SUBIC BAY
METROPOLITAN AUTHORITY

SPECIFICATIONS

FOR THE

REHABILITATION OF SEAPORT FACILITIES: RE-INSTALLATION OF CONCRETE BLOCKS OF DAMAGED REVETMENT (SLOPE PROTECTION) AT LEYTE WHARF

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GENERAL

1. Equivalency of Standards and Codes

Whenever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition, or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national or relate to a particular country or region, other authoritative standards that ensure a substantially equal or higher quality than the standards and codes specified, will be accepted subject to the Engineer's prior review and written consent. Differences between the standards specified and the proposed alternative standards shall be fully described in writing by the Contractor and submitted to the Owner's Representative at least 28 days prior to the date when the Contractor desires to use them for the Owner's Representative consent. In the event the Owner's Representative determines that such proposed deviations do not ensure substantially equal or higher quality, the Contractor shall comply with the standards specified in the documents.

2. The Standard Specifications

The Standard Specifications applicable to this Contract shall be the Republic of the Philippines, Department of Public Works and Highways (DPWH) "Standard Specifications" for Highways, Bridges and Airports (Volume II) 2013 or latest edition and orders of the department. "Item" herein refers to the item number with the Standard Specifications.

3. Special Specifications

To supplement the Standard Specifications, reference should be made to the attached Special Specifications for the special item of works and the Environmental Special Specifications.

For pay items with Lump Sum unit of measurement, having itemized quantities of deliverables specified in the technical specification, note that the said itemized quantities will be accounted per actual quantities and deficits (only) shall be deducted accordingly to the periodic Statement of Work Accomplishment.

The Implementing Unit may withhold advance and/or progress payments due to non-delivery of any item listed under Lump sum and Set units as detailed and specified herein, Special Specifications.

4. Other Generally Accepted Principles and Practices in Civil Engineering

The generally accepted principles and practices in Civil Engineering are hereby adopted in so far as they do not run-in conflict with established specifications.

DEFINITION OF TERMS

Whenever the following terms are used in these specifications, the intent and meaning shall be interpreted as follows:

AASHTO
The American Association of State Highway and Transportation Officials, the successor association to AASHTO.

ASTM
The American Society for Testing and Materials

BS
British Standard Institution.

BRS
Bureau of Research and Standard

DOST
Department of Science & Technology

DTI
Department of Trade & Industry

CONTRACT

The written agreement covering the works to be performed. The Contract shall include, but is not limited to: The Contract Agreement, the Conditions of Contract, the Contract Specifications, drawings, plans and other legal requirements as may be required.

CONTRACTOR
The party or parties on whose behalf the Bid was submitted including its or their respective permitted assignees and where the Contractor comprises more than one party and the context so requires, each and every such party.

PROJECT SITE
The project site refers to the whole road network including related structures within the Subic Bay Freeport Zone

ENGINEER/PROJECT-IN-CHARGE FOR SBMA
Any person, firm or company appointed by the owner, Subic Bay Metropolitan Authority (SBMA) to perform the duties set out in the Conditions of Contract.

LABORATORY
The official testing laboratories of the Contractor as required.

MATERIALS
Any substance specified or required for use in the construction of the Contract work.

NIC
Not included in the Contract.

PLANS
The official drawings or exact reproductions which show the location, character, dimensions and details of works to be done.

WORK
The furnishing of all labor, materials, tools, equipment and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the Contract.

SPECIFICATIONS
The meaning as identified on the Contract conditions and requirements.

For additional Definition of Terms and interpretations, please refer to clauses applicable in the Conditions of Contract.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO SDDP-1-OL	(2003) Shop Detail Drawing Presentation Guidelines

ASTM INTERNATIONAL (ASTM)

ASTM C31/C31M	(2019a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2020) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C192/C192M	(2019) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air Entraining Admixtures for Concrete
ASTM C267	(2001; R 2012) Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes
ASTM C309	(2011) Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

