louver design in metal ja	1.00	set		
	D9 0.90m x 2.10m, pre-painted metal door type design in metal jambs and h	1.00	set		
	Windows				
	W1 4.70m x2.50m, analok framed & awning window w/ 8mm thk tinted glass	1.00	set		
	W2 0.80m x 2.10m, aluminum framed fixed window w/ 8mmthk. Clear glass p	3.00	sets		
	W3 3.20m x 0.60m, aluminum framed fixed window w/ 8mmthk. Clear glass p	1.00	set		
	W4 3.20m x 1.20m, aluminum framed sliding window w/ 8mmthk. Clear glass	9.00	sets		
	W5 1.60m x 1.20m, aluminum framed sliding window w/ 8mmthk. Clear glass	1.00	set		
	W6 1.20m x 0.40m, aluminum framed awning window w/ 8mmthk. Clear glass	4.00	sets		
	W7 0.60m x 0.40m, aluminum framed awning window w/ 8mmthk. Clear glass	2.00	sets		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Doors and Windows Total Material Cost**				
B	**Doors and Windows Total Labor Cost**				
D	**Doors and Windows Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.02	**ARCHITECTURAL WORKS**			1.00	lot
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.02.06	**Miscellaneous**				
A	**Materials**				
	Receiving Counters (1.00m x 1.10m)				
	6mm thk Clear Glass Panels on Aluminum Frame		sets		
	20mm thk. Granite Counter Top		sq.m.		
	Signages				
	ADMINISTRATION BUILDING	1.00	set		
	Specifications:				
	50mm thck. Stainless Steel Built-up Letter Signages		Material Cost	. . . . .	
	Font Style: Arrial Narrow				
	Font Size: 250mm				
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Miscellaneous Works Total Material Cost**				
B	**Miscellaneous Works Total Labor Cost**				
D	**Miscellaneous Works Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.02	**ARCHITECTURAL WORKS**			11.18	sq.m
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
1.02.07	**Toilet Partition, Concrete Countertop and Accessories**				
A	**Materials**				
	13mm Phenolic Compact Laminate Board		sq.m.		
	Aluminum Top Rail		l.m.		
	Aluminum Corner Rail		l.m.		
	Aluminum Edge Trim		l.m.		
	32mm x 32mm Stainless Steel Joint Right Angle Bracket		pcs.		
	SS Countersunk Head Screw		pcs.		
	Adjustable Foot		pcs.		
	Hook		pcs.		
	Door Lock with indicator both		pcs.		
	Beveled Glass Mirror w/ Marine Plywood Backing		sq.m.		
	200x12mm thk. Frosted Tempered Glass Ledge		sq.m.		
	Steel Ledge Support		pcs.		
	20mm Granite Slab Counter Top, Fascia & Splash Board		sq.m.		
	10mmØ DRSB, 6 meters		pcs.		
	#16 G.I. Tie Wire		kg		
	Portland Cement (40kg per bag)		bags		
	Sand		cu.m.		
	Gravel (3/4")		cu.m.		
	1/2" x 4' x 8' Ordinary Plywood		pcs.		
	2" x3" Form Lumber (Coco)		bd.ft.		
	Assorted CWN		kg.		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Toilet Partition, Concrete Countertop and Accessories Material Cost**				
B	**Toilet Partition, Concrete Countertop and Accessories Labor Cost**				
D	**Toilet Partition, Concrete Countertop and Accessories Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.03	**ELECTRICAL WORKS**			501.00	li.m.
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.03.01	**Lighting and Power Conduits and Fittings**				
A	**Materials**				
	20mm Ø x 3m uPVC Electrical Pipe, UL Listed		pcs		
	20mm diameter PVC Coupling		pcs		
	20mm diameter PVC Male Adaptor with locknut		pcs		
	Mica Tube		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Lighting and Power Conduits and Fittings Total Material Cost**				
B	**Lighting and Power Conduits and Fittings Total Labor Cost**				
D	**Lighting and Power Conduits and Fittings Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + F)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.03	**ELECTRICAL WORKS**			10.00	rolls
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.03.02	**Wires and Cables**				
A	**Materials**				
	3.5 mm² THHN/THWN-2 x 150m 600V 90ºC Copper Wire, UL Listed		rolls		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Wires and Cables Total Material Cost**				
B	**Wires and Cables Total Labor Cost**				
D	**Wires and Cables Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + F)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.03	**ELECTRICAL WORKS**			98.00	sets
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.03.03	**Electrical Wiring Devices**				
A	**Materials**				
	Duplex Universal Convenience Outlet with Ground, 16A, 250V with mounting and device plate cover	55.00	sets		
	Weatherproof Duplex Universal Convenience Outlet with Ground, 16A, 250V with mounting and device plate cover	1.00	sets		
	Hand Dryer Outlet, Single, Universal type with ground, 16A, 250V with mounting and device plate cover	5.00	sets		
	Emergency Lamp Outlet, Single, Universal type, 16A, 250V with mounting and device plate cover	10.00	sets		
	One-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	9.00	sets		
	Two-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	11.00	sets		
	Three-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	5.00	sets		
	Three-Gang three-way Switch, 16A, 250V, wide series with mounting strap and device plate cover	2.00	sets		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Electrical Wiring Devices Total Material Cost**				
B	**Electrical Wiring Devices Total Labor Cost**				
D	**Electrical Wiring Devices Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + F)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.03	**ELECTRICAL WORKS**			104.00	sets
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.03.04	**Lighting Fixtures**				
A	**Materials**				
	4" diameter recessed type vertical lamp downlight fixture with powder coated white finish steel housing and matte aluminum reflector and full frosted glass cover with 1×11W 1100-Lumen LED bulb	39.00	sets		
	4" dia. surface mounted vertical lamp downlight fixture with powder coated white finish steel housing and matte aluminum reflector and full frosted glass cover with 1×11W 1100-Lumen LED bulb	8.00	sets		
	1213mm×603mm×100mm recessed mounted troffer type lighting luminaire with 2×18W (T8) 1600-Lumen LED tube, daylight in white powder coat finish zinc phosphated steel sheet housing and 3mm thick prismatic acrylic diffuser	45.00	sets		
	Heavy Duty Emergency Lamp Dual Optics, 2×3Watts LED Bulb	10.00	sets		
	Exit Light, 220 Volts AC	2.00	sets		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Lighting Fixtures Total Material Cost**				
B	**Lighting Fixtures Total Labor Cost**				
D	**Lighting Fixtures Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + F)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.03	**ELECTRICAL WORKS**			232.00	sets
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.03.05	**Boxes and Pullboxes**				
A	**Materials**				
	Octagonal Junction Box with cover, Deep Type		pcs		
	4"×2" Utility Box, Deep Type		pcs		
	Metal Pull Box with Cover, 300mm×300mm×150mm, Gauge 16		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Boxes and Pullboxes Total Material Cost**				
B	**Boxes and Pullboxes Total Labor Cost**				
D	**Boxes and Pullboxes Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + F)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.03	**ELECTRICAL WORKS**			132.00	l.m.
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.03.06	**Feeder/Sub-Feeder Conductor Conduit and Fittings**				
A	**Materials**				
	25mm Ø uPVC Electrical Pipe, UL Listed		pcs		
	25mm Ø PVC Male Adaptor and locknut		pcs		
	63mm Ø uPVC Electrical Pipe, UL Listed		pcs		
	63mm Ø Upvc Elbow		pcs		
	63mm Ø Upvc Coupling		pcs		
	63mm Ø Upvc Male Adaptor with locknut		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Feeder/Sub-Feeder Conductor Conduit and Fittings Total Material Cost**				
B	**Feeder/Sub-Feeder Conductor Conduit and Fittings Total Labor Cost**				
D	**Feeder/Sub-Feeder Conductor Conduit and Fittings Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + F)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.03	**ELECTRICAL WORKS**			520.00	l.m.
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.03.07	**Feeder/Sub-Feeder Conductor**				
A	**Materials**				
	5.5 mm² THHN/THWN-2 600V 90ºC Copper Wire, UL Listed		l.m.		
	8.0 mm² THHN/THWN-2 600V 90ºC Copper Wire, UL Listed		l.m.		
	22 mm² THHN/THWN-2 600V 90ºC Copper Wire, UL Listed		l.m.		
	50 mm² THHN/THWN-2 600V 90ºC Copper Wire, UL Listed		l.m.		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Feeder/Sub-Feeder Conductor Total Material Cost**				
B	**Feeder/Sub-Feeder Conductor Total Labor Cost**				
D	**Feeder/Sub-Feeder Conductor Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + F)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.03	**ELECTRICAL WORKS**			3.00	assy
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.03.08	**Panelboard & Circuit Breaker**				
A	**Materials**				
	Panel MDP	1.00	assy		
	Main: 125AT, 250AF, 3-Pole, 25KAIC, 230V, 60Hz MCCB				
	Branches: 2 - 50AT, 100AF, 3-Pole, 230V, 25KAIC MCCB				
	10 - 20AT, 100AF, 2-Pole, 230V, 10KAIC MCCB				
	With Grounding Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	Panel LP1	1.00	assy		
	Main: 50AT, 100AF, 3-Pole, 230V, 25KAIC, 60Hz MCCB				
	Branches: 9 - 20AT, 100AF, 2-Pole, 230V, 10KAIC MCCB				
	With Grounding Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	Panel LP2	1.00	assy		
	Main: 50AT, 100AF, 3-Pole, 230V, 25KAIC, 60Hz MCCB				
	Branches: 6 - 20AT, 100AF, 2-Pole, 230V, 10KAIC MCCB				
	With Grounding Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Panelboard & Circuit Breaker Total Material Cost**				
B	**Panelboard & Circuit Breaker Total Labor Cost**				
D	**Panelboard & Circuit Breaker Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + F)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.03	**ELECTRICAL WORKS**			300.00	sq.m.
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.03.09	**Structured Cabling System**				
A	**Materials**				
	Optical Network Terminal	4.00	sets		
	2:8 Optical Splitter	1.00	set		
	2C Fiber optic cable		sets		
	Cat5e		rolls		
	Data Outlet	32.00	sets		
	Data & Tel Outlet	7.00	sets		
	650VA UPS	1.00	set		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Structured Cabling System Total Material Cost**				
B	**Structured Cabling System Total Labor Cost**				
D	**Structured Cabling System Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + F)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.03	**ELECTRICAL WORKS**			1.00	lot
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.03.10	**Termination Accessories**				
A	**Materials**				
	G.I. Tie Wire Gauge 16		kgs		
	Electrical Tape		rolls		
	PVC Solvent Cement 400cc		cans		
			Material Cost	. . . . .	
B	**Labor**	QTY	DUR. (DAYS)	RATE/DAY	
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Termination Accessories Total Material Cost**				
B	**Termination Accessories Total Labor Cost**				
D	**Termination Accessories Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + F)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.04	**MECHANICAL WORKS**			10.00	sets
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.04.01	**Air Conditioning Unit and Pipings**				
	Wall mounted Split type ACU (Inverter) - 2.5 Hp with complete accessories (remote control and digital display, circuit breaker in NEMA-3R Enclosure and other fittings) Power Supply: 208-230 V, 1Ø, 60 Hz Refrigerant Type: R32	1.00	set		
	Wall mounted Split type ACU (Inverter) - 2.0 Hp with complete accessories (remote control and digital display, circuit breaker in NEMA-3R Enclosure and other fittings) Power Supply: 208-230 V, 1Ø, 60 Hz Refrigerant Type: R32	4.00	sets		
	Wall mounted Split type ACU (Inverter) - 1.5 Hp with complete accessories (remote control and digital display, circuit breaker in NEMA-3R Enclosure and other fittings) Power Supply: 208-230 V, 1Ø, 60 Hz Refrigerant Type: R32	2.00	sets		
	Wall mounted Split type ACU (Inverter) - 1.0 Hp with complete accessories (remote control and digital display, circuit breaker in NEMA-3R Enclosure and other fittings) Power Supply: 208-230 V, 1Ø, 60 Hz Refrigerant Type: R32	3.00	sets		
	Copper Tube Soft Drawn 3/8" OD. 0.028 thickness x 15m		pcs		
	Copper Tube Soft Drawn 1/2" OD. 0.028 thickness x 15m		pcs		
	Copper Tube Soft Drawn 1/4" OD. 0.028 thickness x 15m		pcs		
	Rubber Insulation 3/8" I.D. 3/4" thickness x 1.8m		pcs		
	Rubber Insulation 1/2" I.D. 3/4" thickness x 1.8m		pcs		
	Rubber Insulation 1/4" I.D. 1/2" thickness x 1.8m		pcs		
	Polyethylene tape		pcs		
	25mm diameter PVC Pipe x 3m (drain pipe)		pcs		
	25mm diameter PVC Elbow		pcs		
			Material Cost		
	Labor	No.	Duration	Rate/Day	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost		

A	**Air Conditioning Unit and Pipings Total Material Cost**	
B	**Air Conditioning Unit and Pipings Total Labor Cost**	
D	**Air Conditioning Unit and Pipings Total Direct Cost**	
	INDIRECT COSTS	
	1. OCM (0% - 10% of TDC)	
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)	
	E. TOTAL OCM & PROFIT	
	F. VALUE ADDED TAX, (VAT) 5.0% of (D + E)	
	G. TOTAL ESTIMATED INDIRECT COST (F + E), P	
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit	
	TOTAL ESTIMATED COST (D + G), P	
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit	

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.04	**MECHANICAL WORKS**			73.59	sq. m.
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.04.02	**Ventilation Equipment and Accessories**				
	12" Ceiling Mounted Exhaust Fan, 150CFM with complete accessories (100mm applicable pipe)	7.00	sets		
	18" Wall Fan, Banana type Plastic blade, 3-speed	4.00	sets		
	Stainless steel vent cap with net (100mm applicable pipe)		pcs		
	100mm diameter PVC x 3m pipe		pc		
	Exhaust Air Ductworks GI Sheet Ga. 24		l.m.		
	Backdraft Damper 150mmX150mm	5.00	pcs		
	Exhaust Air Grille 250mmX200mm	2.00	pcs		
			Material Cost		
	Labor	No.	Duration	Rate/Day	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost		
A	**Ventilation Equipment and Accessories Total Material Cost**				
B	**Ventilation Equipment and Accessories Total Labor Cost**				
D	**Ventilation Equipment and Accessories Total Direct Cost**				
	INDIRECT COSTS				
	1. OCM (0% - 10% of TDC)				
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)				
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.04	**MECHANICAL WORKS**			5.11	sq. m.
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.04.03	**Hangers and Supports**				
A	**Material**				
	50mm x 50mm x 6mm x 6m Angle Bar		pcs		
	6mm diameter x 3m Hanger Rod (threaded)		pcs		
	Welding Rod 1/8", 5 kg/box		boxes		
	6mm expansion shield		pcs		
			Material Cost		
B	**Labor**	No.	Duration	Rate/Day	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost		
C	**Equipment**	No.	Duration	Rate/Day	
	Welding Machine 200 amp				
			Equipment Cost		
A	**Hangers and Supports Total Material Cost**				
B	**Hangers and Supports Total Labor Cost**				
C	**Hangers and Supports Total Equipment Cost**				
D	**Hangers and Supports Total Direct Cost**				
	INDIRECT COSTS				
	1. OCM (0% - 10% of TDC)				
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)				
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION	**I. CONSTRUCTION OF ADMINISTRATION BUILDING**				
LOCATION	Catbalogan Airport, Catbalogan City, Samar				
SUBJECT	**Bill of Quantities and Cost Estimates**				
1.04	**MECHANICAL WORKS**			308.68	sq. m.
ITEM	DESCRIPTION	QTY	UNIT	UNIT COST	AMOUNT (P)
1.04.04	**FDAS and Fire Extinguisher**				
	Photoelectric Smoke Detector w/ built-in sounder and batteries	18.00	sets		
	Fire Alarm Horn w/ Strobe	4.00	sets		
	Rated Strobe Output : 15-110 cd (candela)				
	Manual Pull Station with complete accessories	4.00	sets		
	15mm x 10mm x 2.44m PVC Moulding		pcs		
	1.25 mm^2 TF x 150m Copper Wire (UL Listed) (for Manual Pull Station and Fire Alarm Horn w/ Strobe Connection)		roll		
	10 lbs ABC Dry Chemical Portable Fire Extinguisher with complete accessories	11.00	sets		
			Material Cost		
	Labor	No.	Duration	Rate/Day	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost		
A	**FDAS and Fire Extinguisher Total Material Cost**				
B	**FDAS and Fire Extinguisher Total Labor Cost**				
D	**FDAS and Fire Extinguisher Total Direct Cost**				
	INDIRECT COSTS				
	1. OCM (0% - 10% of TDC)				
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)				
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF ADMINISTRATIVE BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			210.06	days
ITEM	DESCRIPTION				
5.00	**PLUMBING WORKS**				
5.01	**Site works**				
	(requires labor only)				
	Excavation (111.21 cu.m.)				
	Backfill (98.84 cu.m.)				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Gravel Bedding (Catch Basin, Septic Tanks & Trench Drain)				
	Gravel (3/4")		cu.m.		
	Sand Bedding (Ground Pipe Trenches)				
	Sand		cu.m.		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**SITEWORKS MATERIAL COST**			
B	**SITEWORKS LABOR COST**			
C	**SITEWORKS EQUIPMENT COST**			
D	**SITEWORKS DIRECT COST**			
	INDIRECT COSTS			
	1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
	E. TOTAL OCM & PROFIT		of D	
	F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
	G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
	TOTAL ESTIMATED COST (D + G), P			
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF ADMINISTRATIVE BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			108.10	li.m.
ITEM	DESCRIPTION				
5.00	**PLUMBING WORKS**				
5.02	**Sewer Line System**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Soil Pipe/ Waste Pipe (65.2 li.m.)				
	107mmØ x 3m uPVC Pipe, Series 1000		pc.		
	57mmØ x 3m uPVC Pipe, Series 1000		pc.		
	57mmØ uPVC P-Trap		pc.		
	57mmØ SS P-Trap		pcs.		
	57x57mm Ø uPVC 90 deg. Elbow		pcs.		
	107x107mm Ø uPVC 90 deg. Elbow		pcs.		
	57x57mm Ø uPVC 45 deg. Elbow		pcs.		
	107x107mm Ø uPVC 45 deg. Elbow		pcs.		
	57x57x57mm uPVC Wye		pc.		
	107x57x107mm Ø uPVC Wye		pcs.		
	107x107x107mm Ø uPVC Wye		pcs.		
	57x57x57mm Ø uPVC Sanitary Tee		pcs.		
	57mmØ uPVC Cleanout Set		pcs.		
	107mmØ uPVC Cleanout Set		pcs.		
	57x57mm SS Access Cover		pcs.		
	107x107mm SS Access Cover		pcs.		
	Solvent Cement (400 cc)		cans		
	Underground Sewer line Tape (Green) - 3" x 1000 ' per roll		roll		
	Pipe Hanger and Support		sets		
	Vent Pipe (42.90 li.m.)				
	82mmØ x 3m uPVC Pipe, Series 1000		pc.		
	57mmØ x 3m uPVC Pipe, Series 1000		pc.		
	57x57mmØ uPVC 90 deg. Elbow		pc.		
	82x82mmØ uPVC 90 deg. Elbow		pc.		
	57x57x57mmØ uPVC Tee		pc.		
	82x82x82mmØ uPVC Tee		pc.		
	Solvent Cement (400 cc)		pc.		
	Pipe Hanger and Support		sets		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**SEWER LINE SYSTEM MATERIAL COST**	
B	**SEWER LINE SYSTEM LABOR COST**	
C	**SEWER LINE SYSTEM EQUIPMENT COST**	
D	**SEWER LINE SYSTEM DIRECT COST**	

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF ADMINISTRATIVE BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			133.65	l.m.
ITEM	DESCRIPTION				
5.00	**PLUMBING WORKS**				
5.03	**Waterline System**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	20mmØx4m PPR Pipe, PN20		pc.		
	25mmØx4m PPR Pipe, PN20		pc.		
	20mmØ PPR Coupling		pc.		
	25mmØ PPR Coupling		pc.		
	25x25x25mm Ø PPR Tee		pc.		
	32x25x32mm Ø PPR Tee		pc.		
	32x32x32mm Ø PPR Tee		pc.		
	25x32mm Ø PPR Increaser		pc.		
	32x40mm Ø PPR Increaser		pc.		
	32x25mm Ø PPR Reducer		pc.		
	32mm Ø PPR End Cap		pc.		
	40mm Ø PPR End Cap		pc.		
	25mm Ø PPR 90 deg. Elbow		pc.		
	32mm Ø PPR 90 deg. Elbow		pc.		
	15mmØx300mm Flexible hose		pc.		
	15mmØ x 300mm SS Nipple		pc.		
	20mmØ x 300mm SS Nipple		pc.		
	25mmØ x 300mm SS Nipple		pc.		
	25mmØ PPR Gate valve		pc.		
	32mmØ PPR Gate valve		pc.		
	32mmØ Cast Iron Body Water meter		pc.		
	32mmØ Brass Gate valve		pc.		
	32mmØ Brass Check valve		pc.		
	Teflon Tape		roll		
	Underground Waterline Tape (Blue) - 2" x 1000 ' per roll		roll		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR(days)	RATE/DAY	TOTAL RATE
	Heat Fusing Machine				
			Equipment Cost	. . . . .	