ASTM C469/C469M	(2014) Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C531	(2018) Standard Test Method for Linear Shrinkage And Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, and Monolithic Surfacings, and Polymer Concretes
ASTM C579	(2018) Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C580	(2018) Standard Test Method for Flexural Strength And Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C617/C617M	(2015) Standard Practice for Capping Cylindrical Concrete Specimens
ASTM C666/C666M	(2015) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C685/C685M	(2017) Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C881/C881M	(2020) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C882/C882M	(2020) Bond Strength of Epoxy-Resin Systems Used With Concrete by Slant Shear
ASTM C884/C884M	(2016) Standard Test Method for Thermal Compatibility between Concrete and Epoxy-Resin Overlay
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1581/C1581M	(2018) Standard Test Method for Determining Age at Cracking and Induced Tensile Stress Characteristics Of Mortar and Concrete under Restrained Shrinkage
ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used In Production of Hydraulic Cement Concrete
ASTM C42/C42M	(2020) Standard Test Method for Obtaining and Testing Driller Cores and Sawed Beams of Concrete

ASTM C140/C140M	(2020) Standard Test Method for Sampling and Testing Concrete Masonry Units and Related Units
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving And Structural Construction (Non extruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D5023	(2015) Standard Test Method for Plastics: Dynamic Mechanical Properties: In Flexure (Three-Point Bending)

PART B: OTHER GENERAL REQUIREMENTS

DIVISION I: OTHER GENERAL REQUIREMENTS

PART 1: GENERAL SCOPE

The items under this Section include the following scope of works:

B.5 Project Billboard/Signboard
B.7(2)a Occupational Safety and Health Program (PPE & Safety Personnel)
B.7(2)b Occupational Safety and Health Program (Warning Signs)
B.8(2) Traffic Management
B.9 Mobilization/Demobilization
B.14 Environmental Management and Monitoring (Provision of Two (2) Unit Portable Toilet)
B.20(1) Temporary Fence

PART 2: PROJECT REQUIREMENTS

2.1 Project Details:

B.5 Project Billboard/Signboard

B.5.1 Material Requirements:

1. Sign Panel

   The panel for the project informational signboard shall be the standard 8 ft. x 8 ft. white tarpaulin suitably framed. The design and format of the tarpaulin, as shown in the drawings, shall have the following specifications:

Resolution	:	70 dpi
Font	:	Helvetica
Font Size	:	Main Information – 3”
	:	Sub-Information – 1”
Font Color	:	Black

2. Posts and Frames

   The post and frames shall be hard wood of the specie indicated on the drawings.

3. Hardware

   All hardware shall be of the kind and size specified on the drawings or as approved by the Project-in-Charge for SBMA.

B.5.2 Construction Requirements:

1. Location

   The project information signs shall be installed at the area designated by the Project-in-Charge for SBMA.

2. Excavation and Backfilling

   Holes shall be excavated to the required depths of the bottom of the posts as shown on the drawings.
3. Erection of Posts

   The posts shall be erected vertically in position at the locations identified by the Project-in Charge for SBMA.
4. Installation of Sign Panel

   The sign panel shall be erected in accordance with the details shown on the drawings. Any chipping or bending of the sign panel shall be considered as sufficient cause to require replacement of the panel at the expense of the Contractor.

B.7(2)a Personal Protective Equipment (PPE) and Safety Personnel

The Contractor shall provide the required PPE for all its workers needing such equipment. All other persons entering the construction site must wear the necessary PPE. The following PPE required for the project is listed below:

1. Personal Protective Equipment (PPE)

a.	Safety Helmet	30	Each
b.	Safety Shoes.....	30	Pairs
c.	Safety Gloves	30	Pairs
d.	Safety Vest	30	Each

2. Safety and Health Officer/Personnel

a.	Part-time Safety Practitioner	80	Man-hours
b.	Full-time Certified First Aider/Reg. Nurse	960	Man-hours

B.7(2)b Warning Signs

a.	Safety First (4' x 4')	4	Set
b.	Warning Signs (3' x 2')	4	Set
c.	Caution Tape	1	Roll

B.8(2) Traffic Management

The minimum required units of construction safety signs and device necessary for the duration of the project are as follows:

a.	Road Work Ahead (Road Sign).....	4	Set
b.	Temporary Hazard Marker (Road Sign/Barrier).....	4	Set
c.	Barrier (Road Barrier).....	4	Set
d.	Slow Down (Road Sign).....	4	Set
e.	Traffic Cones.....	20	Each

Upon the completion of the Project, all construction safety signs and device shall be turnover to SBMA.