A	**WATERLINE SYSTEM MATERIAL COST**	
B	**WATERLINE SYSTEM LABOR COST**	
C	**WATERLINE SYSTEM EQUIPMENT COST**	
D	**WATERLINE SYSTEM DIRECT COST**	

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF ADMINISTRATIVE BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			81.90	li.m.
ITEM	DESCRIPTION				
5.00	**PLUMBING WORKS**				
5.04	**Storm Drainage System**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	107mmØx3m uPVC Pipe, Series 1000		pcs		
	107mmØ uPVC 90 deg. Elbow		pcs		
	107x107mmØ uPVC Tee		pcs		
	Solvent Cement (400 cc)		cans		
	107mmØ Cast iron Body, Brass Dome Gutter Drain		sets		
	Galvanived Flat Bar Pipe Support		sets		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**STORM DRAINAGE SYSTEM MATERIAL COST**			
B	**STORM DRAINAGE SYSTEM LABOR COST**			
C	**STORM DRAINAGE SYSTEM EQUIPMENT COST**			
D	**STORM DRAINAGE SYSTEM DIRECT COST**			
	INDIRECT COSTS			
	1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT			of D	
F. VALUE ADDED TAX, (VAT)		5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P				
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit				
TOTAL ESTIMATED COST (D + G), P				
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit				

NAME OF PROJECT : **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**
DESCRIPTION : **CONSTRUCTION OF ADMINISTRATIVE BUILDING**
LOCATION : Catbalogan Airport
Catbalogan City, Samar

		QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**	11.83	cu.m.

ITEM	DESCRIPTION				
5.00	**PLUMBING WORKS**				
5.05	**Septic Tank and Catch Basin**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Septic Tank (10.15 cu.m.)				
	Portland Cement (40kg per bag)		bags		
	Sand		cu.m.		
	Gravel (3/4")		cu.m.		
	6" Nonbearing CHB		pcs.		
	12mmØ DRSB Grade 33, 6 meters		pcs.		
	#16 G.I. Tie Wire		kgs.		
	1/2" x 4' x 8' Ordinary Plywood		pcs.		
	2" x3" Form Lumber (Coco)		bd.ft.		
	Bituminous Paint (4L)		can		
	Assorted CWN		kg.		
	4" Paint brush		pc.		
	Catch Basin (1.68 cu.m.)				
	Portland Cement (40kg per bag)		bags		
	Sand		cu.m.		
	Gravel (3/4")		cu.m.		
	4" Nonbearing CHB		pcs.		
	12mmØ DRSB Grade 33, 6 meters		pc.		
	10mmØ DRSB Grade 33, 6 meters		pcs.		
	#16 G.I. Tie Wire		kgs.		
	1/2" x 4' x 8' Ordinary Plywood		pcs.		
	2" x2" Form Lumber		bd.ft.		
	16mmØ SS Hexagonal Nut		bag		
	Assorted CWN		kg.		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR(days)	RATE/DAY	TOTAL RATE
	One bagger concrete mixer				
	Concrete vibrator				
			Equipment Cost	. . . . .	

A	**SEPTIC TANK AND CATCH BASIN MATERIAL COST**	
B	**SEPTIC TANK AND CATCH BASIN LABOR COST**	
C	**SEPTIC TANK AND CATCH BASIN EQUIPMENT COST**	
D	**SEPTIC TANK AND CATCH BASIN DIRECT COST**	

INDIRECT COSTS

1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF ADMINISTRATIVE BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			1.00	lot
ITEM	DESCRIPTION				
5.00	**PLUMBING WORKS**				
5.06	**Fixtures and Accessories**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Fixtures and Accessories				
	Undercounter Oval Shape Lavatory with Faucet, Double Handle Lever, Complete Fittings and Accessories	10.00	sets		
	Water Closet Vitreous- Elongated with Top Inlet Flush Valve and Complete Fittings	7.00	sets		
	Tank Type Water Closet Vitreous- Elongated with Dual Push Button Flush and Complete Fittings	1.00	set		
	Stainless Steel Hygiene Spray with with Complete Fittings and Accessories	8.00	sets		
	Urinal Vitreous- Stall Type with Lever Flush and Complete Fittings	4.00	sets		
	Stainless Steel Tissue Holder	8.00	sets		
	Hand Dryer	6.00	sets		
	100x100mm Stainless Steel Floor Drain	8.00	sets		
	Wall Mounted Baby Changing Station (Diaper Change)	1.00	set		
	1-1/2" x 24" Straight Type Stainless Steel Grab Bar Complete Hardware and Accessories	2.00	sets		
	1-1/2" L-Type Stainless Steel Grab Bar Complete Hardware and Accessories	1.00	set		
	Drop-in Single Bowl Stainless Steel Kitchen Sink with Drain Board, Faucet, Complete Fittings and Accessories	1.00	set		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**FIXTURES AND ACCESSORIES MATERIAL COST**		
B	**FIXTURES AND ACCESSORIES LABOR COST**		
C	**FIXTURES AND ACCESSORIES EQUIPMENT COST**		
D	**FIXTURES AND ACCESSORIES DIRECT COST**		
	INDIRECT COSTS		
	1. OCM (0% - 10% of TDC)	of Estimated Direct Cost	
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)	of Estimated Direct Cost	
	E. TOTAL OCM & PROFIT	of D	
	F. VALUE ADDED TAX, (VAT) 5.0%	of (D + E)	
	G. TOTAL ESTIMATED INDIRECT COST (F + E), P		
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit		
	TOTAL ESTIMATED COST (D + G), P		
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit		

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.01	**CIVIL/STRUCTURAL WORKS**			1,454.00	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.01.01	**Site Works**				
	Excavation - 893.39 cu.m.				
	Backfill - 499.62 cu.m.				
A	**Materials**				
	Gravel Bedding, G-1 (delivered on site)		cu.m.		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborers				
	Common Laborers				
			Labor Cost	. . . . .	
C	**Equipment**	# of EQPT	DUR. (DAYS)	RATE/DAY	
	Backhoe, 0.80 cu.m.				
	Payloader, 1.50 cu.m.				
	Dump Truck, 9 cu.m.				
	Vibratory Single Smooth Drum Roller, 10MT				
			Equipment Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
C	**TOTAL EQUIPMENT**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.01	**CIVIL/STRUCTURAL WORKS**			3,402.00	Li.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.01.02	**Pile Driving Works**				
A	**Materials**				
	400mm x 400mm x18m Driven Pile - 5000psi		li.m.		
	Oxygen & Acetylene		sets		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborers				
	Common Laborers				
			Labor Cost	. . . . .	
C	**Equipment**	# of EQPT	DUR. (DAYS)	RATE/DAY	
	Truck Mounted Crane, (41-45 MT)				
	Diesel Pile Hammer, Mitsubishi, DSL - 10.5 ton				
	Drop Hammer				
	Oxy-Acetylene Cutting Torch/Welding Outfit				
	Jack Hammer				
	Air Compressor (355-450 cfm)				
			Equipment Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
C	**TOTAL EQUIPMENT COST**				
D	**TOTAL DIRECT COST**				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.01	**CIVIL/STRUCTURAL WORKS**			967.00	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.01.03	**Concrete Works**				
A	**Materials**				
	Portland Cement		bags		
	Sand		cu.m.		
	Gravel (3/4")		cu.m.		
	28 mm Ø x 6m DRSB, G60		pcs.		
	25 mm Ø x 6m DRSB, G60		pcs.		
	20 mm Ø x 6m DRSB, G60		pcs.		
	16 mm Ø x 6m DRSB, G60		pcs.		
	12 mm Ø x 6m DRSB, G40		pcs.		
	10 mm Ø x 6m DRSB, G40		pcs.		
	#16 G.I. Tie Wires		kgs.		
	2" x 3" Formlumber (Coco)		bdft.		
	1.2m x 4.8m x 12.5mm thk. Ordinary Plywood		pcs.		
	1.2m x 4.8m x 12.5mm thk.Phenolic Board		pcs.		
	CWN assorted		kgs.		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	# of EQPT	DUR. (DAYS)	RATE/DAY	
	Rental of Scaffolding and Staging				
	2-H Frame (1.2x1.5), 2-Crossbraces, 4 Joint Pins				
	Concrete Batch Plant (Improvised)				
	Transit Mixer (5 cu.m.)				
	Payloader, 1.50 cu.m.				
	Concrete Vibrator				
	Water Truck, 4,000 gals				
	Tower Crane				
	Pump Crete				
	Bar Cutter/Shear, 42mm				
	Electric Bar Bender				
			Equipment Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
C	**TOTAL EQUIPMENT COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.01	**CIVIL/STRUCTURAL WORKS**			1,396.52	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.01.04	**Masonry Works**				
A	**Materials**				
	6" CHB		pcs.		
	4" CHB		pcs.		
	Portland Cement		bags		
	Sand		cu.m.		
	10 mm Ø x 6m DRSB, G40		pcs.		
	#16 G.I. Tie Wires		kgs.		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	# of EQPT	DUR. (DAYS)	RATE/DAY	
	One-bagger Concrete Mixer				
			Equipment Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
C	**TOTAL EQUIPMENT COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.01	**CIVIL/STRUCTURAL WORKS**			9,352.86	kgs.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.01.05	**Steel Works**				
A	**Materials**				
	20mm thk Base plate, 0.35m x 0.35m		pcs.		
	4' x 8' x 10mm thick Stiffener		pc.		
	20mmØ x 400mm A325 Structural Bolt		pcs.		
	W8x31, 6 meters		pcs.		
	W8x21, 6 meters		pcs.		
	W10x26, 6 meters		pcs.		
	GA 18 Plate		pcs.		
	12mm thick Plate, 0.15m x 0.15m		pcs.		
	10mm dia. x 6m. DRSB, G40		pcs.		
	1-1/2"Ø G.I. Pipe Sched. 40, 6m.		pcs.		
	Steel Flange Cover		pcs.		
	4.5mm thick Plate, 0.675m x 0.063m		pcs.		
	12 mm Ø x 100mm Expansion Bolt		pcs.		
	25 mm Ø G.I. Pipe Sched. 40, 6m.		pc.		
	50mm x 80mm x 3mm thick Base Plate		pcs		
	75mm x 65mm x 3mm thick Base Plate		pcs		
	100mm x 65mm x 3mm thick Base Plate		pcs		
	Self-drilling Screw		pcs.		
	50 x 50 x 6mm thk. Angle bar, 6m.		pc.		
	16 mm Ø 6m. Round bar, G60		pcs.		
	10 mm Ø x 50mm Expansion Bolt		pcs.		
	600mm x 600mm x 4.76mm Hatch Cover	1.00	set		
	4' x 8' x 4.76mm thk. Steel Frame		pc.		
	38 x 38 x 4.5mm thk. Angle bar, 6m.		pc.		
	25 x 25 x 4.5mm thk. Angle bar, 6m.		pc.		
	25 x 4.5mm thk. Flat Bar, 6m.		pc.		
	891 x 891 x 4.5mm thk Checkered Plate		set		
	2250mm x 910mm Roof Hatch (including complete accessories)	1.00	set		
	GA #14 Galvanized Steel Frame		pc.		
	101mm x 3mm thk C - Purlins, 6m.		pcs.		
	Welding Rod E6011		boxes		
	Oxygen		cyl		
	Acetylene		cyl		
	Rust Converter		gals		
	Epoxy Primer w/ Catalyst		gals		
	QDE		gals		
	Paint Thinner		gals		
	Paint Brush, 3"		pcs		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	# of EQPT	DUR. (DAYS)	RATE/DAY	
	Welding Machine, 200Amp				
	51-100kw Generator Set				
	Abrasive Cutting Machine				
	Oxy-Acetylene Cutting Torch/Welding Outfit				
	Tower Crane				
			Equipment Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
C	**TOTAL EQUIPMENT COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.01	**CIVIL/STRUCTURAL WORKS**			109.00	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.01.06	**Moisture and Thermal Protection Works**				
A	**Materials**				
	25mm thk. Polystyrene Insulation Board		sq.m.		
	Portland Cement		bags		
	Sand		cu.m.		
	WWF 3mmØ x 100mm x 100mm		sq.m.		
	Liquid-Applied Waterproofing		sq.m.		
	25mm thk. Fiber Insulation Board		sq.m.		
	331 x 150 x 50mm Treated Wood Blocking		pcs.		
	Extruded Aluminum Coping (2.34m length)		pcs.		
	100mm x 1mm thk. Aluminum Flashing		li.m		
	10mmØ x 40mm Expansion Shield w/ M10 x 75mm hexagon head bolt		pcs.		
	12mm thk Clear Tempered Glass w/ safety Film Roofing Sheet on Metal Framing		sq.m.		
	Rustproof-Countersunk Long-Self Tapping Screw		pcs.		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.02	**ARCHITECTURAL WORKS**			817.20	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.02.01	**Carpentry Works**				
1A	***Ceiling Finishes***				
A	**Materials**				
	600mm x 1200mm Perforated Metal Ceiling Panel		pcs.		
	600mm x 1200mm Acoustic Ceiling Panel		pcs.		
	Triangle Keel A, 0.34mm x 3.0m		pcs.		
	38mm x 12mm x 0.80mm C-Channel, 5 meters		pcs.		
	2 Legs Suspension Part - Twin Clamps		pcs.		
	Perimeter Trims, 23mm x 23mm x 3.0m		pcs.		
	Threaded Bolt with Nut 3/8" x 3m		pcs.		
	Expansion Shield		pcs.		
	J-Type Hanger Bracket 3/8		pcs.		
	1/4" thk x 4' x 8' Fiber Cement Board		pcs.		
	16mm thk. 4' x 8' Gypsum Board		pcs.		
	100mm x 3.0m GA 18 Horizontal Steel Studs		pcs.		
	50mm x 19mm x 0.40mm J-Furring, 5 meters		pcs.		
	25mm x 25mm x 0.40mm x 3meters Wall Angle		pcs.		
	Double Furring Clip		pcs.		
	Drive Angle		pcs.		
	Suspension Clip and Hanger Rod		pcs.		
	Blind Rivets, 1/8" x 3/8"		boxes		
	Concrete Nails		kgs.		
	Fiber Cement Board Screw		pcs.		
	Gypsum Screw, 6 x 1" 25mm Fluted pt.		pcs.		
	Mesh Tape, 2" x 30 meters		pcs.		
	Jointing Compound		bags		
	Concrete Neutralizer		gal		
	Flat Latex Paint		gals		
	Semi-gloss Latex Paint		gals		
	Acrylic Water Base Latex Paint		gals		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**TOTAL MATERIAL COST**	
B	**TOTAL LABOR COST**	
D	**TOTAL DIRECT COST**	
	INDIRECT COSTS	
1. OCM (0% - 10% of TDC)		
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		
E. TOTAL OCM & PROFIT		
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P		
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit		
TOTAL ESTIMATED COST (D + G), P		
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit		

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.02	**ARCHITECTURAL WORKS**			344.98	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.02.01	**Carpentry Works**				
1B	**Wall Finishes**				
A	**Materials**				
	Dry Wall Finishes -132.80 sq.m				
	12mm. thk. x 4' x 8' Fiber Cement Board		pcs.		
	0.6mm thk. x 35mm x 100mm x 3.0m Metal Studs		pcs.		
	Board Screw		pcs.		
	Blind Rivets		pcs.		
	Wall Finishes at Tower Cab - 114.75 sq.m.				
	4mm thk. Aluminum Composite Panel		sq.m.		
	9mm thk. Compressed Fiber Cement Board		pcs.		
	Foil-faced Batt Insulation		sq.m.		
	100mm x 3.0m GA 18 Metal Studs		pcs.		
	38mm thk. x 5.0m GA No.18 Top Hats		pcs.		
	Board Screw		pcs.		
	Blind Rivets		pcs.		
	at Stair going to CAB Tower - 10.43 sq.m.				
	16mm thk. 4' x 8' Gypsum Board		pcs.		
	100mm x 3.0m GA 18 Metal Studs		pcs.		
	9mm thk. Fiber Cement Board		pcs.		
	22mm thk. x 5.0m GA No.18 Top Hats		pc.		
	Board Screw		pcs.		
	Blind Rivets		pcs.		
	Louver Panels - 87 sq.m				
	10mm x 50mm Expansion Shield with bolt and nut		pcs		
	1/4" x 2" Anodized Aluminum Plate		l.m.		
	2" x 2" Anodized square tubular		l.m.		
	1" x 1" Anodized square tubular bracket		l.m.		
	1/4" x 2" Anodized Aluminum continous flat bar		l.m.		
	20mm thk. Anodized Aluminum Louver Blade		l.m.		
	20 x 50 Channel Frame		l.m.		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)		5.0%	of (D + E)		
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.02	**ARCHITECTURAL WORKS**			1,031.87	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.02.02	**Tile Works**				
A	**Materials**				
	Portland Cement		bags		
	Sand		cu.m.		
	600mm x 600mm Synthetic Granite		pcs.		
	600mm x 600mm Non-Skid Synthetic Granite		pcs.		
	600mm x 600mm Homogenous Non-Skid Tiles		pcs.		
	300mm x 600mm Homogenous Wall Tiles		pcs.		
	3mm thk 6063 Alloy T5 Temper Mill Finish		li.m.		
	Grade Alum. Stair Nosing				
	3/4" thk Counter Top		sq.m.		
	Tile Adhesive (25kgs)		bags		
	Tile Grout (2kgs)		bags		
	Tile Cutting Disk, 4"		pcs		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.02	**ARCHITECTURAL WORKS**			31.00	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.02.03	**Raised Floor and Precast Wall Works**				
A	**Materials**				
	Raised Floor (Fully Accessible Floor Panels) System		sq.m.		
	Precast Wall- Tower Fins		sets		
	2"Ø x 6m Pipe		pcs.		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.02	**ARCHITECTURAL WORKS**			4,940.04	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.02.04	**Painting Works**				
A	**Materials**				
	Rubberized Paint		gal		
	Concrete Neutralizer		gals		
	Elastomeric Paint		gals		
	Elastomeric Sealer		gals		
	Semi Gloss Latex Paint		gals		
	Flat Latex Paint		gals		
	Masonry Putty		gals		
	9" Roller Brush w/ Tray		pcs.		
	4" Paint Brush		pcs.		
	Paint Brush 2"		pcs.		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.02	**ARCHITECTURAL WORKS**			99.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.02.05	**Doors and Windows**				
5A	**Doors - 59 sets**				
A	**Materials**				
D-1	4.13m x 2.10m , 12mm Thk. Frameless Tempered Glass Swing Door on Patch Fittings	2.00	sets		
D-2	4.13m x 2.10m , 12mm Thk. Frameless Tempered Glass Swing Door on Patch Fittings	1.00	set		
D-3	0.80m x 2.10m, Solid Wood Panel Door in 2"x6" WD Door Jambs and Headers w/ Complete Accessories	21.00	sets		
D-4	0.90m x 2.10m, Solid Wood Panel Door in 2" x 6" WD Door Jambs and Headers w/ Complete Accessories	7.00	sets		
D-5	0.90m x 2.10m, Solid Wood Panel Door w/ Louver in 2" x 6" WD. Door Jambs and Headers w/ Complete Accessories	2.00	sets		
D-6	0.60m x 2.10m, Solid Wood Panel Door w/ Louver In 2" x 6" WD. Door Jambs and Headers w/ Complete Accessories	7.00	sets		
D-7	0.60m x 2.10m, Solid Wood Panel Door in 2" x 6" WD Door Jambs and Headers w/ Complete Accessories	4.00	sets		
D-8	0.9m x 2.10m, Fire Rated Steel Door	5.00	sets		
D-9	1.8m x 2.10m, Steel Louver Door	1.00	set		
D-10	0.9m x 2.10m, Steel Louver Door	1.00	set		
D-11	0.9m x 2.10m, Hollow Metal Panic Door	1.00	set		
D-12	5.075m x 2.10m , 12mm Thk. Frameless Tempered Glass Swing Door on Patch Fittings	1.00	set		
D-13	2.234m x 2.10m , 12mm Thk. Frameless Tempered Glass Sliding Door on Patch Fittings	1.00	set		
D-14	7.30m x 2.10m , 12mm Thk. Frameless Tempered Glass Sliding Door on Patch Fittings	1.00	set		
D-15	4.00m x 2.10m , 12mm Thk. Frameless Tempered Glass Sliding Door on Patch Fittings	1.00	set		
D-16	4.288m x 2.10m , 12mm Thk. Frameless Tempered Glass Sliding Door on Patch Fittings	1.00	set		
D-17	6.95m x 2.10m , 12mm Thk. Frameless Tempered Glass Swing Door on Patch Fittings	1.00	set		
D-18	6.40/2.55m x 2.10m , 12mm Thk. Frameless Tempered Glass Swing/ Partition Door on Patch Fittings	1.00	set		
5B	**Windows - 40 sets**				
A	**Materials**				
W-1	3.0m x 1.20m, Aluminum Framed Sliding Window w/ 10mm Thk. Tempered Clear Glass and Accessories	5.00	sets		
W-2	2.0m x 1.20m, Aluminum Framed Sliding Window w/ 10mm Thk. Tempered Clear Glass and Accessories	8.00	sets		
W-3	1.20m x 0.90m, Aluminum Framed Sliding Window w/ 10mm Thk. Tempered Clear Glass and Accessories	2.00	sets		
W-4	0.70m x 0.50m, Aluminum Framed Awning Window w/ 10mm Thk. Tempered Clear Glass and Accessories	2.00	sets		
W-5	3.00m x 0.60m, Steel Louver Window	1.00	set		
W-6	4.00m x 0.60m, Steel Louver Window	1.00	set		
W-7	0.70m x 11.40m, 12mm Thk. Tempered Glass Fixed Window	2.00	sets		
W-8	5.52m x 1.27m Aluminum Framed Fixed Type Window W/ 10mm Thk., Tempered Clear Glass and Accessories	2.00	sets		
W-9	3.22m x 1.27m Aluminum Framed Casement Type Window w/ 10mm Thk., Tempered Clear Glass and Accessories	10.00	sets		
W-10	1.11m x 0.60m Aluminum Framed Casement Type Window w/ 10mm Thk., Tempered Clear Glass and Accessories	4.00	sets		
W-11	5.03m x 0.90m Aluminum Framed Awning Type Window w/ 10mm Thk., Tempered Clear Glass and Accessories	2.00	sets		
W-12	22.60/28.44m x 2.80m 2-12mm Clear Float Insulated Tempered Glass Panel w/ 2mm Airspace in Silicone Butt Joint	1.00	set		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.02	**ARCHITECTURAL WORKS**			16.88	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.02.06	**Toilet Partition, Concrete Countertop and Accessories**				
A	**Materials**				
	13mm Phenolic Compact Laminate Board		sq.m.		
	Aluminum Top Rail		li.m.		
	Aluminum Corner Rail		li.m.		
	Aluminum Edge Trim		li.m.		
	32mm x 32mm Stainless Steel Joint Right Angle Bracket		pcs.		
	SS Countersunk Head Screw		pcs.		
	Adjustable Foot		pcs.		
	Hook		pcs.		
	Door Lock with indicator both		pcs.		
	Beveled Glass Mirror w/ Marine Plywood Backing		sq.m.		
	200x12mm thk. Frosted Tempered Glass Ledge		sq.m.		
	Steel Ledge Support		pcs.		
	20mm Granite Slab Counter Top, Fascia & Splash Board		sq.m.		
	10mmØ DRSB, 6 meters		pcs.		
	#16 G.I. Tie Wire		kg		
	Portland Cement (40kg per bag)		bags		
	Sand		cu.m.		
	Gravel (3/4")		cu.m.		
	1/2" x 4' x 8' Ordinary Plywood		pcs.		
	2" x3" Form Lumber (Coco)		bd.ft.		
	Assorted CWN		kg.		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			1,008.00	lm
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.01	**Lighting and Power Conduits and Fittings**				
A	**Materials**				
	20mm diameter × 3m uPVC Electrical Pipe, UL Listed		pcs.		
	20mm diameter PVC Coupling		pcs.		
	20mm diameter PVC Male Adaptor with locknut		pcs.		
	25mm diameter × 3m Electrical Metallic Tubing UL Listed		pcs.		
	25mm diameter EMT Coupling		pcs.		
	25mm diameter EMT Connector with Locknut and Bushing		pcs.		
	25mm diameter × 3m Intermediate Metal Conduit, UL Listed		pcs.		
	25mm diameter IMC Elbow		pcs.		
	25mm diameter IMC Coupling		pcs.		
	25mm diameter IMC Locknut and Bushing		pairs		
	32mm diameter × 3m Intermediate Metal Conduit, UL Listed		pcs.		
	32mm diameter IMC Elbow		pcs.		
	32mm diameter IMC Coupling		pcs.		
	32mm diameter IMC Locknut and Bushing		pairs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			23.00	rolls
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.02	**Wires and Cables**				
A	**Materials**				
	3.5 mm² THHN/THWN-2 x 150m 600V 90ºC Copper Wire, UL Listed		rolls		
	5.5 mm² THHN/THWN-2 x 150m 600V 90ºC Copper Wire, UL Listed		rolls		
	8.0 mm² THHN/THWN-2 x 150m 600V 90ºC Copper Wire, UL Listed		rolls		
	14 mm² THHN/THWN-2 Copper Wire, UL Listed		l.m.		
	22 mm² THHN/THWN-2 Copper Wire, UL Listed		l.m.		
	30 mm² THHN/THWN-2 Copper Wire, UL Listed		l.m.		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			187.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.03	**Electrical Wiring Devices**				
A	**Materials**				
	Three-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	6.00	sets		
	Two-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	15.00	sets		
	One-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	20.00	sets		
	Two-Gang, three-way Switch, 16A, 250V, wide series with mounting strap and device plate cover	2.00	sets		
	One-Gang, three-way Switch, 16A, 250V, wide series with mounting strap and device plate cover	10.00	sets		
	Dimmer Switch, 10A, 250V, 800W	1.00	set		
	Simplex Universal Convenience Outlet with Ground, 16A, 250V	14.00	sets		
	Duplex Universal Convenience Outlet with Ground, 16A, 250V with mounting and device plate cover	112.00	sets		
	Weather Proof Duplex Universal Convenience Outlet with Ground, 16A, 250V with mounting and device plate cover	2.00	sets		
	Duplex GFCI Outlet, 16A, 250V	1.00	set		
	Air Conditioning Unit Outlet, with safety breaker, 20A, 220V	1.00	set		
	Air Conditioning Unit Outlet, with safety breaker, 30A, 220V	3.00	sets		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			146.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.04	**Lighting Fixtures**				
A	**Materials**				
	LED BULK HEAD 20W 1100Lm IP67	3.00	sets		
	90mmØ LED RECESSED LIGHTING FIXTURE, 12W 800Lm	4.00	sets		
	FLUORESCENT SLIM BATTEN W/ 18W 1800LM T5 LED LAMP	4.00	sets		
	177mmØ LED SURFACE MOUNTED, 32W 2000LM	21.00	sets		
	600x1200mm RECESSED LED PANEL LIGHT, 56W 6400Lm	13.00	sets		
	600x1200mm SURFACE MOUNTED LED PANEL LIGHT, 56W	17.00	sets		
	152mmØ LED RECESSED LIGHTING FIXTURE, 14W, 1080Lm	23.00	sets		
	600x600mm RECESSED LED PANEL LIGHT, 40W 3200Lm	6.00	sets		
	E-27 CEILING RECEPTACLE WITH 11W 1100Lm LED BULB	2.00	sets		
	174mmØ 12W SURFACE MOUNTED LED LIGHTING FIXTURE	37.00	sets		
	100W LED SPOTLIGHT IP 65 10000Lm	4.00	sets		
	LED EMERGENCY LIGHTS	12.00	sets		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			393.00	pcs.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.05	**Boxes and Pullboxes**				
A	**Materials**				
	4"×2" Utility Box, Deep Type		pcs.		
	Octagonal Junction Box with cover, Deep Type		pcs.		
	Metal Pull Box with cover, 150mmx150mmx100mm, Gauge 16		pcs.		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT : **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**
PROJECT DESCRIPTION : **II. CONSTRUCTION OF CONTROL TOWER**
LOCATION : Tacbalogan Airport
SUBJECT : **Bill of Quantities and Cost Estimates**

2.03	**ELECTRICAL WORKS**			14.00	assy
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.06	**Panel Board/Circuit Breaker/Circuit Protection/Gutter**				
A	**Materials**				
	MDP:	1.00	assy		
	Main: 300AT, 400AF, 3P, 400V, 60Hz 25KAIC MCCB				
	Branch 2-100AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	1-60AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	4-50AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	1-30AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	With Grounding and Neutral Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	EDP:	1.00	assy		
	Main: 100AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	Branch 3-50AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	1-30AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	With Grounding and Neutral Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	LP1:	1.00	assy		
	Main: 50AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	Branch 8-20AT, 100AF, 1P, 230V, 60Hz 10KAIC MCCB				
	With Grounding and Neutral Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	PP1:	1.00	assy		
	Main: 50AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	Branch 14-20AT, 100AF, 1P, 230V, 60Hz 10KAIC MCCB				
	With Grounding and Neutral Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	PP2:	1.00	assy		
	Main: 50AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	Branch 12-20AT, 100AF, 1P, 230V, 60Hz 10KAIC MCCB				
	With Grounding and Neutral Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	PP3:	1.00	assy		
	Main: 60AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	Branch 4-30AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	With Grounding and Neutral Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	EP1:	1.00	assy		
	Main: 50AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	Branch 20-20AT, 100AF, 1P, 230V, 60Hz 10KAIC MCCB				
	With Grounding and Neutral Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	EP2:	1.00	assy		
	Main: 50AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	Branch 14-20AT, 100AF, 1P, 230V, 60Hz 10KAIC MCCB				
	With Grounding and Neutral Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	AP1:	1.00	assy		
	Main: 60AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	Branch 1-50AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	2-30AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	1-20AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	With Grounding and Neutral Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	AP2:	1.00	assy		
	Main: 100AT, 100AF, 3P, 400V, 60Hz 10KAIC MCCB				
	Branches: 4-30AT, 100AF, 3P, 230V, 60Hz 10KAIC MCCB				
	16-20AT, 100AF, 3P, 230V, 60Hz 10KAIC MCCB				
	With Grounding and Neutral Bus Bar, Terminal Lugs and Bolted Dead Front				
	Enclosure: NEMA-1 Gauge 16, Powder coated gray finish				
	Wire gutter, 5.00m×0.30m×0.30m, Gauge 16	1.00	set		
	BUS BAR GUTTER (TYPICAL)	1.00	assy		
	TYPE 1+2 400V SURGE ARRESTER 12.5 Ka Imax 10 Ka ISC	1.00	set		
	TYPE 3 400V SURGE ARRESTER 8 Ka Imax 10Ka Isc	1.00	set		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				

INDIRECT COSTS

1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			375.00	lm
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.07	**Feeder Conductors**				
A	**Materials**				
	MDP to Power House				
	200 mm² THHN/THWN-2 Copper Wire, UL Listed		l.m.		
	50 mm² THHN/THWN-2 Copper Wire, UL Listed		l.m.		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			81.00	lm
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.08	**Feeder wires, conduits and fittings**				
A	**Materials**				
	MDP to Power House				
	90mm diameter × 3m Intermediate Metal Conduit, UL Listed		pcs.		
	90mm diameter × 3m IMC Locknut and Bushings		pcs.		
	90mm diameter × 3m uPVC Electrical Pipe, UL Listed		pcs.		
	90mm diameter Endbell		pcs.		
	90mm diameter PVC Elbow		pcs.		
	90mm diameter PVC Coupling		pcs.		
	90mm diameter PVC Adaptor with Locknut		pairs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			1.00	lot
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.09	**Access Control System**				
A	**Materials**				
	ACCESS CONTROL SYSTEM				
	ACS SOFTWARE	1.00	set		
	ACS PANEL	1.00	set		
	CARD READER	7.00	sets		
	CONTACTLESS SMART CARD	100.00	pcs.		
	DOOR ACCESSORIES				
	ILLUMINATED EXIT BUTTON	1.00	pc.		
	MAGNETIC LOCK	7.00	pcs.		
	BRACKET FOR SWING DOOR	7.00	pcs.		
	12V POEWR SUPPLY, BACK UP BATTERY CHARGER W/ ENCLOS	7.00	pcs.		
	EMERGENCY BREAK GLASS	7.00	pcs.		
	RECHARGEABLE BATTERY	7.00	pcs.		
	MAGNETIC CONTACTS	7.00	pcs.		
	PIEZO BUZZER	1.00	pc.		
	BIOMETRIC ACCESS CONTROL	5.00	sets		
	ACS SERVER	1.00	set		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			16.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03	**ELECTRICAL WORKS**				
2.03.10	**CCTV System**				
A	**Materials**				
	CAMERA SOFTWARE LICENSE	16.00	pcs.		
	16 CH NVR	1.00	pc.		
	4TB NETWORK VIDEO RECORDER	3.00	pcs.		
	2MP IP CAMERA	16.00	sets		
	CCTV CENTRAL POWER	1.00	set		
	4-Pair CAT6 UTP cable		l.m.		
	20mm diameter × 3m Electrical Metallic Tubing UL Listed		pcs.		
	20mm diameter EMT Coupling		pcs.		
	20mm diameter EMT Connector with Locknut and Bushing		pcs.		
	32" LED TV	1.00	set		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			1.00	assy
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03	**ELECTRICAL WORKS**				
2.03.11	**Back-up Power Supply**				
A	**Materials**				
	50KVA UPS Three-phase 400V in 400V out 60Hz	1.00	assy		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			1.00	lot
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.12	**Lightning Protection & Grounding System**				
A	**Materials**				
	Double action Early Streamer Emission (ESE) Lighting protection system	1.00	assy		
	8.0 mm² BCW		l.m.		
	50.0 mm² BCW		l.m.		
	Grounding Rod Copper Clad steel with connector		sets		
	Grounding Well		sets		
	Cadweld Connector		sets		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			602.00	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.13	**Auxiliary Units**				
A	**Materials**				
	Optical Network Terminal	1.00	set		
	Data Computer Outlet, RJ45 Socket	2.00	sets		
	Telephone and Data Outlet, RJ45 Socket	9.00	sets		
	RJ45 Connector		pcs.		
	CAT6 UTP Data LAN Cable × 305m		roll		
	20mm diameter × 3m Electrical Metallic Tubing UL Listed		pcs.		
	20mm diameter IMC Coupling		pcs.		
	20mm diameter IMC Connector with Locknut and Bushing		pcs.		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.03	**ELECTRICAL WORKS**			1.00	lot
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.03.14	**Termination Accessories**				
A	**Materials**				
	G.I. Tie Wire Gauge 16		kgs		
	Electrical Tape		rolls		
	Rubber Tape		rolls		
	PVC Solvent Cement 400cc		cans		
	Hacksaw Blade		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.04	**MECHANICAL WORKS**			27.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.04.01	**Air-Conditioning Units, Pipings and Support**				
A	**Materials**				
	VRF Outdoor Unit 45.0 Kw	1.00	unit		
	Indoor Unit w/ remote controller				
	VRF Indoor FCU Wall Mounted 4.5 kW	4.00	units		
	VRF Indoor FCU Wall Mounted 5.6 kW	2.00	units		
	VRF Indoor FCU Ceiling Cassette 4-way 7.1 kW	2.00	units		
	SPLIT TYPE AC UNIT, INVERTER with complete accessories,				
	remote controller and cirucit breaker in NEMA-3R Enclosure				
	Ceiling Casette, 2.5 HP	1.00	set		
	Wall Mounted, 1.5 HP	4.00	sets		
	Wall Mounted, 1.0 HP	9.00	sets		
	Window Type AC Unit 2.5 HP, R-410a	3.00	units		
	Window Type AC Unit, 1.5 HP, R-410a	1.00	unit		
	Refrigerant Piping				
	Copper Pipe Hard Drawn Type L				
	28.6 mmø X 6.0 m.		pcs		
	15.9 mmø X 6.0 m.		pcs		
	9.5 mmø X 6.0 m.		pcs		
	6.4 mmø X 6.0 m.		pcs		
	Copper Pipe Soft Drawn				
	15.9 mmø X 15.0 m. X 0.028 thickness		pcs		
	9.5 mmø X 15.0 m. X 0.028 thickness		pcs		
	6.4 mmø X 15.0 m. X 0.028 thickness		pcs		
	Copper Elbow (Long Radius)				
	28.6 mmø		pcs		
	15.9 mmø		pcs		
	9.5 mmø		pcs		
	6.4 mmø		pcs		
	Copper Coupling				
	28.6 mmø		pcs		
	15.9 mmø		pcs		
	9.5 mmø		pcs		
	6.4 mmø		pcs		
	Y-Shape Branching Joint (Gas and Liquid Side)		sets		
	Rubber Insulation				
	1-1/8"ø x 1" thk x 6'		pcs		
	5/8"ø x 1" thk x 6'		pcs		
	3/8"ø x 1" thk x 6'		pcs		
	1/4"ø x 1" thk x 6'		pcs		
	Polyethylene Tape		pcs		
	25mmØ PVC Pipe x 3m		pcs		
	25mmØ PVC Elbow		pcs		
	50mm x 50mm x 6mm x 6m Angle Bar		pcs		
	6mmØ x 3m Hanger Rod (threaded)		pcs		
	Welding Rod 1/8", 5 kg/box		boxes		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Air-Conditioning Units, Pipings and Support Material Cost**				
B	**Air-Conditioning Units, Pipings and Support Labor Cost**				
D	**Air-Conditioning Units, Pipings and Support Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.04	**MECHANICAL WORKS**			104.44	sq. m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.04.02	**Ventilation Equipment, Accessories, Hangers and Support**				
A	**Materials**				
	12" Ceiling Cassette Exhaust Fan	11.00	units		
	14" Wall Type Exhaust Fan 1300 CFM	3.00	units		
	Inline Centrifugal Fan 200 CFM	2.00	units		
	Axial Flow Fan Supply 5000 CFM	1.00	unit		
	Air Grille with Insect Screen 200 x 200 mm		pcs		
	Air Grille with Insect Screen 350 x 350 mm		pcs		
	G.I Sheet Gauge 24 Duct		sheets		
	100mm dia. PVC Pipe, 3 meters		pcs		
	100mm dia. PVC Coupling		pcs		
	100mm Stainless Steel Vent Cap with Insect Screen		sets		
	Air Pressure Relief Damper 300mm	1.00	set		
	Clevis Hanger 100mmØ with bolt and nut		sets		
	50mm x 50mm x 6mm x 6m Angle Bar		pcs		
	6mmØ x 3m Hanger Rod (threaded)		pcs		
	Welding Rod 1/8", 5 kg/box		box		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Ventilation Equipment, Accessories, Hangers and Support Material Cost**				
B	**Ventilation Equipment, Accessories, Hangers and Support Labor Cost**				
D	**Ventilation Equipment, Accessories, Hangers and Support Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.04	**MECHANICAL WORKS**			901.80	sq. m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.04.03	**FDAS and Fire Extinguisher**				
A	**Materials**				
	Stand-alone Smoke Detector w/ base, built-in sounder and batteries Alarm sound level: 85 dB or more	38.00	sets		
	Fire Alarm Horn w/ Strobe, 15-100cd (candela) with complete accessories	13.00	sets		
	Manual Pull Station, 24-30 Vdc	13.00	sets		
	1.25 mm2 TF Twisted Pair x 150m Copper Wire (UL Listed)		roll		
	10 lbs. ABC Dry Chemical Portable Fire Extinguisher with wall bracket	22.00	sets		
	10 lbs. Manual/Automatic HFC-236fa Portable Fire Extinguisher (Thermal-type) with sprinkler head and heat sensor, wall mounted with wall bracket	17.00	sets		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**FDAS and Fire Extinguisher Total Material Cost**				
B	**FDAS and Fire Extinguisher Total Labor Cost**				
D	**FDAS and Fire Extinguisher Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
PROJECT DESCRIPTION :	**II. CONSTRUCTION OF CONTROL TOWER**				
LOCATION :	Tacbalogan Airport				
SUBJECT :	**Bill of Quantities and Cost Estimates**				
2.04	**MECHANICAL WORKS**			1.00	unit
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
2.04.04	**Passenger Elevator**				
A	**Materials**				
	Passenger Elevator System, capacity of 630 kgs. 8 Persons, 1mps speed, AC VVVF GL.	1.00	unit		
			Material Cost	. . . . .	
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
A	**Passenger Elevator Material Cost**				
B	**Passenger Elevator Labor Cost**				
D	**Passenger Elevator Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF CONTROL TOWER BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			462.78	days
ITEM	DESCRIPTION				
2.05	**PLUMBING WORKS**				
2.05.01	**Site Works**				
	(requires labor only)				
	Excavation (237.78 cu.m.)				
	Backfill (225.00 cu.m.)				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Gravel Bedding (Catch Basin, Septic Tanks & Trench Drain)				
	Gravel (3/4")		cu.m.		
	Sand Bedding (Ground Pipe Trenches)				
	Sand		cu.m.		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**SITEWORKS MATERIAL COST**		
B	**SITEWORKS LABOR COST**		
C	**SITEWORKS EQUIPMENT COST**		
D	**SITEWORKS DIRECT COST**		
	I N D I R E C T C O S T S		
	1. OCM (0% - 10% of TDC)	of Estimated Direct Cost	
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)	of Estimated Direct Cost	
	E. TOTAL OCM & PROFIT	of D	
	F. VALUE ADDED TAX, (VAT) 5.0%	of (D + E)	
	G. TOTAL ESTIMATED INDIRECT COST (F + E), P		
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit		
	TOTAL ESTIMATED COST (D + G), P		
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit		