B.9 Mobilization/Demobilization

The minimum equipment requirements are the following:

MINIMUM EQUIPMENT REQUIREMENT			
Item No.	Equipment Description	Capacity	No. of Units
1	Crawler Crane	25 tons	1
2	Silent Piler Machine		1
3	One Bagger Mixer	4.0 - 6.0 cu. ft/min	1
4	Concrete Vibrator, Flexible Shaft Type 2" Head Ø Gasoline Driven Unit	5 amperes	1
5	Bar Cutter	25mm Ø	1
6	Bar Bender	25mm Ø	1
7	Welding Machine	500 amps	1
8	Cutting Outfit		1

B.14 Environmental Management and Monitoring (Provision of Two (2) Unit Portable Toilet)

This Item shall consist of provision of at least two (2) unit portable toilet on rental basis including cleaning and disposal services and all other incidentals necessary to complete the work in accordance with this Specification or as directed by the Engineer.

The Contractor must ensure that portable toilets are to be compliant with all applicable codes, regulations, and industry standards, including proper disposal.

The Contractor and service provider agreement shall be in satisfaction to the Architect/Engineer in Charge in accordance with the Environmental Management Program required for the duration of the project.

B.20(1) Temporary Fence

Temporary Perimeter Fence with Main Gate and Emergency Gate ..... 1 Lump Sum
Sheet, 0.50mm thick x 1.22m x 2.00m High, Ribbed Type
Studs, LC, 50mm x 150mm x 0.80mm x 6.00m

NOTES:

i. The above items and/or quantities shall be the minimum requirement. If the project will require, the Contractor shall provide additional items/quantities as necessary with no additional cost to the Procuring Entity but will be considered as a subsidiary obligation of the Contractor under other Contract Items.
ii. The Contractor shall provide proof of purchase of all items listed above.
iii. Also, the Contractor shall provide and submit records (i.e., DTR) that will show it conforms to the minimum safety and health officer/personnel requirement.
iv. The Contractor shall remove the fence and all temporary structures and "turnover" all salvageable materials including the safety signages to SBMA-PPMD. The project site shall be cleared and graded or as required by the SBMA Architect/Engineer In-Charge.

2.2 Materials and Construction Requirements

Shall conform to the applicable requirements in the latest DPWH STANDARD SPECIFICATIONS FOR PUBLIC WORKS STRUCTURES, Volume III – 2019 and/or respective Manufacturer's Specifications and Standards.

See the following Items for reference:

- B.5 – PROJECT BILLBOARD / SIGNBOARD
- B.7 – OCCUPATIONAL SAFETY AND HEALTH
- B.8 – TRAFFIC MANAGEMENT
- B.9 – MOBILIZATION / DEMOBILIZATION
- B.14 – ENVIRONMENTAL MANAGEMENT PLAN
- B.20 – TEMPORARY FENCE

PART 3: PAYMENT SCHEDULE

Payment shall be made under:

Pay Item No.	Description	Unit of Measurement
B.5	Project Billboard/Signboard	Each
B.7(2)a	Occupational Safety and Health Program (PPE & Safety Personnel)	Lump Sum
B.7(2)b	Occupational Safety and Health Program (Warning Signs)	Lump Sum
B.8(2)	Traffic Management	Lump Sum
B.9	Mobilization/Demobilization	Lump Sum
B.14	Environmental Management and Monitoring (Provision of Two (2) Units Portable Toilet)	Month
B.20(1)	Temporary Fence	Lump Sum

DIVISION II: OTHER INSTRUCTIONS TO CONTRACTOR

1. Photographs and Contract Documentation

Provide necessary documents as stipulated in the contract and as required by the Project-in-Charge for SBMA including photographs taken at the jobsite at the specified stages of the contracted work or as again directed by the Project-in-Charge for SBMA.

At all instances requiring progress photograph presentation, the following guidelines must be maintained:

- Size: 5R
- Type: Smooth surface, glossy print, single weight paper with white base mounted on muslin or on double weight glossy paper.
- Photographs and prints must be of professional quality; clear, in focus, with high resolution and sharpness, and with minimum distortion.