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF CONTROL TOWER BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			424.91	li.m.
ITEM	DESCRIPTION				
2.05	**PLUMBING WORKS**				
2.05.02	**Sewerline System**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Soil Pipe/ Waste Pipe (203.75 li.m.)				
	57mmØ x 3m uPVC Pipe, Series 1000		pc.		
	107mmØ x 3m uPVC Pipe, Series 1000		pc.		
	57mmØ uPVC P-Trap		pcs.		
	57mmØ SS P-Trap		pcs.		
	57x57mm Ø uPVC 90 deg. Elbow		pcs.		
	107x107mm Ø uPVC 90 deg. Elbow		pcs.		
	57x57mm Ø uPVC 45 deg. Elbow		pcs.		
	107x107mm Ø uPVC 45 deg. Elbow		pcs.		
	57x57x57mm uPVC Wye		pcs.		
	107x57x107mm Ø uPVC Wye		pcs.		
	107x107x107mm Ø uPVC Wye		pcs.		
	57mmØ uPVC Cleanout Set		pcs.		
	107mmØ uPVC Cleanout Set		pcs.		
	57x57mm SS Access Cover		pcs.		
	107x107mm SS Access Cover		pcs.		
	107x107mm Brass Countersunk Plug Access Cover		pcs.		
	100x100mm SS Floor drain		pcs.		
	Solvent Cement (400 cc)		cans		
	Underground Sewer line Tape (Green) - 3" x 1000 ' per roll		roll		
	Pipe Hanger and Support		sets		
	Vent Pipe (221.16 li.m.)				
	57mmØ x 3m uPVC Pipe, Series 1000		pc.		
	57x57mmØ uPVC 90 deg. Elbow		pcs.		
	57x57x57mmØ uPVC Tee		pcs.		
	107x57x107mmØ uPVC Tee		pcs.		
	Solvent Cement (400 cc)		cans		
	Pipe Hanger and Support		sets		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**SEWER LINE SYSTEM MATERIAL COST**	
B	**SEWER LINE SYSTEM LABOR COST**	
C	**SEWER LINE SYSTEM EQUIPMENT COST**	
D	**SEWER LINE SYSTEM DIRECT COST**	

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF CONTROL TOWER BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			246.06	l.m.
ITEM	DESCRIPTION				
2.05	**PLUMBING WORKS**				
2.05.03	**Waterline System**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	20mmØx4m PPR Pipe, PN20		pc.		
	32mmØx4m PPR Pipe, PN20		pc.		
	20mmØ PPR Coupling		pcs.		
	32mmØ PPR Coupling		pcs.		
	20x20x20mm Ø PPR Tee		pcs.		
	32x20x32mm Ø PPR Tee		pcs.		
	32x32x32mm Ø PPR Tee		pcs.		
	20mm Ø PPR 90 deg. Elbow		pcs.		
	32mm Ø PPR 90 deg. Elbow		pcs.		
	32x20mm Ø PPR Reducer		pcs.		
	20x32mm Ø PPR Increaser		pcs.		
	32x40mm Ø PPR Increaser		pcs.		
	32mm Ø PPR End Cap		pcs.		
	40mm Ø PPR End Cap		pcs.		
	20mmØx100mm Flexible hose		pcs.		
	20mmØ x 100mm SS Nipple		pcs.		
	32mmØ x 100mm SS Nipple		pcs.		
	20mmØ PPR Compact Ball Valve		pcs.		
	32mmØ PPR Compact Ball Valve		pcs.		
	32mmØ Cast Iron Body Water meter		pc.		
	32mmØ Brass Gate valve		pc.		
	32mmØ Brass Check valve		pc.		
	Teflon Tape		pc.		
	Underground Waterline Tape (Blue) - 2" x 1000 ' per roll		roll		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR(days)	RATE/DAY	TOTAL RATE
	Heat Fusing Machine				
			Equipment Cost	. . . . .	

A	**WATERLINE SYSTEM MATERIAL COST**	
B	**WATERLINE SYSTEM LABOR COST**	
C	**WATERLINE SYSTEM EQUIPMENT COST**	
D	**WATERLINE SYSTEM DIRECT COST**	

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF CONTROL TOWER BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			141.45	li.m.
ITEM	DESCRIPTION				
2.05	**PLUMBING WORKS**				
2.05.04	**Storm Drainage System**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	82mmØx3m uPVC Pipe, Series 1000		pc.		
	107mmØx3m uPVC Pipe, Series 1000		pc.		
	160mmØx3m uPVC Pipe, Series 1000		pc.		
	82x82x82mmØ uPVC Wye		pcs.		
	82x82x82mmØ uPVC 90 deg. Elbow		pcs.		
	82x82x82mmØ uPVC 45 deg. Elbow		pcs.		
	Solvent Cement (400 cc)		cans		
	82mmØ Flat Type, Cast iron Body with integral clamping collar, Brass Loose set Grate with Frame Deck Drain		sets		
	Galvanived Flat Bar Pipe Support		sets		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**STORM DRAINAGE SYSTEM MATERIAL COST**
B	**STORM DRAINAGE SYSTEM LABOR COST**
C	**STORM DRAINAGE SYSTEM EQUIPMENT COST**
D	**STORM DRAINAGE SYSTEM DIRECT COST**

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF CONTROL TOWER BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			15.39	cu.m.
ITEM	DESCRIPTION				
2.05	**PLUMBING WORKS**				
2.05.05	**Septic Tank and Catch Basin**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Septic Tank (11.25 cu.m.)				
	Portland Cement (40kg per bag)		bags		
	Sand		cu.m.		
	Gravel (3/4")		cu.m.		
	6" Nonbearing CHB		pcs.		
	12mmØ DRSB, 6 meters		pcs.		
	10mmØ DRSB, 6 meters		pcs.		
	#16 G.I. Tie Wire		kgs.		
	1/2" x 4' x 8' Ordinary Plywood		pcs.		
	2" x3" Form Lumber		bd.ft.		
	Bituminous Paint (4L)		can		
	4" Paint brush		pcs.		
	Assorted CWN		kg.		
	Catch Basin (4.14 cu.m.)				
	Portland Cement (40kg per bag)		bags		
	Sand		cu.m.		
	Gravel (3/4")		cu.m.		
	4" Nonbearing CHB		pcs.		
	12mmØ DRSB, 6 meters		pcs.		
	10mmØ DRSB, 6 meters		pcs.		
	#16 G.I. Tie Wire		kgs.		
	1/2" x 4' x 8' Ordinary Plywood		pcs.		
	2" x3" Form Lumber		bd.ft.		
	16mmØ SS Hexagonal Nut		bag		
	Assorted CWN		kg.		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR(days)	RATE/DAY	TOTAL RATE
	One bagger concrete mixer				
	Concrete vibrator				
			Equipment Cost	. . . . .	

A	**SEPTIC TANK AND CATCH BASIN MATERIAL COST**		
B	**SEPTIC TANK AND CATCH BASIN LABOR COST**		
C	**SEPTIC TANK AND CATCH BASIN EQUIPMENT COST**		
D	**SEPTIC TANK AND CATCH BASIN DIRECT COST**		
	INDIRECT COSTS		
1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **CONSTRUCTION OF CONTROL TOWER BUILDING**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			1.00	lot
ITEM	DESCRIPTION				
2.05	**PLUMBING WORKS**				
2.05.06	**Fixtures and Accessories**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Fixtures and Accessories				
	Oval Undercounter Lavatory with Faucet, Double Handle Lever, Complete Fittings and Accessories	10.00	sets		
	Water Closet Vitreous- Elongated with Top Inlet Flush Valve and Complete Fittings	7.00	sets		
	Urinal Vitreous- Stall Type with Lever Flush and Complete Fittings	1.00	set		
	Stainless Steel Hygiene Spray with with Complete Fittings and Accessories	8.00	sets		
	Drop-in Single Bowl Stainless Steel Kitchen Sink, Faucet, Complete Fittings and Accessories	4.00	sets		
	Shower head	8.00	sets		
	Stainless Steel Tissue Holder	6.00	sets		
	Hand Dryer	8.00	sets		
	1-1/2" L-Type Stainless Steel Grab Bar Complete Hardware and Accessories	1.00	set		
	Stainless Steel Hose Bibb	2.00	sets		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**FIXTURES AND ACCESSORIES MATERIAL COST**	
B	**FIXTURES AND ACCESSORIES LABOR COST**	
C	**FIXTURES AND ACCESSORIES EQUIPMENT COST**	
D	**FIXTURES AND ACCESSORIES DIRECT COST**	

INDIRECT COSTS			
1. OCM (0% - 8% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			227.00	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.01	**CIVIL/STRUCTURAL WORKS**				
3.01.01	**Site Works**				
	Excavation - labor only (143.00 cu.m.)				
	Backfill - labor only (74 .00 cu.m.)				
A	**Materials**				
	Gravel, G1		cu.m		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY.	DUR. (DAYS)	RATE/DAY	
	Backhoe Crawler, 0.80 cu.m.				
	Plate Compactor, 5hp				
			Equipment Cost	. . . . .	
	Site Works Material Cost				
	Site Works Labor Cost				
	Site Works Equipment Cost				
	Site Works Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			75.63	cu.m
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.01	**CIVIL/STRUCTURAL WORKS**				
3.01.02	**Concrete Works**				
A	**Materials**				
	Portland Cement, 40kgs		bags		
	Sand		cu.m.		
	Gravel, 3/4"		cu.m.		
	16mm dia. DRSB Grade 40, 6meters		pcs		
	12mm dia. DRSB Grade 40, 6meters		pcs		
	10mm dia. DRSB Grade 33, 6meters		pcs		
	#16 GI Tie Wires		kgs		
	Coco Lumber 2" x 3"		bd.ft.		
	Coco Lumber 2" x 2"		bd.ft.		
	Coco Lumber 2" x 4"		bd.ft.		
	1/2" x 4' x 8' Ordinary Plywood		pcs		
	CWN assorted		kgs		
	Polyethylene Sheet (1m x 60m)		roll		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY.	DUR. (DAYS)	RATE/DAY	
	One-bagger Concrete Mixer				
	Concrete Vibrator				
	Manual Bar Cutter				
			Equipment Cost	. . . . .	
	Concrete Works Material Cost				
	Concrete Works Labor Cost				
	Concrete Works Equipment Cost				
	Concrete Works Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			190.03	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.01	**CIVIL/STRUCTURAL WORKS**				
3.01.03	**Masonry Works** *(including Plastering)*				
A	**Materials**				
	150mm thick CHB		pcs.		
	100mm thick CHB		pcs.		
	40kg Portland Cement		bags		
	Sand		cu.m.		
	12mmØ x 6m DRSB Grade 40		pcs.		
	10mmØ x 6m DRSB Grade 40		pcs.		
	#16 GI Tie Wire		kgs.		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Masonry Works Material Cost				
	Masonry Works Labor Cost				
	Masonry Works Direct Cost				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			702.78	kgs
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.01	**CIVIL/STRUCTURAL WORKS**				
3.01.04	**Steel Works**				
A	**Materials**				
	7.5m - W8x28		pcs.		
	5 ton Chain Block		sets		
	5 ton Plain Trolley Adjustable		sets		
	Ø16mm Structural Anchor Bolt		pcs		
	10mm x 180mm x 300mm MS Plate		pcs		
	10mm x 180mm x 200mm MS Plate		pcs.		
	10mm x 200mm x 380mm MS Plate		pcs.		
	1.2m x 2.4m x 6mm Checkered Plate		pcs		
	38mm x 38mm x 6mm x 6m Angle Bar		pcs		
	25mm x 25mm x 6mm x 6m Angle Bar		pcs		
	6m - Ø10mm Round Bar		pcs.		
	3m - Ø50mm PVC Pipe		pcs.		
	Welding Rod, (20kg/box)		box		
	Oxygen & Acetylene		set		
	Rust Converter		gal		
	Epoxy Primer		gal		
	Quick Drying Enamel		gal		
	Paint Thinner		gal		
	2" Paint Brush		pcs		
	4" Paint Brush		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY.	DUR. (DAYS)	RATE/DAY	
	Welding Machine 200 amp				
	Oxy-Acetylene Cutting Torch/Welding Outfit				
			Equipment Cost	. . . . .	
	Steel Works Material Cost				
	Steel Works Labor Cost				
	Steel Works Equipment Cost				
	Steel Works Direct Cost				

INDIRECT COSTS

1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			117.56	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.01	**CIVIL/STRUCTURAL WORKS**				
3.01.05	**Waterproofing Works**				
A	**Materials**				
	Portland Cement (40kg/bag)		bags		
	Sand		cu.m.		
	Gravel 1/8"		cu.m.		
	1.2m x 2.4m x 4.5mm - 4" x 4" Wire Mesh		pcs		
	10mmØ x 6m DRSB Grade 40		pcs		
	#16 Tie Wire		kgs		
	1m x 10m x 4mm Waterproof Membrane		rolls		
	LPG Gas (11kg/tank)		tank		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY.	DUR. (DAYS)	RATE/DAY	
	Torch with regulator and gauge				
			Labor Cost	. . . . .	
	Waterproofing Works Material Cost				
	Waterproofing Works Labor Cost				
	Waterproofing Works Equipment Cost				
	Waterproofing Works Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			28.88	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.02	**ARCHITECTURAL WORKS**				
3.02.01	**Tile Works**				
A	**Materials**				
	600mm x 600mm Homogenous Synthetic Granite Floor Tiles (Polished)		pcs		
	300mm x 300mm Homogenous Synthetic Granite Floor Tiles (Matte)		pcs		
	300mm x 300mm Homogenous Synthetic Granite Wall Tiles (Polished)		pcs		
	Cutting Disk (4")		pcs		
	40kg Portland Cement		bags		
	Sand		cu.m.		
	Tile Grout (2kg/bag)		bags		
	Tile Adhesive (25kg/bag)		bags		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Tile Works Material Cost				
	Tile Works Labor Cost				
	Tile Works Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			295.11	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.02	**ARCHITECTURAL WORKS**				
3.02.02	**Painting Works**				
A	**Materials**				
	Concrete Putty		gals		
	Flat Latex Paint Semi Gloss		gals		
	Elastomeric Sealer		gals.		
	Elastomeric Paint		gals.		
	Paint Thinner		gals.		
	Flat Latex Paint		gals		
	9" Paint Roller with Pan		pc		
	4" Paint Brush		pcs		
	Rugs		kgs.		
	Abrasive Sand Paper #100 for masonry		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Painting Works Material Cost				
	Painting Works Labor Cost				
	Painting Works Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			12.00	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.02	**ARCHITECTURAL WORKS**				
3.02.03	**Ceiling Works**				
A	**Materials**				
	12mm thk x 0.60m x 0.60m PVC Laminated Board		pcs		
	Main Runner - 3600mm x 24mm x 38mm		pcs		
	Cross Tee 1200mm x 24mm x 25mm		pcs		
	4.5mm thk x 1.2m x 2.4m Ficem Board		pcs		
	Metal Furring, 50mm x 19mm x 0.6mm x 5m		pcs		
	Carrying Channel, 38mm x 12mm x 5m x 0.6mm thk.		pcs		
	Suspension Rod 5mm x 3600mm		pcs		
	Suspension G.I. Clip		pcs		
	Rod Joiner		pcs		
	Screw		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Ceiling Works Material Cost				
	Ceiling Works Labor Cost				
	Ceiling Works Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			13.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.02	**ARCHITECTURAL WORKS**				
3.02.04	**Doors and Windows**				
A	**Materials**				
	Doors - 7 sets				
	D-1 0.9m x 2.10m, Double Swing Aluminum Framed door in patch fittings with 8mm thk. tempered glass panels and powder coated aluminum frame with complete accessories	1.00	set		
	D-2 0.80m x 2.10m, Double Swing Aluminum Framed door in patch fittings with 8mm thk. tempered glass panels and powder coated aluminum frame with complete accessories	1.00	set		
	D-3 0.9m x 2.10m, single swing steel louver door in spray applied epoxy paint finish with complete accessories	1.00	set		
	D-4 0.80m x 2.10m, single swing wooden panel door with 5mm Grooves in spray applied QDE paint with complete accessories	1.00	set		
	D-5 0.60m x 2.10m , single swing wooden flush door with 6mm thk marine plywood hollow core in spray applied QDE paint with Complete Accessories	1.00	set		
	D-6 3.60m x 3.78m , G.A. #18 G.I. sheet manual operated roll-up door with peep hole in spray applied epoxy paint and with complete accessories	2.00	sets		
	Windows 6 stes				
	W-1 2.00m x 1.25m, 6mm thk tempered clear glass casement window on powder coated aluminum frame with complete accessories	1.00	sets		
	W-2 1200mm x 1000mm 1/4"thk Clear Glass Sliding Window on Analok window frame (with complete window hardware and accessories)	1.00	sets		
	W-3 2.00m x 0.40m, 6mm thk tempered clear glass fixed window on powder coated aluminum frame with complete accessories	2.00	set		
	W-4 1.00m x 0.40m, 6mm thk tempered clear glass awning window on powder coated aluminum frame with complete accessories	1.00	sets		
	W-5 0.50m x 0.4m, 6mm thk tempered clear glass awning window on powder coated aluminum frame with complete accessories	1.00	set		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Doors and Windows Material Cost				
	Doors and Windows Labor Cost				
	Doors and Windows Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			153.00	ln.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.01	**Lighting and Power Conduits and Fittings**				
A	**Materials**				
	20mm diameter x 3m uPVC Electrical Pipe, UL Listed		pcs		
	20mm diameter x 1m Flexible Conduit		pcs		
	15mm diameter Flexible Metal Conduit (1/2") x 1m		pcs		
	20mm diameter PVC Elbow		pcs		
	20mm diameter PVC Coupling		pcs		
	20mm diameter PVC Male Adapter w/ locknut		pcs		
	G.I. Tie Wire Ga. 16		kgs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Lighting and Power Conduits and Fittings Material Cost				
	Lighting and Power Conduits and Fittings Labor Cost				
	Lighting and Power Conduits and Fittings Direct Cost				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			17.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.02	**Electrical Wiring Devices**				
A	**Materials**				
	Single Convenience outlet with plate and bracket - 10A, 250V Universal type with ground	2.00	sets		
	Duplex Convenience outlet with plate and bracket - 16A, 250V Universal type with ground	9.00	sets		
	One-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	3.00	sets		
	Two-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	1.00	sets		
	Three-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	2.00	set		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Skilled Laborer				
			Labor Cost	. . . . .	
	Electrical Wiring Devices Material Cost				
	Electrical Wiring Devices Labor Cost				
	Electrical Wiring Devices Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			28.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.03	**Lighting Fixtures**				
A	**Materials**				
	1200 mm Industrial Type lighting fixture with powder coated white finish steel housing, aluminum reflector and 1x18W (T-8) LED Tube, 50,000 life hour, 2070 lumens, 198-277V, 60Hz. (Complete with Hanger, Support and Accessories)	8.00	sets		
	150mm diameter x 250mm Surface mounted vertical round down light fixture with glass diffuser and 1x12W LED bulb, 15 000 life hour, 1300 lumens, 110-240V, 60Hz.	10.00	sets		
	600mm x 600mm Recessed mounted louver type lighting fixture, with mirrorized aluminum reflector with 2 x 9W (T-8) LED tube, 30 000 life hour, 850 lumens, 100V-277V, 60Hz	4.00	sets		
	150mm diameter recessed type vertical lamp downlight fixture, powde white finish steel housing, matte aluminum reflector and full frosted glass cover with with 1×11W, 1100-Lumen warm white LED bulb	4.00	sets		
	Heavy Duty Emergency Lamp Dual Optics, 2×3Watts LED Bulb	2.00	sets		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Lighting Fixtures Material Cost				
	Lighting Fixtures Labor Cost				
	Lighting Fixtures Direct Cost				

INDIRECT COSTS

1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			48.00	pcs
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.04	**Boxes**				
A	**Materials**				
	Octagonal Junction Box with cover, Deep Type		pcs		
	4"×2" Utility Box, Deep Type		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Boxes Material Cost				
	Boxes Labor Cost				
	Boxes Direct Cost				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			12.00	In.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.05	**Air conditioning Unit Power Supply Conduit and Fittings**				
A	**Materials**				
	20mm diameter × 3m uPVC Electrical Pipe, UL Listed		pcs		
	20mm diameter PVC Elbow		pcs		
	20mm diameter PVC Coupling		pcs		
	20mm diameter PVC Male Adapter w/nut		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Air conditioning Unit Power Supply Conduit and Fittings Material Cost				
	Air conditioning Unit Power Supply Conduit and Fittings Labor Cost				
	Air conditioning Unit Power Supply Conduit and Fittings Direct Cost				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			4.00	rolls
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.06	**Lighting and Power Wires & Cables**				
A	**Materials**				
	3.5 mm² THHN/THWN-2, 600V 90°C X 150m		rolls		
	Copper Wire (UL Listed)				
	Electrical Tape		rolls		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Lighting and Power Wires & Cables Material Cost				
	Lighting and Power Wires & Cables Labor Cost				
	Lighting and Power Wires & Cables Direct Cost				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			70.00	ln.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.07	**Grounding System**				
A	**Materials**				
	100 mm² Bare Copper Wire		ln.m.		
	Grounding Rod Copper Clad steel with connector		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Grounding System Material Cost				
	Grounding System Labor Cost				
	Grounding System Direct Cost				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			4.00	assy
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.08	**Panelboard/Circuit Breaker**				
A	**Materials**				
	Lighting and Power Panelboard	1.00	assy		
	3Ø, 3W, 230V, 60HZ, WITH GROUND				
	Main: 40AT, 100AF, 3-Pole, 240V, Bolt-on, 10KAIC				
	Branches: 6-20AT, 2-Pole, 240V, Bolt-on, 10KAIC				
	Enclosure: NEMA-1				
	Materials: G.I.#16				
	Finished: Powder Coated Gray Finish				
	Panel Features: Pushlock, Grounding Lugs, Neutral Lugs				
	Bolted Dead Front, Directory Holder				
	Distribution Panelboard Power House	1.00	assy		
	3Ø, 3W, 230V, 60HZ, WITH GROUND				
	Main: 300AT, 400AF, 3-Pole, 240V, Bolt-on, 36KAIC				
	Branches: 1-40AT, 100AF, 3-Pole, 240V, MCCB, 10KAIC				
	1-125AT,225AF, 3-Pole, 240V, MCCB, 25KAIC				
	4 slots (Spare)				
	Enclosure: NEMA-1				
	Materials: G.I.#16				
	Finished: Powder Coated Gray Finish				
	Panel Features: Pushlock, Grounding Lugs, Neutral Lugs				
	Bolted Dead Front, Directory Holder				
	Main Distribution Panelboard Power House	1.00	assy		
	3Ø, 4W, 230V, 60HZ, WITH GROUND				
	Main: 1000AT, 1000AF, 3-Pole, 400V, Bolt-on, MCCB				
	Branches: 1-500AT, 600AF, 3-Pole, 400V, Bolt-on, MCCB				
	1-300AT, 400AF, 3-Pole, 400V, Bolt-on, MCCB				
	1-160AT, 250AF, 3-Pole, 400V, Bolt-on, MCCB				
	4 slots (Spare)				
	Enclosure: NEMA-1				
	Materials: G.I.#16				
	Finished: Powder Coated Gray Finish				
	Panel Features: Pushlock, Grounding Lugs, Neutral Lugs, Mechanical lugs				
	Bolted Dead Front, Directory Holder				
	Automatic Transfer Switch	1.00	assy		
	3Ø, 4W, 400V, 60 Hz with ground bus & neutral busbar				
	Main: 2x1000AT, 3P, 400V, MCCB				
	Equipped with a electrically operated, completely wired and tested				
	Transfer Switch System and other standard accessories				
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

Panelboard/Circuit Breaker Material Cost	
Panelboard/Circuit Breaker Labor Cost	
Panelboard/Circuit Breaker Direct Cost	
INDIRECT COSTS	
1. OCM (0% - 10% of TDC)	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)	
E. TOTAL OCM & PROFIT	
F. VALUE ADDED TAX, (VAT) 5.0% of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P	
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit	
TOTAL ESTIMATED COST (D + G), P	
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit	

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			1,474.00	ln.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.09	**Feeder/Sub Feeder Conductor**				
A	**Materials**				
	LPP to MDPPH (24 l.m.)				
	5.5 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	8.0 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	DPPH to 112.5 kVA (20 l.m.)				
	50 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	150 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	112.5 kVA to MDPPH (20 l.m.)				
	22 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	50 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	MDPPH to ATS (90 l.m.)				
	50 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	200 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	ATS to GENERATOR 1 (120 l.m.)				
	50 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	200 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	ATS to TRANSFORMER PAD (1200 l.m.)				
	50 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
	200 mm² THHN/THWN-2 600V 90°C Copper Wire (UL Listed)		ln.m.		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Feeder/Sub Feeder Conductor Material Cost				
	Feeder/Sub Feeder Conductor Labor Cost				
	Feeder/Sub Feeder Conductor Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			210.00	ln.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.10	**Feeder/Sub Feeder Conductor Conduit and Fittings**				
A	**Materials**				
	LPP to MDPPH (3 l.m.)				
	20mm diameter × 3m Electrical Metallic Tubing UL Listed		pc		
	20mm diameter EMT Connector with Locknut and Bushing		pcs		
	DPPH to 112.5 kVA (3 l.m.)				
	80mm diameter × 3m IMC UL Listed		pc		
	80mm diameter IMC Elbow		pcs		
	80mm diameter IMC Locknut and Bushing		pairs		
	112.5 kVA to MDPPH (3 l.m.)				
	50mm diameter × 3m IMC UL Listed		pc		
	50mm diameter IMC Elbow		pc		
	50mm diameter IMC Locknut and Bushing		pairs		
	MDPPH to ATS (6 l.m.)				
	80mm diameter × 3m IMC UL Listed		pcs		
	80mm diameter × 3m IMC Locknut and Bushing		pairs		
	ATS to GENERATOR 1 (6 l.m.)				
	80mm diameter × 3m IMC UL Listed		pcs		
	80mm diameter IMC Locknut and Bushing		pairs		
	ATS to TRANSFORMER PAD (189 l.m.)				
	110mm diameter × 3m PVC		pcs		
	110mm diameter Endbell		pcs		
	100mm diameter × 3m IMC		pcs		
	100mm diameter IMC Locknut and Bushing		pairs		
	100mm diameter Entrace cap		pcs		
	Electrical Warning tape 3" x 1000ft		rolls		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Feeder/Sub Feeder Conductor Conduit and Fittings Material Cost				
	Feeder/Sub Feeder Conductor Conduit and Fittings Labor Cost				
	Feeder/Sub Feeder Conductor Conduit and Fittings Direct Cost				
	INDIRECT COSTS				
	1. OCM (0% - 10% of TDC)				
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)				
	E. TOTAL OCM & PROFIT				
	F. VALUE ADDED TAX, (VAT) 5.0% of (D + E)				
	G. TOTAL ESTIMATED INDIRECT COST (F + E), P				
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit				
	TOTAL ESTIMATED COST (D + G), P				
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit				

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			1.00	assy
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.03	**ELECTRICAL WORKS**				
3.03.11	**Power Supply**				
A	**Materials**				
	Dry Type Transformer	1.00	assy		
	kVA:112.5				
	Phase:3				
	Frequency:60				
	Primary Voltage: 400				
	Secondary Voltage:230				
	Enclosure: UL/NEMA 1				
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Power Supply Material Cost				
	Power Supply Labor Cost				
	Power Supply Direct Cost				
	INDIRECT COSTS				
	1. OCM (0% - 10% of TDC)				
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)				
	E. TOTAL OCM & PROFIT				
	F. VALUE ADDED TAX, (VAT) 5.0% of (D + E)				
	G. TOTAL ESTIMATED INDIRECT COST (F + E), P				
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit				
	TOTAL ESTIMATED COST (D + G), P				
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit				

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			1.00	set
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.04	**MECHANICAL WORKS**				
3.04.01	**Air Conditioning Unit and Piping System**				
A	**Materials**				
	Inverter Wall Mounted Split type Air-Conditioning Unit-1.0 HP with complete accessories (FCU, ACCU, remote control and circuit breaker in NEMA-3R Enclosure and other standard fittings) Power Supply: 220-230 V, 1Ø, 60 Hz Refrigerant Type: R-32	1.00	set		
	Copper Tube Soft Drawn 3/8" OD. 0.028 thickness x 15m		pc		
	Copper Tube Soft Drawn 1/4" OD. 0.028 thickness x 15m		pc		
	Rubber Insulation 3/8" I.D. 3/4" thickness x 1.8m		pcs		
	Rubber Insulation 1/4" I.D. 1/2" thickness x 1.8m		pcs		
	Polyethylene tape		pcs		
	25mm diameter PVC Pipe x 3m (drain pipe)		pcs		
	25mm diameter PVC Elbow		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Air Conditioning Unit and Piping System Material Cost				
	Air Conditioning Unit and Piping System Labor Cost				
	Air Conditioning Unit and Piping System Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			2.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.04	**MECHANICAL WORKS**				
3.04.02	**Ventilation Equipment and Accessories**				
A	**Materials**				
	12"×12" White Ceiling type Exhaust Fan with Complete Standard accessories (Hangers & Supports and other Standard Fittings)	1.00	set		
	20" Industrial type Wall mounted Exhaust Fan, single phase, 240V, 60hz with thermal fuse, industrial grade steel blade, front grill and casing	1.00	set		
	Stainless steel vent cap with net (100mm applicable pipe)		pc		
	100mm diameter PVC x 3m pipe		pc		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
			Labor Cost	. . . . .	
	Ventilation Equipment and Accessories Material Cost				
	Ventilation Equipment and Accessories Labor Cost				
	Ventilation Equipment and Accessories Direct Cost				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			2.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.04	**MECHANICAL WORKS**				
3.04.03	**Hangers and Supports , Fire Extinguisher**				
A	**Materials**				
	50mm x 50mm x 6mm x 6m Angle Bar		pc		
	Welding Rod 1/8", 5 kg/box		box		
	Portable Fire Extinguisher	2.00	sets		
	ABC Dry Chemical Portable Fire Extinguisher includes wall hanger and complete accessories, 4.5 kgs (10 lbs) capacity				
			Material Cost	. . . . .	
B	**Labor**	No.	Duration	Rate/Day	
	Construction Foreman				
	Skilled Laborer				
		Labor Cost			
	Hangers and Supports , Fire Extinguisher Material Cost				
	Hangers and Supports , Fire Extinguisher Labor Cost				
	Hangers and Supports , Fire Extinguisher Direct Cost				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			10.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.05	**PLUMBING WORKS**				
3.05.01	**Fixtures**				
A	**Materials**				
	Lavatory - vitreous china class "AA", wall-hung, white, w/ faucet, inclu	1.00	set		
	Water closet - vitreous china class "AA", big, white, elongated, siphon	1.00	set		
	Tissue holder - stainless, surface-mounted	1.00	pc.		
	Floor drain, 100mm x 100mm, stainless	2.00	pcs		
	Bidet hose - stainless	1.00	pc		
	Bath & Shower	1.00	pc		
	Soap Dispenser	1.00	pc		
	Hose Bib	1.00	pc		
	Shower Head	1.00	pc		
			Material Cost		
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Plumber				
	Skilled Laborer				
			Labor Cost	. . . . .	
	Fixtures Material Cost				
	Fixtures Labor Cost				
	Fixtures Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC	**: CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION	**: III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION	: Catbalogan City, Samar				
SUBJECT	**: Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			9.00	ln.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.05	**PLUMBING WORKS**				
3.05.02	**Waste Water Line**				
A	**Materials**				
	4"Ø PVC Pipe (Series 1000), 3 meters		pcs.		
	4"Ø PVC Wye		pcs.		
	4"Ø x 4"Ø PVC 45deg. Elbow		pcs.		
	4" P-trap		pcs.		
	4" Clean Out		pc.		
	Solvent Cement (400cc/can)		pcs.		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Plumber				
	Skilled Laborer				
			Labor Cost	. . . . .	
	Waste Water Line Material Cost				
	Waste Water Line Labor Cost				
	Waste Water Line Direct Cost				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)		5.0%	of (D + E)		
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			20.00	ln.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.05	**PLUMBING WORKS**				
3.05.03	**Cold Water Line**				
A	**Materials**				
	1"Ø PPR Pipe (PN 10), 4 meters		pcs.		
	1/2"Ø PPR Pipe (PN 10), 4 meters		pc.		
	1/2"Ø PPR 90deg. Elbow		pcs.		
	1/2"Ø x 1/2"Ø x 1/2"Ø PPR Tee		pc.		
	1/2"Ø PPR End Cap		pcs.		
	Teflon Tape		rolls		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Plumber				
	Skilled Laborer				
			Labor Cost	. . . . .	
	Cold Water Line Material Cost				
	Cold Water Line Labor Cost				
	Cold Water Line Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC	**: CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION	**: III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION	: Catbalogan City, Samar				
SUBJECT	**: Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			81.00	ln.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.05	**PLUMBING WORKS**				
3.05.04	**Storm Drainage Pipe**				
A	**Materials**				
	4"Ø x 3m PVC Pipe		pcs.		
	4" - 90° PVC Elbow		pcs.		
	4" Stainless Roof Drain		pcs.		
	Solvent Cement (400cc)		can		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Plumber				
	Skilled Laborer				
			Labor Cost	. . . . .	
	Storm Drainage Material Cost				
	Storm Drainage Labor Cost				
	Storm Drainage Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
DESCRIPTION :	**III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION :	Catbalogan City, Samar				
SUBJECT :	**Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF POWERHOUSE			9.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.05	**PLUMBING WORKS**				
3.05.05	**Catch Basin**				
A	**Materials**				
	Portland Cement (40kg/bag)		bags		
	Sand		cu.m.		
	Gravel 3/4"		cu.m.		
	100mm thick CHB		pcs		
	10mmØ x 6m DRSB Grade 40		pcs		
	#16 GI Tie Wire		kgs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Plumber				
	Skilled Laborer				
			Labor Cost	. . . . .	
	Catch Basin Material Cost				
	Catch Basin Labor Cost				
	Catch Basin Direct Cost				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC : CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021
DESCRIPTION : III. POWERHOUSE AND TRANSFORMER YARD
LOCATION : Catbalogan City, Samar
SUBJECT : Bill of Materials & Cost Estimate