- Photographs must be of the same view position of the works to show continuous progress of the works until the works are completed or as directed by the Project-in-Charge for SBMA.
- Photographer should identify each photograph location or by such other means as acceptable to the Project-in-Charge for SBMA, to enable future photographs to be taken from the same location and position.

Progress photographs shall not be measured and paid but shall be considered part of necessary documents to be provided as stipulated in the contract and as required by the Project-in-Charge for SBMA.

2. Water and Electrical Charges

A. Scope of Work

SBMA shall provide assistance for necessary coordination for the provision of water and electrical supply for project related activities by the Contractor during the duration of the contract.

Necessary temporary connections/extensions, etc. (labor and materials) shall be provided by the Contractor upon prior identification by the Project-in-Charge for SBMA of the source/tapping point for water and electrical supply to be used for the project, subject to the concurrence of the service provider concerned. The Contractor shall dismantle all temporary connections/extensions, etc., and restore to original state the sources of the utility supplies upon project completion, except when:

1. Such sources were tapped without the prior identification by the SBMA Project-In-Charge and concurrence of the service provider concerned; and
2. Unnecessary damages were caused which are beyond repair or restoration.

In both situations above, the Contractor shall be solely liable for payment of damages in favor of the Service Provider concerned.

In case no source/tapping point can be found within the site, the Project-in-Charge for SBMA and the Contractor shall agree with any means that will satisfy the needs for water and electrical supply for the duration of the project.

Note that all expenses incurred, tapping, consumption and restoration, for this item shall be shouldered by the Contractor.

3. Material Testing and Documentation

A. Scope of Work

Material Testing

Seven (7) days upon receipt of the Notice to Proceed (NTP), The Contractor or his duly authorized materials engineer together with the Materials Engineer of SBMA shall jointly undertake sampling and testing of all material requirements of the Contract for the purposes of this project. The Materials Engineer of SBMA must see to it that extra samples be set aside in his/her office for future reference purposes. ***It shall be the responsibility of the Contractor's Materials Engineer to ensure the integrity of the materials for testing.***

All tests shall be normally carried out on the site, except that certain special tests may, subject to the approval of the Materials Engineer for SBMA, be carried out at an independent testing laboratory duly approved and accredited by the Department of Public Works and Highways (DPWH). The Contractor shall, if so approved, make all necessary arrangements for the supply and delivery of samples to, and collection of samples from such independent Laboratory. Unless otherwise specified, the Contractor shall arrange for one (1) copy of the independent testing laboratory test certificate to be delivered to the Materials Engineer for SBMA not less than three (3) days before the materials covered by the relevant test certificate are incorporated in the Works, and test certificates shall be relatable to the materials from which the sample was taken.

Accredited Testing Laboratory

Testing of materials shall be carried out, conducted or be performed at testing laboratory accredited by the Bureau of Research and Standard (BRS) of the Department of Public Works and Highways (DPWH) and Department of Science and Technology (DOST).

Minimum Testing Requirements (MTR)

The Minimum Testing Requirements (MTR) is prepared to specify the type and frequency of tests to be undertaken for materials and products contained in the DPWH Standard Specifications as enforced through the latest DPWH Department Order (D.O. No. 49 Series 2021) governing minimum testing requirements of item of work. The implementation of the MTR shall strengthen the Quality Control of the Contractors and the Quality Assurance Program of the Department

The MTR is issued together with the list of Quality Tests **(Annex A)** and list of Standard Test Methods **(Annex B)**. Refer to the latest **DPWH Schedule of Minimum Testing Requirements** *Governing Items of Work of the DPWH Standard Specifications for Public Works Structures (Buildings, Ports and Harbors, Flood Control and Drainage Structures and Water Supply Systems), Volume III, 2019 Edition*. In Annex A, the required Quality Tests in the MTR are specified per material. On the other hand, Standard Test Methods and reference Standard Specifications such as the American Society for Testing and Materials (ASTM), American Association of State Highway and Transportation Officials (AASHTO), International Organization for Standardization (ISO), and Philippine National Standards (PNS) are enumerated in Annex B. The listed reference standards' designation/code comprises its year/edition in which the values, specification or requirements are being used or referred from. Nevertheless, some standards will follow the latest year/edition when the Annexes are being prepared.