	CONSTRUCTION OF POWERHOUSE			5.52	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.05	**PLUMBING WORKS**				
3.05.06	**Septic Tank**				
A	**Materials**				
	Portland Cement (40kg/bag)		bags		
	Sand		cu.m.		
	Gravel 3/4"		cu.m.		
	Gravel G1		cu.m.		
	12mmØ x 6m DRSB Grade 40		pcs		
	#16 GI Tie Wire		kgs		
	150mm thick CHB		pcs		
	4"Ø x 3m PVC Pipe		pc		
	4"Ø PVC Pipe Clean-out		pcs		
	4"Ø PVC Pipe Tee		pcs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Master Plumber				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Septic Tank Material Cost				
	Septic Tank Labor Cost				
	Septic Tank Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJEC	**: CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	**: III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION	: Catbalogan City, Samar				
SUBJECT	**: Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF TRANSFORMER YARD			31.02	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.06	**CIVIL/STRUCTURAL WORKS**				
3.06.01	**Site Works**				
	Excavation - labor only (21.64 cu.m.)				
	Backfill - labor only (9.38 cu.m.)				
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY.	DUR. (DAYS)	RATE/DAY	
	Plate Compactor, 5hp				
			Equipment Cost	. . . . .	
	Site Works Labor Cost				
	Site Works Equipment Cost				
	Site Works Direct Cost				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC	**: CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	**: III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION	: Catbalogan City, Samar				
SUBJECT	**: Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF TRANSFORMER YARD			19.05	cu.m
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.06	**CIVIL/STRUCTURAL WORKS**				
3.06.02	**Concrete Works**				
A	**Materials**				
	Portland Cement, 40kg/bag		bags		
	Sand		cu.m.		
	Gravel 3/4		cu.m.		
	Gravel G1		cu.m.		
	16 mm Ø x 6m DRSB		pcs		
	12 mm Ø x 6m DRSB		pcs		
	10 mm Ø x 6m DRSB		pcs		
	8 mm Ø x 6m DRSB		pcs		
	#16 Tiewire		kgs		
	1/2 x 1.2m x 2.4m Ordinary Plywood		pcs		
	2" x 2" x 10' Coco Lumber		bd.ft.		
	Assorted Common Nail		kgs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY.	DUR. (DAYS)	RATE/DAY	
	One-bagger Concrete Mixer				
	Concrete Vibrator				
	Manual Bar Cutter				
			Equipment Cost	. . . . .	
	Concrete Works Material Cost				
	Concrete Works Labor Cost				
	Concrete Works Equipment Cost				
	Concrete Works Direct Cost				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC	**: CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	**: III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION	: Catbalogan City, Samar				
SUBJECT	**: Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF TRANSFORMER YARD			14.04	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.06	**CIVIL/STRUCTURAL WORKS**				
3.06.03	**Masonry Works** *(including Plastering)*				
A	**Materials**				
	100mm thick CHB		pcs.		
	40kg Portland Cement		bags		
	Sand		cu.m.		
	10mm dia. DRSB, 6meters		pcs.		
	#16 GI Tie Wire		kgs.		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
	Masonry Works Material Cost				
	Masonry Works Labor Cost				
	Masonry Works Direct Cost				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & PROFIT					
F. VALUE ADDED TAX, (VAT)	5.0% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (F + E), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJEC	**: CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	**: III. POWERHOUSE AND TRANSFORMER YARD**				
LOCATION	: Catbalogan City, Samar				
SUBJECT	**: Bill of Materials & Cost Estimate**				
	CONSTRUCTION OF TRANSFORMER YARD			701.53	kgs
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
3.06	**CIVIL/STRUCTURAL WORKS**				
3.06.04	**Steel Works**				
A	**Materials**				
	50 mm Ø x 6m Pre-Painted GI Pipe		pcs		
	1.2m x 2.8m Cyclone Wire Gauge # 6		rolls		
	Barbed Wire, 2.7mm thk x 135m long		roll		
	25mm x 3mm x 6m Flat bar		pcs		
	50mm Dia. Plug End Cap		pcs		
	Padlock, Long Shackle, Solid Brass 50mm		pc		
	Welding Rod		kgs		
			Material Cost	. . . . .	
B	**Labor**	QTY.	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY.	DUR. (DAYS)	RATE/DAY	
	Welding Machine 200 amp				
	Oxy-Acetylene Cutting Torch/Welding Outfit				
			Equipment Cost	. . . . .	
	Steel Works Material Cost				
	Steel Works Labor Cost				
	Steel Works Equipment Cost				
	Steel Works Direct Cost				

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)			
2. CONTRACTOR's PROFIT (0% - 8% of TDC)			
E. TOTAL OCM & PROFIT			
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	**UNIT**
SUBJECT :	**BILL OF MATERIALS AND COST ESTIMATES**			39.37	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.01	**COVERED PATHWALK**				
4.01.01	**Site Works**				
	including excavation & disposal of				
	demolished and excavated materials				
	Volume of excavation - 39.37 cu.m.				
	Common Borrow *(use suitable excavated materials)* - 26.24 cu.m.				
	Volume for disposal - 13.13 cu.m.				
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Dump Truck, 12 yd³				
			Equipment Cost.		
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
	1. OCM (0% - 10% of TDC)				
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)				
	E. TOTAL OCM & CONTRACTOR's PROFIT				
	F. VALUE ADDED TAX, (VAT) 5% of (D + E)				
	G. TOTAL ESTIMATED INDIRECT COST (E + F), P				
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit				
	TOTAL ESTIMATED COST (D + G), P				
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit				

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	**UNIT**
SUBJECT :	**BILL OF MATERIALS AND COST ESTIMATES**			28.48	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.01	**COVERED PATHWALK**				
4.01.02	**Concrete Works**				
A	**Materials**				
	Portland Cement, 40kgs		bags		
	Sand		cu.m.		
	Gravel, 3/4"		cu.m.		
	12mm dia. DRSB Grade 33, 6 meters		pcs.		
	10mm dia. DRSB Grade 33, 6 meters		pcs.		
	G.I. Tie Wire #16		kgs.		
	1/2" x 4' x 8' Ordinary Plywood		pcs.		
	Form Lumber		bd.ft.		
	Assorted CWN		kgs.		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	One-bagger Concrete Mixer, 1 cu.m.				
	Manual bar cutter				
			Equipment Cost.		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	**UNIT**
SUBJECT :	**BILL OF MATERIALS AND COST ESTIMATES**			3,557.39	kgs.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.01	**Covered Pathwalk**				
4.01.03	**Steel Works (including Painting Works)**				
A	**Materials**				
	100mm dia. G.I. Pipe Sch. 40		pcs		
	50mm dia. G.I. Pipe Sch. 40		pcs		
	32mm dia. G.I. Pipe Sch. 40		pcs		
	25mm dia. G.I. Pipe Sch. 40		pcs		
	12mm dia. Anchor Bolts with Washers		pcs.		
	1.2m x 2.4m x 10mm thick Steel Base Plate		kgs.		
	1.2m x 2.4m x 6mm thick Steel Plate		kgs.		
	Welding rod E6011		kgs.		
	Oxygen		cyl		
	Acetylene		cyl		
	6mm thick Polycarbonate Prismatic Skylight Roofing Sheet		ln.m.		
	Pre-painted Curved Roof Sheet				
	0.6mm thk. x 1.025m (EFF: 0.995m x 2.95)				
	Epoxy Top Coat		gals		
	Red Oxide Primer		gals		
	Epoxy Paint Reducer		gals		
	2" Paint Brush w/ tray		pcs.		
	Paint Brush 2"		pcs.		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Manual Bar Cutter				
	Welding Machine, 200A-500A				
	Oxy-Acetylene Cutting Torch/Welding Outfit				
			Equipment Cost.		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	**UNIT**
SUBJECT :	**BILL OF MATERIALS AND COST ESTIMATES**			238.50	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.01	**Covered Pathwalk**				
4.01.04	**Pavement Blocks**				
A	**Materials**				
	100mm x 200mm Paving Block		pcs.		
	Grit Sand		cu.m.		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	**UNIT**
SUBJECT :	**BILL OF MATERIALS AND COST ESTIMATES**			234.00	lnm.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.01	**Covered Pathwalk**				
4.01.05	**Electrical Works**				
4.01.05A	**Lighting and Power Conduits and Fittings**				
A	**Materials**				
	15mm diameter × 3m Electrical Metallic Tubing (1/2") UL Listed		pcs		
	15mm diameter Flexible Metal Conduit (1/2") x 1m		pcs		
	15mm diameter EMT Coupling		pcs		
	15mm diameter EMT Connector with Locknut and Bushing		pcs		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	**UNIT**
SUBJECT :	**BILL OF MATERIALS AND COST ESTIMATES**			6.00	rolls
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.01	**Covered Pathwalk**				
4.01.05	**Electrical Works**				
4.01.05B	**Lighting and Power Wires & Cables**				
A	**Materials**				
	3.5 mm² THHN/THWN-2, 600V 90°C X 150m Copper Wire (UL Listed)		rolls		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
A	**Material Cost**				
B	**Labor Cost**				
D	**Total Direct Cost**				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	**UNIT**
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			2.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.01	**Covered Pathwalk**				
4.01.05	**Electrical Works**				
4.01.05C	**Electrical Wiring Devices**				
A	**Materials**				
	Two-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	1.00	set		
	Three-Gang Switch, 16A, 250V, wide series with mounting strap and device plate cover	1.00	set		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Skilled Laborer				
			Labor Cost		
A	**Material Cost**				
B	**Labor Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	**UNIT**
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			27.00	sets
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.01	**Covered Pathwalk**				
4.01.05	**Electrical Works**				
4.01.05D	**Lighting Fixtures**				
A	**Materials**				
	1245mm surface mounted dustproof/moistureproof/weather-proof lighting fixture with polycarbonate housing and cover with stainless clips and 2x18W (T8) LED tube, 30,000 life hour, 1650 lumens, 100V-277V, 60Hz. (Complete with Support and Accessories)	27.00	sets		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
A	**Material Cost**				
B	**Labor Cost**				
D	**Total Direct Cost**				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	**UNIT**
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			29.00	pcs
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.01	**Covered Pathwalk**				
4.01.05	**Electrical Works**				
4.01.05E	**Boxes**				
A	**Materials**				
	Cast aluminum weatherproof round junction box ga. 16		pcs		
	4"×2" Utility Box, Steel Gauge 16		pcs		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
A	**Material Cost**				
B	**Labor Cost**				
D	**Total Direct Cost**				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	**UNIT**
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			150.00	lnm.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.01	**Covered Pathwalk**				
4.01.05	**Electrical Works**				
4.01.05F	**Hangers, Supports and Termination Accessories**				
A	**Materials**				
	G.I. Tie Wire Ga. 16		kgs		
	Electrical Tape		rolls		
	40mm x 40mm x 3m Unistrut Channel		pcs		
	Unistrut clamp with bolt and nut		sets		
	EMT Pipe Clamp		sets		
			Material Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Master Electrician				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
A	**Material Cost**				
B	**Labor Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			50.52	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.02	**TYPE IV SECURITY FENCE WITH GATES**				
4.02.01	**Site Works**				
	including demolition, excavation & disposal				
	demolished and excavated materials				
	Type IV Security Fence with gates -255.40 ln.m.				
	Volume of excavation - 50.52 cu.m.				
	Common Borrow *(use suitable excavated materials)* - 6.33 cu.m.				
	Volume for disposal - 44.20 cu.m.				
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Common Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Dump Truck, 12 yd³				
			Equipment Cost.		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			28.67	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.02	**TYPE IV SECURITY FENCE WITH GATES**				
4.02.02	**Concrete Works**				
	Type IV Security Fence with gates - 28.670 cu.m.				
	Length of 2-bay Cyclone wire fence - 232 ln.m.				
	Man and Vehicular Security Gate - 1 set				
A	**Materials**				
	Portland Cement, 40kgs		bags		
	Sand		cu.m.		
	Gravel, 3/4"		cu.m.		
	12mm dia. DRSB Grade 33, 6 meters		pcs.		
	10mm dia. DRSB Grade 33, 6 meters		pcs.		
	G.I. Tie Wire #16		kgs.		
	1/2" x 4' x 8' Ordinary Plywood		pcs.		
	Form Lumber		bd.ft.		
	Assorted CWN		kgs.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Manual Bar Cutter				
	One-bagger Concrete Mixer, 1cu.m.				
			Equipment Cost.		

A	**Material Cost**	
B	**Labor Cost**	
C	**Equipment Cost**	
D	**Total Direct Cost**	
	INDIRECT COSTS	
1. OCM (0% - 10% of TDC)		
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		
E. TOTAL OCM & CONTRACTOR's PROFIT		
F. VALUE ADDED TAX, (VAT)	5% of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (E + F), P		
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit		
TOTAL ESTIMATED COST (D + G), P		
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit		

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			232.00	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.02	**TYPE IV SECURITY FENCE WITH GATES**				
4.02.03	**Masonry Works (including plastering)**				
A	**Materials**				
	Type IV Security Fence with gates - 232 sq.m.				
	150mm thk. CHB		pcs.		
	Portland Cement, 40kgs		bags		
	Sand		cu.m.		
	10mm dia. DRSB Grade 33, 6 meters		pcs.		
	G.I. Tie Wire #16		kgs.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Manual Bar Cutter				
			Equipment Cost.		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			255.40	ln.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.02	**TYPE IV SECURITY FENCE WITH GATES**				
4.02.04	**Steel Works (including Painting Works)**				
A	**Materials**				
	Type IV Security Fence with gates including:				
	3 sets of man gate and vehicular gate				
	4 sets of man gate				
	38mm dia. G.I. Pipe Sch. 40, 6 meters		pcs.		
	8mm dia. DRSB Grade 33, 6 meters		pcs.		
	38mm dia. G.I. Elbow 90deg.		pcs.		
	38mm dia. G.I. Couplings		pcs.		
	12mm dia. Tension Rod, 6 meters		pcs.		
	12mm dia. Turnbuckle		pcs.		
	10mm dia. Round Steel Bar Grade 33, 6 meters		pcs.		
	Cyclone Wire, 5ft. Gauge 10		ln.m.		
	25mm x 25mm x 6mm thk. Angle Bar, 6 meters		kgs.		
	12mm dia. Round Steel Bar, 6 meters		pc.		
	1.2m x 2.4m x 6mm thk. MS Plate		kgs.		
	19mm dia. G.I. Pipe (Sch.40), 6 meters		ln.m.		
	Welding rod E6011		kgs.		
	Oxygen		cyl		
	Acetylene		cyl		
	Epoxy Top Coat		gals		
	Red Oxide Primer		gals		
	Epoxy Paint Reducer		gals		
	2" Paint Brush w/ tray		pcs.		
	Paint Brush 2"		pcs.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Manual Bar Cutter				
	Welding Machine, 200A-500A				
	Oxy-Acetylene Cutting Torch/Welding Outfit				
			Equipment Cost.		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			33.16	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.03	**PERIMETER CHB FENCE**				
4.03.01	**Site Works**				
	including demolition, excavation & disposal				
	demolished and excavated materials				
	Perimeter Fence (CHB) - 70.0 ln.m.				
	Volume of excavation - 33.16 cu.m.				
	Common Borrow *(use suitable excavated materials)* - 0.11 cu.m.				
	Volume for disposal - 33.05 cu.m.				
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Dump Truck, 12 yd³				
			Equipment Cost.		
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	I N D I R E C T C O S T S				
	1. OCM (0% - 10% of TDC)				
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)				
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			23.92	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.03	**PERIMETER CHB FENCE**				
4.03.02	**Concrete Works**				
	CHB Fence - 70.0 ln.m				
	Length of 10-bay CHB fence (7 bays)				
A	**Materials**				
	Portland Cement, 40kgs		bags		
	Sand		cu.m.		
	Gravel, 3/4"		cu.m.		
	12mm dia. DRSB Grade 33, 6 meters		pcs.		
	10mm dia. DRSB Grade 33, 6 meters		pcs.		
	G.I. Tie Wire #16		kgs.		
	1/2" x 4' x 8' Ordinary Plywood		pcs.		
	Form Lumber		bd.ft.		
	Assorted CWN		kgs.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Manual Bar Cutter				
	One-bagger Concrete Mixer, 1cu.m.				
			Equipment Cost.		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			164.50	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.03	**PERIMETER CHB FENCE**				
4.03.03	**Masonry Works (including plastering)**				
A	**Materials**				
	Type I CHB Fence with barbed wire - 164.50 sq.m.				
	150mm thk. CHB		pcs.		
	Portland Cement, 40kgs		bags		
	Sand		cu.m.		
	10mm dia. DRSB Grade 33, 6 meters		pcs.		
	G.I. Tie Wire #16		kgs.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Manual Bar Cutter				
			Equipment Cost.		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			70.00	ln.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.03	**PERIMETER CHB FENCE**				
4.03.04	**Steel Works (including Painting Works)**				
A	**Materials**				
	Type I CHB Fence with barbed wire - 70.0 ln.m.				
	50mm dia. G.I. Pipe Sch. 40, 6 meters		pcs.		
	10mm dia. Round Steel Bar Grade 33, 6 meters		pc		
	50mm dia. G.I. End Cap		pcs.		
	Barbed Wire, 2.7mm thk.		ln.m.		
	Welding rod E6011		kgs.		
	Oxygen		cyl		
	Acetylene		cyl		
	Epoxy Top Coat		gal		
	Red Oxide Primer		gal		
	Epoxy Paint Reducer		gal		
	Paint Brush 2"		pcs.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Manual Bar Cutter				
	Welding Machine, 200A-500A				
	Oxy-Acetylene Cutting Torch/Welding Outfit				
			Equipment Cost.		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			1,008.75	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.04	**VEHICULAR PARKING AREA CONCRETE PAVEMENT**				
105(1)a	**Subgrade Preparation**				
	Subgrade preparation of VPA PCCP - 1,008.75 sq.m.				
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Motorized Road Grader, 140HP				
	Vibratory Single Smooth Drum Roller, 10MT				
	Water Truck, 4,000 gals				
			Equipment Cost.		
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	I N D I R E C T C O S T S				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			302.62	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.04	**VEHICULAR PARKING AREA CONCRETE PAVEMENT**				
P-154-5.1	**Aggregate Subbase Course**				
A	**Materials**				
	Aggregate Subbase Coarse		cu.m.		
	with 15% Shrinkage Factor				
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Motorized Road Grader, 140HP				
	Vibratory Single Smooth Drum Roller, 10MT				
	Water Truck, 4,000 gals				
			Equipment Cost.		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5%	of (D + E)			
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			1,008.75	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.04	**VEHICULAR PARKING AREA CONCRETE PAVEMENT**				
P-501-8.1b.1	**Cement Concrete Pavement, 250mm thick**				
A	**Materials**				
	Portland Cement, 40 kgs		bags		
	Sand		cu.m.		
	Gravel, 3/4"		cu.m.		
	25mm dia. Round Steel Bar, Gr.60		pcs.		
	10mm dia. Round Steel Bar, Gr.40		pcs.		
	#16 G.I. Tie Wires		kgs.		
	Curing Compound		L		
	Asphalt Joint Sealer		L		
	25mm Polyethylene Backer Rod, 3.50 meters		pcs.		
	Form Oil		L		
	Grease/Tar		L		
	Red Oxide		L		
	2" Paint Brush		pcs.		
	Steel Form 25cm width (rental)		lm.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Transit Mixer, 5.0 cu.m				
	Concrete Batch Plant, 40 cu.m/day				
	Payloader, 1.5 cu.m				
	Concrete Vibrator				
	Concrete Screeder, 5.5hp				
	Concrete Saw, self-propelled 10 3/4 in				
	Bar Cutter/Shear, 42mm				
	Water Truck, 4,000 gals				
			Equipment Cost.		

A	**Material Cost**	
B	**Labor Cost**	
C	**Equipment Cost**	
D	**Total Direct Cost**	
	INDIRECT COSTS	
1. OCM (0% - 10% of TDC)		
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		
E. TOTAL OCM & CONTRACTOR's PROFIT		
F. VALUE ADDED TAX, (VAT)	5% of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (E + F), P		
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit		
TOTAL ESTIMATED COST (D + G), P		
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit		

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			2,112.30	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.05	**LANDSCAPING WORKS**				
	Total Area - 2,112.30 sq.m.				
A	**Materials**				
	Bermuda Grass	2,112.30	sq.m.		
	Garden Soil		cu.m.		
	Foxtail Palm	30.00	pcs.		
	Fukien Tea Plant	130.00	pcs.		
	Giant Calathea	130.00	pcs.		
	Eugenia	150.00	pcs.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			104.82	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.06	**CONCRETE CURBS**				
4.06.01	**Site Works**				
	Excavation - 104.82 cu.m.				
	Excavated materials for disposal - 24.06 cu.m.				
A	**Materials**				
	Gravel, G1		cu.m.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	UnSkilled Laborer				
			Labor Cost		
A	**Material Cost**				
B	**Labor Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			80.76	cu.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.06	**CONCRETE CURBS**				
4.06.02	**Concrete Works**				
A	**Materials**				
	Portland Cement, 40kgs		bags		
	Sand		cu.m.		
	Gravel, 3/4"		cu.m.		
	12mm dia. DRSB Grade 33, 6 meters		pcs.		
	G.I. Tie Wire #16		kgs.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
C	**Equipment**	# of EQPT.	DUR. (DAYS)	RATE/DAY	
	Manual Bar Cutter				
	One-bagger Concrete Mixer, 1cu.m.				
			Equipment Cost.		
A	**Material Cost**				
B	**Labor Cost**				
C	**Equipment Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
1. OCM (0% - 10% of TDC)					
2. CONTRACTOR's PROFIT (0% - 8% of TDC)					
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT :	**CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**				
PROJECT DESCRIPTION:	**IV. SITE DEVELOPMENT**				
LOCATION :	Catbalogan Airport, Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			128.89	sq.m.
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
4.07	**VPA Painting Works**				
	Curbs - 111.17 sq.m.				
	Parking Line - 8.42 sq.m.				
	Pedestrian Lane - 4.80 sq.m.				
	PWD sign - 4.50 sq.m.				
A	**Materials**				
	Flat Latex Paint (Primer)		gals		
	Latex Paint (Topcoat)		gals		
	Paint Reducer		gal		
	2" Paint Brush w/ tray		pcs.		
	Paint Brush 2"		pcs.		
			Materials Cost		
B	**Labor**	# of Manpower	DUR. (DAYS)	RATE/DAY	
	Construction Foreman				
	Skilled Laborer				
	UnSkilled Laborer				
			Labor Cost		
A	**Material Cost**				
B	**Labor Cost**				
D	**Total Direct Cost**				
	INDIRECT COSTS				
	1. OCM (0% - 10% of TDC)				
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)				
E. TOTAL OCM & CONTRACTOR's PROFIT					
F. VALUE ADDED TAX, (VAT)	5% of (D + E)				
G. TOTAL ESTIMATED INDIRECT COST (E + F), P					
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit					
TOTAL ESTIMATED COST (D + G), P					
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit					

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **SITE DEVELOPMENT**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			601.81	cu.m.
ITEM	DESCRIPTION				
4.08	**EXTERIOR DRAINAGE SYSTEM**				
4.08.01	**Site Works**				
	(requires labor only)				
	Excavation (392.67 cu.m.)				
	Backfill (209.14 cu.m.)				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Gravel Bedding (Catch Basin, Septic Tanks & Trench Drain)				
	Gravel (3/4")		cu.m.		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR(days)	RATE/DAY	TOTAL RATE
	Backhoe Crawler (0.80cu.m.)				
	Payloader (1.50 cu.m)				
	Dump Truck (9 cu.m)				
			Equipment Cost	. . . . .	

A	**SITEWORKS MATERIAL COST**			
B	**SITEWORKS LABOR COST**			
C	**SITEWORKS EQUIPMENT COST**			
D	**SITEWORKS DIRECT COST**			
	I N D I R E C T C O S T S			
	1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
	E. TOTAL OCM & PROFIT		of D	
	F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
	G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
	TOTAL ESTIMATED COST (D + G), P			
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **SITE DEVELOPMENT**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			23.72	days
ITEM	DESCRIPTION				
4.08	**EXTERIOR DRAINAGE SYSTEM**				
4.08.02	**Concrete Works (Manhole and Trench Drain)**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Portland Cement (40kg per bag)		bags		
	Sand		cu.m.		
	Gravel (3/4")		cu.m.		
	1/2" x 4' x 8' Ordinary Plywood		pcs.		
	2" x3" Form Lumber		bd.ft.		
	Assorted CWN		kg.		
	12mmØ DRSB, 6 meters		pcs.		
	10mmØ DRSB, 6 meters		pcs.		
	#16 G.I. Tie Wire		kgs.		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR(days)	RATE/DAY	TOTAL RATE
	One bagger concrete mixer				
	Concrete vibrator				
			Equipment Cost	. . . . .	

A	**CONCRETE WORKS MATERIAL COST**	
B	**CONCRETE WORKS LABOR COST**	
C	**CONCRETE WORKS EQUIPMENT COST**	
D	**CONCRETE WORKS DIRECT COST**	

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT : **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**

DESCRIPTION : **SITE DEVELOPMENT**

LOCATION : Catbalogan Airport
Catbalogan City, Samar

				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			3,737.96	days
ITEM	DESCRIPTION				
4.08	**EXTERIOR DRAINAGE SYSTEM**				
4.08.03	**Steel Works (Manhole and Trench Drain)**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	5mm thk. x 38mm x 6m Flat bar		pcs.		
	5mm thk. x 4' x 8' MS Plate		pcs.		
	10mmØ x 6m, Deformed reinforcing steel bar		pcs.		
	10mm thk. x 38mm x 6m Flat bar		pcs.		
	6mm thk. x 38mm x 6m Flat bar		pcs.		
	3mm thk. x 12mm x 6m Flat bar		pcs.		
	6mm thk. x 50mm x 50mm angle bar		pcs.		
	3mm thk. x 25mm x 25mm angle bar		pcs.		
	10mm x 10mm (1m x 27m) aluminum screen		pcs.		
	5mm thk. x 25mm x 6m Flat bar		pcs.		
	8mm x 6m square bar		pcs.		
	Oxygen		cyl.		
	Acetylene		cyl.		
	Welding Rod (20kgs./box)		boxes		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR(days)	RATE/DAY	TOTAL RATE
	Oxy-Acetylene Cutting Torch with Welding Outfit				
	Portable Generator Set, 10 kVA				
	Welding Machine, 10-200 Amp				
			Equipment Cost	. . . . .	

A	**STEEL WORKS MATERIAL COST**	
B	**STEEL WORKS LABOR COST**	
C	**STEEL WORKS EQUIPMENT COST**	
D	**STEEL WORKS DIRECT COST**	

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT : **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**
DESCRIPTION : **SITE DEVELOPMENT**
LOCATION : Catbalogan Airport
Catbalogan City, Samar

				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			242.64	sq.m.
ITEM	DESCRIPTION				
4.08	**EXTERIOR DRAINAGE SYSTEM**				
4.08.04	**Masonry Works (Manhole and Trench Drain)**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	Portland Cement (40kg per bag)		bags		
	Sand		cu.m.		
	6" Nonbearing CHB		pcs.		
	12mmØ DRSB, 6 meters		pcs.		
	#16 G.I. Tie Wire		kgs.		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	

A	**MASONRY WORKS MATERIAL COST**		
B	**MASONRY WORKS LABOR COST**		
C	**MASONRY WORKS EQUIPMENT COST**		
D	**MASONRY WORKS DIRECT COST**		
	INDIRECT COSTS		
	1. OCM (0% - 10% of TDC)	of Estimated Direct Cost	
	2. CONTRACTOR's PROFIT (0% - 8% of TDC)	of Estimated Direct Cost	
	E. TOTAL OCM & PROFIT	of D	
	F. VALUE ADDED TAX, (VAT) 5.0%	of (D + E)	
	G. TOTAL ESTIMATED INDIRECT COST (F + E), P		
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit		
	TOTAL ESTIMATED COST (D + G), P		
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit		

NAME OF PROJECT	: **CATBALOGAN AIRPORT DEVELOPMENT PROJECT**				
DESCRIPTION	: **SITE DEVELOPMENT**				
LOCATION	: Catbalogan Airport Catbalogan City, Samar				
				QUANTITY	UNIT
SUBJECT	: **BILL OF QUANTITIES AND COST ESTIMATES**			207.50	li.m.
ITEM	DESCRIPTION				
4.08	**DRAINAGE SYSTEM**				
4.08.05	**Pipe Culverts and Storm Drainage**				
A	**Materials**	QTY	UNIT	UNIT COST	TOTAL AMOUNT
	600mmØ x 1m Reinforced Concrete Pipe		pcs.		
	900mmØ x 1m Reinforced Concrete Pipe		pcs.		
	Portland Cement (40kg per bag)		bags		
	Sand		cu.m.		
	160mmØ PVC Pipe Series 1000		pcs.		
	Solvent Cement (400 cc)		can		
			Material Cost	. . . . .	
B	**Labor**	MANPOWER	DUR(days)	RATE/DAY	TOTAL RATE
	Construction Foreman				
	Skilled Laborer				
	Common Laborer				
			Labor Cost	. . . . .	
C	**Equipment**	QTY	DUR(days)	RATE/DAY	TOTAL RATE
	Backhoe Crawler (0.8 cu.m.)				
			Equipment Cost	. . . . .	

A	**PIPE CULVERTS AND STORM DRAINAGE**
B	**PIPE CULVERTS AND STORM DRAINAGE**
C	**PIPE CULVERTS AND STORM DRAINAGE**
D	**PIPE CULVERTS AND STORM DRAINAGE**

INDIRECT COSTS			
1. OCM (0% - 10% of TDC)		of Estimated Direct Cost	
2. CONTRACTOR's PROFIT (0% - 8% of TDC)		of Estimated Direct Cost	
E. TOTAL OCM & PROFIT		of D	
F. VALUE ADDED TAX, (VAT)	5.0%	of (D + E)	
G. TOTAL ESTIMATED INDIRECT COST (F + E), P			
H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit			
TOTAL ESTIMATED COST (D + G), P			
TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit			

NAME OF PROJECT : **CATBALOGAN AIRPORT DEVELOPMENT PROJECT CY 2021**

LOCATION : Catbalogan Airport, Catbalogan City, Samar

				QUANTITY	UNIT
SUBJECT	**BILL OF MATERIALS AND COST ESTIMATES**			1.00	lot
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
SPL-2	**TEMPORARY FACILITY**				
A	**Materials**				
	Staff House, fully furnished, including electric and water utilities	13.00	months		
			Material Cost	. . . . .	
C	**Equipment**	# of EQPT	UNIT	UNIT COST	
	Service Vehicle (including driver, maintenance and gas)	1.00	unit		
			Equipment Cost	. . . . .	
A	**MATERIAL COST**				
C	**EQUIPMENT COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
	1. OCM (0% of TDC)				
	2. CONTRACTOR's PROFIT (0% of TDC)				
	E. TOTAL OCM & CONTRACTOR's PROFIT				
	F. VALUE ADDED TAX, (VAT) 5.0% of (D + E)				
	G. TOTAL ESTIMATED INDIRECT COST (E + F), P				
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit				
	TOTAL ESTIMATED COST (D + G), P				
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit				

Section IX. Bidding Forms

TABLE OF CONTENTS

Other Bidding Forms

(ANNEX "A")

{ATTACH COMPANY LETTERHEAD/LOGO}

Statement of all its ON-GOING 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

Name of Project: _____
Location of Project: _____

Name of Company : _____
Address of Company: _____

Name of Contract	a. Owner's Name b. Address c. Telephone No.	Nature of Work	Contractor's Role		Contract Amount at Award	a. Date Awarded b. Date of Contract c. Contract Duration d. Date Started e. Date Completed	Accomplishment		Values of Outstanding Works
			Description	%			Planned	Actual	
Government									
Private									
							Total value of outstanding works		

Submitted by: _____
(Print Name & Signature)

Designation: _____

Date: _____

{ATTACH COMPANY LETTERHEAD/LOGO}

Statement of single largest COMPLETED contract similar to the contract to be bid

Name of Project: _____
Location of Project: _____

Name of Company : _____
Address of Company: _____

Name of Contract	a. Owner's Name b. Address c. Telephone No.	Nature of Work	Contractor's Role		Contract Amount at Award	a. Date Awarded b. Date of Contract c. Contract Duration d. Date Started e. Date Completed
			Description	%		

Submitted by: _____
(Print Name & Signature)

Designation: _____

Date: _____

JOINT RESOLUTION

Whereas, _____ (Bidder / Name of Particular JV Partner), duly organized and existing under the Laws of the _____, with office address at _____, represented herein by its _____, _____, and _____ (Name of Particular JV Partner), duly organized and existing under the Laws of the _____, with main office address at _____, represented by herein by its _____, have entered into a Joint Venture (JV) Agreement to undertake the following project / contract:

(Name of Project / Contract)

Whereas, in order to facilitate the orderly execution and conduct of the contract that was entered into by the joint venture in the name of the joint venture, it is hereby resolved by the parties in the Joint Venture as follows:

a. To appoint _____ as the Authorized Managing Officer and Official Representative, to represent, to manage the Joint Venture and is empowered to enter in contract in the name of the Joint Venture, or to sign for any document in the name of the Joint Venture required by the (Procurement Agency) or any entities pursuant to the terms of the Joint Venture Agreement:

b. That, the parties agreed to make _____(Name of Particular Lead Partner) _____ as the Lead Partner of the Joint Venture and (Name of Authorized Officer) _____ as the Official Representative & Managing Partner of the Joint Venture, and are granted full power and authority to do, execute and perform any and all acts necessary and/or to represent the Joint Venture in the Eligibility Check, Bidding and Undertaking of the said contract in the name of the Joint Venture, as fully and effectively and the Joint Venture may do and if personally present with full power of substitution and revocation. _____ is fully authorized and empowered to sign any or all documents pertaining to the above stated project / contract in the name of the Joint Venture.

c. That the parties agree to be jointly and severally liable for their participation in the Eligibility Check, Bidding and Undertaking of the said contract.

d. That the terms of the JV Agreement entered into the parties shall be valid and is co-terminus with the final completion and turnover of the Name of Contract / Project to

the agency of the government, which in this case, the (Name of Procurement Entity);

IN WITNESS THEREFORE, We hereby sign jointly this Joint Resolution this _____ day of _____, 20 ____ in _____.

Name of Bidder (Lead Partner)	**Name of Bidder (Member Partner)**
By: _____	**By:** _____
Signature & Name of Managing Officer	Signature & Name of Authorized Authorized Representative
_____	_____
Designation / Position	Designation / Position
Name of Bidder (Member Partner)	**Name of Bidder (Member Partner)**
By: _____	**By:** _____
Signature & Name of Managing Officer	Signature & Name of Authorized Authorized Representative
_____	_____
Designation / Position	Designation / Position

SIGNED IN THE PRESENCE OF:

_____

_____

_____

_____

A C K N O W L E D G E M E N T

REPUBLIC OF THE PHILIPPINES)

CITY OF_____)S.S.

BEFORE ME, a Notary Public, for and in the City of _____, Philippines, this _____ day of _____, 20____ personally appeared the following persons:

NAME	**Community Cert. No.**	**Date / Place of Issue**

Representing to be the _____ of _____ and _____ of _____ respectively, known to me and to me known to be the same persons who executed the foregoing instrument for and in behalf of said corporations and who acknowledge to me that same is their free and voluntary act and deed as well as of the corporations which they represent, for the uses, purposes, and considerations therein set forth and that they are duly authorized to sign the same.

This Instrument consists of THREE (3) pages including this page wherein this Acknowledgement is written and signed by the parties and their instrumental witnesses on each and every page thereon.

WITNESS MY HAND AND NOTARIAL SEAL at the place and date hereinafter first above written.

NOTARY PUBLIC

Doc. No. _____

Book No. _____

Page No. _____

Series of _____

Other Bidding Forms

(ANNEX "B")

Republic of the Philippines
CIVIL AVIATION AUTHORITY OF THE PHILIPPINES

CERTIFICATE OF SITE INSPECTION

This is to CERTIFY that _____, employee of _____, has conducted the required Site Inspection for the bidding of the project "_____" at _____.

Issued this _____**, 2021**

Airport Manager/Officer-in-Charge:

_____
Signature over Printed Name

Bid-Securing Declaration

(REPUBLIC OF THE PHILIPPINES)
CITY OF _____) S.S.
x----------x

Invitation to Bid *[Insert reference number]*

To: *[Insert name and address of the Procuring Entity]*

I/We, the undersigned, declare that:

1. I/We understand that, according to your conditions, bids must be supported by a Bid Security, which may be in the form of a Bid-Securing Declaration.

2. I/We accept that: (a) I/we will be automatically disqualified from bidding for any contract with any procuring entity for a period of two (2) years upon receipt of your Blacklisting Order; and, (b) I/we will pay the applicable fine provided under Section 6 of the Guidelines on the Use of Bid Securing Declaration, within fifteen (15) days from receipt of written demand by the procuring entity for the commission of acts resulting to the enforcement of the bid securing declaration under Sections 23.1(b), 34.2, 40.1 and 69.1, except 69.1 (f), of the IRR of RA 9184; without prejudice to other legal action the government may undertake.

3. I/We understand that this Bid-Securing Declaration shall cease to be valid on the following circumstances:

    a. Upon expiration of the bid validity period, or any extension thereof pursuant to your request;

    b. I am/we are declared ineligible or post-disqualified upon receipt of your notice to such effect, and (i) I/we failed to timely file a request for reconsideration or (ii) I/we filed a waiver to avail of said right;

    c. I am/we are declared as the bidder with the Lowest Calculated Responsive Bid, and I/we have furnished the performance security and signed the Contract.

IN WITNESS WHEREOF, I/We have hereunto set my/our hand/s this ____ day of *[month] [year]* at *[place of execution]*.

[Insert NAME OF BIDDER'S AUTHORIZED REPRESENTATIVE]
[Insert signatory's legal capacity]

Affiant

SUBSCRIBED AND SWORN to before me this __ day of *[month] [year]* at *[place of execution]*, Philippines. Affiant/s is/are personally known to me and was/were identified by me through competent evidence of identity as defined in the 2004 Rules on Notarial Practice (A.M. No. 02-8-13-SC). Affiant/s exhibited to me his/her *[insert type of government identification card used]*, with his/her photograph and signature appearing thereon, with no. _____.

Witness my hand and seal this ___ day of *[month] [year]*.

NAME OF NOTARY PUBLIC

Serial No. of Commission _____
Notary Public for _____ until _____
Roll of Attorneys No. _____
PTR No. __, *[date issued], [place issued]*
IBP No. __, *[date issued], [place issued]*
Doc. No. ___
Page No. ___
Book No. ___
Series of ____.

Contractor's Organizational Chart for the Project

Submit Copy of the Organizational Chart that the Contractor intends to use to execute the contract if awarded to him. Indicate in the chart the names of the Key Engineering Personnel who will be assigned in the Project.

{ATTACH COMPANY LETTERHEAD/LOGO}

Attach the required Proposed Organizational Chart for the Contract as stated above.

Submitted by: _____

Designation : _____

Date : _____

{ATTACH COMPANY LETTERHEAD/LOGO}

Qualification of Key Personnel Proposed to be Assigned to the Project

Name of Project: _____
Location of Project: _____

Name of Company: _____
Address of Company: _____

	Project Manager/Engineer	Material Engineer	Foreman	Construction Safety and Health Personnel	Other Position deemed required by the Applicant for this project
1. Name					
2. Address					
3. Date of Birth					
4. Employed Since					
5. Experience					
6. Previous Employment					
7. Education					
8. PRC License					

Note: Attached individual PRC License of the (professional) personnel.

Submitted by : _____
(Signature over Printed Name)
Designation : _____
Date : _____

{ATTACH COMPANY LETTERHEAD/LOGO}

Date: _____

CAPTAIN DONALDO A. MENDOZA
Chairman, Bids and Awards Committee - Charlie
Civil Aviation Authority of the Philippines
Mia Road, Pasay City, M.M. 1300
Tel: 944-2358

Subject: Contractor's Letter-Certificate to Procuring Entity

Dear Sir:

Supplementing our Organizational Chart for the Contract, we have the honor to submit herewith, and to certify as true and correct, the following pertinent information:

That I/we have engaged the service of *(Name of Employee)*, to be the *(Designation)* of the *(Name of Project)*, who is a *(Profession)* with Professional License Certificate No. __ issued on _____ and who has performed the duties in the construction of the project enumerated in the filled Annex "B" Form 5b.

That *(Name of Employee)* shall personally perform the duties of the said position in the above-mentioned project, if and when the same is awarded in our favor.

That *(Name of Employee)* shall employ the best care, skill and ability in performing his duties in accordance with the Contract Agreement, Conditions of Contract, Plans, Specifications, Special Provisions, and other provisions embodied in the proposed contract.

That *(Name of Employee)* shall be personally present at the jobsite all the time to supervise the phase of the construction work pertaining to his assignment as *(Designation)*.

That *(Name of Employee)* is aware that he shall be authorized to handle only one contract at a time.

That in order to guarantee that *(Name of Employee)* shall perform his duties properly and be personally present in the Job Site, he is hereby required to secure a certificate of appearance for the Procuring Entity's Engineer at the end of every month.

That in the event that I/we elect or choose to replace *(Name of Employee)* with another Engineer, the Procuring Entity will be accordingly notified by us in writing at least twenty one (21) days before making replacement. We will submit to the Procuring Entity, for prior approval, the name of the proposed new *(Designation)*, his qualification, experience, list of projects undertaken and other relevant information.

That any willful violation on my/our part of the herein conditions may prejudice my/our standing as a reliable contractor in future bidding of the Procuring Entity.

Very truly yours,

_____

(Authorized Representative of Bidder)

CONCURRED BY:

_____

(Name of Engineer)

{ATTACH COMPANY LETTERHEAD/LOGO}

Date: _____

CAPTAIN DONALDO A. MENDOZA
Chairman, Bids and Awards Committee - Charlie
Civil Aviation Authority of the Philippines
Mia Road, Pasay City, M.M. 1300
Tel: 944-2358

Subject: Key Personnel's Certificate of Employment

Dear Sir:

I am *(Name of Employee)* a License _____ Engineer with Professional License No. issued on *(Date of Issuance)* at *(Place of Issuance)*.

I hereby certify that *(Name of Bidder)* has engaged my services as *(Designation)* for *(Name of the Project)*, if awarded in their favor.

As *(Designation)*, I know I will have to stay in the job site all the time to supervise and managed the Contract works to the best of my ability, and aware that I am authorized to handle only one (1) contract at a time.

I do not allow the use of my name for the purpose of enabling the above-mentioned Contractor to qualify for the Contract without any firm commitment on my part to assume the post of *(Designation)*.

As *(Designation)*, I supervised the following completed projects similar to the contract under bidding:

NAME OF PROJECT	OWNER	COST	DATE COMPLETED

At present, I am supervising the following project:

NAME OF PROJECT	OWNER	COST	DATE COMPLETION

In case of my separation for any reason whatsoever from the above-mentioned Contractor, I shall notify the _____*(Name of the Procuring Entity)* at least twenty one (21) days before the effective date of my separation.

_____

(Signature of Engineer)

SUBSCRIBED AND SWORN to before me this ___ day of _____, 20___ affiant exhibiting to me his/her Residence Certificate No. _____ issued on _____ at _____, Philippines.

_____

Notary Public

Until 31 December 20
PRT No.: _____
Issued at: _____
Issued on: _____
TIN No.: _____

Doc. No._____
Page No._____

Book No. _____
Series of_____

CAAP-BAC-SF Annex "B" Form 5c

KEY PERSONNEL

(FORMAT OF BIO-DATA)

Give the detailed information of the following personnel who are scheduled to be assigned as full-time field staff for the project. Fill up a form for each person.

1. Authorized Managing Officer / Representative: _____

2. Sustained Technical Employee:

Name: _____

Date of Birth: _____

Nationality: _____

Education and Degrees: _____

Specialty: _____

Registration: _____

Length of Service with the Firm:

_____Year From _____ (months) _____ (year)

To _____ (months) _____ (year)

Years of Experience:

If Item 7 is less than ten (10) years, give name and length of service with previous employers for a ten (10) year period (attached additional sheet/s, if necessary:

Name and Address of Employer	Length of Service	
_____	_____ year(s)	from _____to _____
_____	_____ year(s)	from _____to _____
_____	_____ year(s)	from _____to _____

Experience:

This should cover the past ten (10) years of experience. (Attached as many pages as necessary to show involvement of personnel in projects using the format below).

a. Name: _____
b. Name and Address of Owner: _____
_____
c. Name and Address of the Owner's Engineer (Consultant):_____
_____
d. Indicate the Features of Project (particulars of the project components and any other particular interest connected with the project): _____
_____
e. Contract Amount Expressed in Philippine Currency: _____
f. Position: _____
g. Structures for which the employee was responsible: _____
_____
h. Assignment Period: from _____(months) _____ (years)
to _____(months) _____ (years)

_____
Name and Signature of Employee

It is hereby certified that the above personnel can be assigned to the _____ Project, if the contract is awarded to our company.

_____ _____
(Place and Date) (The Authorized Representative)

List of Equipment, Owned or Leased and/or under Purchased Agreements, Pledge to the Proposed Project

Name of Project: _____
Location of Project: _____

Name of Company: _____
Address of Company: _____

Description	Model/Year	Capacity/ Performance/ Size	Plate No.	Motor No./ Body No.	Location	Condition	Proof of Ownership/ Lessor or Vendor
A. Owned							
I.							
II.							
III.							
IV.							
V.							
B. Leased							
I.							
II.							
III.							
IV.							
V.							
C. Under Purchased Agreement							
I.							
II.							
III.							
IV.							
V.							

Submitted by : _____
(Signature over Printed Name)
Designation : _____
Date : _____

Omnibus Sworn Statement

REPUBLIC OF THE PHILIPPINES)
CITY/MUNICIPALITY OF _____) S.S.

A F F I D A V I T

I, *[Name of Affiant]*, of legal age, *[Civil Status]*, *[Nationality]*, and residing at *[Address of Affiant]*, after having been duly sworn in accordance with law, do hereby depose and state that:

1. ***Select one, delete the other:***

   If a sole proprietorship: I am the sole proprietor or authorized representative of *[Name of Bidder]* with office address at *[address of Bidder]*;

   If a partnership, corporation, cooperative, or joint venture: I am the duly authorized and designated representative of *[Name of Bidder]* with office address at *[address of Bidder]*;

2. ***Select one, delete the other:***

   If a sole proprietorship: As the owner and sole proprietor or authorized representative of *[Name of Bidder]*, I have full power and authority to do, execute and perform any and all acts necessary to participate, submit the bid, and to sign and execute the ensuing contract for *[Name of the Project]* of the *[Name of the Procuring Entity] [insert "as shown in the attached duly notarized Special Power of Attorney" for the authorized representative]*;

   If a partnership, corporation, cooperative, or joint venture: I am granted full power and authority to do, execute and perform any and all acts necessary to participate, submit the bid, and to sign and execute the ensuing contract for *[Name of the Project]* of the *[Name of the Procuring Entity]*, accompanied by the duly notarized Special Power of Attorney, Board/Partnership Resolution, or Secretary's Certificate, whichever is applicable;

3. *[Name of Bidder]* is not "blacklisted" or barred from bidding by the Government of the Philippines or any of its agencies, offices, corporations, or Local Government Units, foreign government/foreign or international financing institution whose blacklisting rules have been recognized by the Government Procurement Policy Board;

4. Each of the documents submitted in satisfaction of the bidding requirements is an authentic copy of the original, complete, and all statements and information provided therein are true and correct;

5. *[Name of Bidder]* is authorizing the Head of the Procuring Entity or its duly authorized representative(s) to verify all the documents submitted;

6. ***Select one, delete the rest:***

   If a sole proprietorship: The owner or sole proprietor is not related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

   If a partnership or cooperative: None of the officers and members of *[Name of Bidder]* is related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

   If a corporation or joint venture: None of the officers, directors, and controlling stockholders of *[Name of Bidder]* is related to the Head of the Procuring Entity, members of the Bids and Awards Committee (BAC), the Technical Working Group, and the BAC Secretariat, the head of the Project Management Office or the end-user unit, and the project consultants by consanguinity or affinity up to the third civil degree;

7. *[Name of Bidder]* complies with existing labor laws and standards; and

8. *[Name of Bidder]* is aware of and has undertaken the following responsibilities as a Bidder:

   a) Carefully examine all of the Bidding Documents;

   b) Acknowledge all conditions, local or otherwise, affecting the implementation of the Contract;

   c) Made an estimate of the facilities available and needed for the contract to be bid, if any; and

   d) Inquire or secure Supplemental/Bid Bulletin(s) issued for the *[Name of the Project]*.

9. *[Name of Bidder]* did not give or pay directly or indirectly, any commission, amount, fee, or any form of consideration, pecuniary or otherwise, to any person or official, personnel or representative of the government in relation to any procurement project or activity.

IN WITNESS WHEREOF, I have hereunto set my hand this __ day of ___, 20__ at _____, Philippines.

_____
Bidder's Representative/Authorized Signatory

SUBSCRIBED AND SWORN to before me this ___ day of *[month] [year]* at *[place of execution],* Philippines. Affiant/s is/are personally known to me and was/were identified by me through competent evidence of identity as defined in the 2004 Rules on Notarial Practice (A.M. No. 02-8-13-SC). Affiant/s exhibited to me his/her [insert type of government identification card used], with his/her photograph and signature appearing thereon, with no. _____ and his/her Community Tax Certificate No. _____ issued on ____ at _____.

Witness my hand and seal this ___ day of *[month] [year]*.

NAME OF NOTARY PUBLIC
Serial No. of Commission _____
Notary Public for _____ until _____
Roll of Attorneys No. _____
PTR No. _____ *[date issued], [place issued]*
IBP No. _____ *[date issued], [place issued]*

Doc. No. _____
Page No. _____
Book No. _____
Series of _____

* This form will not apply for WB funded projects.

{ATTACH COMPANY LETTERHEAD/LOGO}

Bid Form

Date: _____

IB[2] N°: _____

To: *[name and address of PROCURING ENTITY]*

Address: *[insert address]*

We, the undersigned, declare that:

(a) We have examined and have no reservation to the Bidding Documents, including Addenda, for the Contract *[insert name of contract]*;

(b) We offer to execute the Works for this Contract in accordance with the Bid and Bid Data Sheet, General and Special Conditions of Contract accompanying this Bid;

The total price of our Bid, excluding any discounts offered below is: *[insert information]*;

The discounts offered and the methodology for their application are: *[insert information]*;

(c) Our Bid shall be valid for a period of *[insert number]* days from the date fixed for the Bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(d) If our Bid is accepted, we commit to obtain a Performance Security in the amount of *[insert percentage amount]* percent of the Contract Price for the due performance of the Contract;

(e) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from the following eligible countries: *[insert information]*;

(f) We are not participating, as Bidders, in more than one Bid in this bidding process, other than alternative offers in accordance with the Bidding Documents;

(g) Our firm, its affiliates or subsidiaries, including any subcontractors or suppliers for any part of the Contract, has not been declared ineligible by the Funding Source;

[2] If ADB, JICA and WB funded projects, use IFB.

(h) We understand that this Bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal Contract is prepared and executed; and

(i) We understand that you are not bound to accept the Lowest Calculated Bid or any other Bid that you may receive.

(j) **We likewise certify/confirm that the undersigned, is the duly authorized representative of the bidder, and granted full power and authority to do, execute and perform any and all acts necessary to participate, submit the bid, and to sign and execute the ensuing contract for the *[Name of Project]* of the *[Name of the Procuring Entity]*.**

(k) **We acknowledge that failure to sign each and every page of this Bid Form, including the Bill of Quantities, shall be a ground for the rejection of our bid.**

Name: _____

In the capacity of: _____

Signed: _____

Duly authorized to sign the Bid for and on behalf of: _____

Date: _____

Other Bidding Forms

(ANNEX "C")

{ATTACH COMPANY LETTERHEAD/LOGO}

BILL OF QUANTITIIES

PROJECT: _____
LOCATION: _____

ITEM NO.	DESCRIPTION	QTY	UNIT	UNIT PRICE (Pesos)	AMOUNT (Pesos)
	Pesos_____ Amount in Words _____ _____ __and_____ _____ centavos				
	Pesos_____ Amount in Words _____ _____ __and_____ _____ centavos				
	Pesos_____ Amount in Words _____ _____ __and_____ _____ centavos				
	Pesos_____ Amount in Words _____ _____ __and_____ _____ centavos				

TOTAL BID AMOUNT (Php) _____

TOTAL BID AMOUNT IN WORDS _____
_____
_____

Signature: _____
Printed Name: _____
Position: _____
Name Company: _____
Date: _____

{ATTACH COMPANY LETTERHEAD/LOGO}

CAAP-BAC-SF Annex " C" Form 2

SUMMARY OF BID PROPOSAL

PROJECT:
LOCATION:

ITEM NO.	DESCRIPTION OF WORK	QTY	UNIT	ESTIMATED DIRECT COST	MARK-UPS IN PERCENT		TOTAL MARK-UP		V.A.T.	TOTAL INDIRECT COST	TOTAL COST	UNIT COST
					OCM	PROFIT	%	VALUE				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9] [5] x [8]	[10] 5%{[5] +[9]}	[11] [9] +[10]	[12] [5] + [11]	[13] [12] / [3]

SUBMITTED BY:

Signature: _____
Printed Name: _____
Position: _____
Name Company: _____
Date: _____

{ATTACH COMPANY LETTERHEAD/LOGO}

BILL OF MATERIALS & COST ESTIMATES

NAME OF PROJECT :
DESCRIPTION :
LOCATION :

				QUANTITY	UNIT

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
A	**TOTAL MATERIAL COST**				
B	**TOTAL LABOR COST**				
C	**TOTAL EQUIPMENT COST**				
D	**TOTAL DIRECT COST**				
	INDIRECT COSTS				
	1. OCM (0% of TDC)				
	2. CONTRACTOR's PROFIT (0% of TDC)				
	E. TOTAL OCM & CONTRACTOR's PROFIT				
	F. VALUE ADDED TAX, (VAT) 5.0%				
	G. TOTAL ESTIMATED INDIRECT COST (E + F), P				
	H. TOTAL ESTIMATED UNIT INDIRECT COST (G / Quantity), P/Unit				
	TOTAL ESTIMATED COST (D + G), P				
	TOTAL ESTIMATED UNIT COST (Total Estimated Cost / Quantity), P/Unit				

SUBMITTED BY:

Signature: _____

Printed Name: _____

Position: _____

Name Company: _____

Date: _____

{ATTACH COMPANY LETTERHEAD/LOGO}

SUMMARY FOR UNIT PRICES OF MATERIALS

PROJECT: _____

LOCATION: _____

DESCRIPTION	UNIT PRICE	UNIT

SUBMITTED BY:

Signature: _____

Printed Name: _____

Position: _____

Name Company: _____

Date: _____

{ATTACH COMPANY LETTERHEAD/LOGO}

SUMMARY FOR UNIT PRICES OF LABOR

PROJECT: _____

LOCATION: _____

DESCRIPTION	UNIT PRICE	UNIT

SUBMITTED BY:

Signature: _____

Printed Name: _____

Position: _____

Name Company: _____

Date: _____

{ATTACH COMPANY LETTERHEAD/LOGO}

SUMMARY FOR UNIT PRICES OF EQUIPMENT

PROJECT: _____

LOCATION: _____

DESCRIPTION	UNIT PRICE	UNIT

SUBMITTED BY:

Signature: _____

Printed Name: _____

Position: _____

Name Company: _____

Date: _____

{ATTACH COMPANY LETTERHEAD/LOGO}

Name of Project : _____

Location of Project : _____

CASH FLOW BY QUARTER AND PAYMENY SCHEDULE

PARTICULAR	% W	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
ACCOMPLISHMENT					
CASH FLOW					
CUMULATIVE ACCOMPLISHMENT					
CUMULATIVE CASH FLOW					

Submitted by:

_____
Name of the Representative of the Bidder

_____
Position

_____
Name of the Company

_____
Date

Other Bidding Forms

(ANNEX "D")

Annex "D" Form 1 ……. Authority of Signatory (Secretary's Certificate)

AUTHORITY OF SIGNATORY

(SECRETARY'S CERTIFICATE)

I,, a duly elected and qualified Corporate Secretary of (Name of the Bidder), a corporation duly organized and existing under and by virtue of the law of the, DO HEREBY CERTIFY, that:

I am familiar with the facts herein certified and duly authorized to certify the same;

At the regular meeting of the Board of Directors of the said Corporation duly convened and held on at which meeting a quorum was present and acting throughout, the following resolutions were approve, and the same have been annulled, revoked and amended in any way whatever and are in full force and effect on the date hereof:

RESOLVED, that*(Name of Bidder)*be, as it hereby is, authorized to participate in the bidding of*(Name of the Project)*by the*(Name of the Procuring Entity)*; and in that if awarded the project shall enter into a contract with the*(Name of the Procuring Entity)*and in connection therewith hereby appoints*(Name of Representative)*, acting as duly authorized and designated representatives of*(Name of the Bidder)*, and granted full power and authority to do, execute and perform any and all acts necessary and/or to represent*(Name of the Bidder)*in the bidding as fully and effectively as the*(Name of the Bidder)*might do if personally present with full power of substitution and revocation and hereby satisfying and confirming all that my said representative shall lawfully do or cause to be done by virtue hereof;

RESOLVED FERTHER THAT, the Board hereby authorized its President to:

a. execute a waiver of jurisdiction whereby the *(Name of the Bidder)* hereby submits itself to the jurisdiction of the Philippine government and hereby waives its right to question the jurisdiction of the Philippine court;
b. execute a waiver that the *(Name of the Bidder)* shall not seek and obtain writ of injunctions or prohibition or restraining order against the CAAP or any other agency in connection with this Project to prevent and restrain the bidding procedures related thereto, the negotiating and award of a contract to a successful bidder, and the carrying out of the awarded project.

WITNESS the signature of the undersigned as such officer of the said_this.

_

(Corporate Secretary)

SUBSCRIBED AND SWORN to before me thisday of, 20affiant exhibited to me his/her Community Tax Certificate No. _____ issued on_____ _____at, Philippines.

Notary Public

Until 31 December 20_____

PRT No.: _____

Issued at: _____

Issued on: _____

TIN No.: _____

Doc. No. _____

Page No.: _____

Book No.: _____

Series of _____

Section X. Checklist of Technical and Financial Documents

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

☐ (d) Tax clearance per E.O. No. 398, s. 2005, as finally reviewed and approved by the Bureau of Internal Revenue (BIR); **and**

Technical Documents

☐ (e) 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. *(Annex "A" Form 1)*; **and**

☐ (f) Statement of the bidder's Single Largest Completed Contract (SLCC) similar to the contract to be bid, except under conditions provided under the rules. *(Annex "A" Form 2)*; **and**

☐ (g) 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 Joint Resolution *(Annex "A" Form 3)*; **and**

☐ (h) 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 *(Annex "B" Form 2)*;
and

☐ (i) Project Requirements, which shall include the following:
1. Organizational chart for the contract to be bid *(Annex "B" Form 3)*; **and**

☐ 2. 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 *(Annex "B" Form 4, 5a, 5b & 5c)*; **and**

☐ 3. 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 *(Annex "B" Form 6)*; **and**

☐ (j) Original duly signed Omnibus Sworn Statement (OSS) *(Annex "B" Form 7)*; **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; **and**

This shall include all of the following documents as attachment to the Omnibus Sworn Statement:

☐ 1. Certification, under oath, attesting that they have no pending case(s) against the Government, in addition to the eligibility requirements as prescribe under the 2016 Revise Implementing Rules and Regulation (R-IRR) of RA No. 9184; **and**

☐ 2. Legal Clearance to be issued by the CAAP Enforcement and Legal Service with respect to the non-pending cases of the prospective bidders against this Authority; **and**

☐ 3. Bid Bulletins (if applicable); **and**

☐ (k) **Certificate of Site Inspection** *(Annex "B" Form 1)* duly signed by **Mr. Norman Nuñez, Officer-in-charge of Catbalogan Airport** or his duly authorized representative; **and**

This shall include all of the following documents as attachment to the Certificate of Site Inspection:

☐ 1. Copy of company ID of the person who conducted the site inspection; **and**

☐ 2. Copy of the airport/facility visitor's logbook; **and**

☐ 3. Picture of the proposed site including the personnel who conducted the site inspection together with the Airport Manager/Officer in Charge or his duly authorized representative: **and**

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 *(Annex "C" Form 1)*; **and**

☐ (q) Summary of Bid Proposal *(Annex "C" Form 2)*; **and**

☐ (r) Bill of Materials & Cost Estimates *(Annex "C" Form 3)*; **and**

☐ (s) Summary Sheet indicating the Unit Prices of Construction Materials, Labor Rates, and Equipment Rentals used in coming up with the Bid *(Annex "C" Form 4, 5 & 6)*; **and**

☐ (t) Cash Flow by Quarter and Payment Schedule *(Annex "C" Form 7)*.


Republic of the Philippines
gppb
Government Procurement Policy Board