For easy reference purposes, materials in the MTR are presented per Item of Work. Composite materials are broken down into its basic components whenever separate/individual testing is applicable or required. Some materials are also repeatedly presented per Item where it is used for quick reference.
In as much as new and improved testing methods and specifications are constantly being developed, it is contemplated that MTR will be revised from time to time.

Further, existing issuances relative to Quality Control and Quality Assurance shall continue to be enforced.

Guidelines for the Implementation of MTR

1. Quality Tests

Quality Tests includes the chemical and/or physical tests required to be conducted on a material or product in accordance with the DPWH Standard Specifications. Quality tests are listed down in Annex A - Quality Tests on Construction Materials, with its corresponding Standard Test Method shown in Annex B – Reference Standards.

All quality tests are required to be satisfied. Tests shall be done based on the Frequency specified in the MTR. Where, the number of times the required tests must be done relative to the quantity specified in the MTR per size, type, layer, batch, lot, shipment or source.

For cases where not all the required tests in quality test list can be performed, the Original Mill Certificate (OMC) will serve as supplemental document.

2. Original Mill Certificate (OMC)

OMC is a quality assurance document generated by the raw material manufacturer and provided with the material to intermediate suppliers and ultimately to a finished goods manufacturer. It certifies the materials' compliance with the standard specification such as ASTM, AASHTO, PNS, ACI, etc.

The OMC per batch production must be supplied by the Supplier/Contractor. For cases where original product Authentication Certificate (Red Ribbon) is not possible to obtain, supplier may opt to provide an Authentication Certificate issued by the Department of Foreign Affairs (DFA). For multiple copies of such document, a Certified True Copy will also be accepted.

OMC is a supplemental document for materials where not all of its required tests can be satisfied or performed, such as those pertaining to third-party testing of elevators or lifts (see succeeding page).

3. Other Than Test

These are additional requirements that must be submitted/produced/accomplished by the Contractor as part of its Quality Control measure such as Welding Report, Inspection Report of Casting, Geotechnical Investigation Report, or Concrete Monitoring Record. The attached standard format for these documents should be strictly complied.

Elevator Performance and Acceptance Test Inclusion

In addition to the minimum testing requirements on materials, a third-party testing of the elevator shall be done by an accredited company or firm specializing on such testing. On this regard, the testing shall cover, among others, the complete examination of the structural, mechanical, electrical, and safety systems, including all lifting accessories that will ensure the functional integrity of the elevator. The accredited testing company or firm shall likewise independently witness the equipment performance tests in accordance with the prevailing standards on elevators or lifts.

4. Engineer's Certificate (EC)

EC is part of DPWH's Quality Assurance and shall be issued provided that the specifications of the material/product satisfied/passed the requirements stipulated in the DPWH Standard Specifications.
It is also an additional requirement if the implementing office of SBMA or the third party has no capability to perform such test. The EC shall be prepared by the SBMA Materials Engineer or Consultant's Materials Engineer in a standard format approved by the implementing office of SBMA. When signed "as received" by the SBMA Project Engineer or Consultant's Resident Engineer and SBMA Materials Engineer or Consultant's Quality Assurance Engineer, EC is a QA/QC record.
If in doubt, the Procuring Entity, or its authorized representative from the implementing office/ department, may have the option to conduct tests prior to issuance of the EC.

Definition of Terms

Test Required – Mandatory tests to be done on the materials prior to its incorporation/use in the implementation of Item of Work.

Contractor's Quality Control (QC) – All those activities such as materials handling and construction procedures, calibration and maintenance of equipment, production process control, and all sampling, testing, and inspection undertaken by the Contractor.

SBMA Quality Assurance – All Quality Assurance inspections, sampling and testing undertaken for and on behalf of the implementing office of SBMA by the Project Engineer whenever necessary.

Frequency – The number of times the required tests must be done relative to the quantity specified in the MTR per size, type, layer, batch, lot, shipment or source.

Lot size – The lot size as stated in the MTR refers to the quantity of an item ordered for delivery on a specific date or manufactured in a single production run.

Shipment – This refers to an amount of a particular product/material that is sent to another country on a ship, train, airplane, or other vehicle.

Welding Report – It is an additional document required when welding works are conducted. The report shall be in accordance with the guidelines of the American Welding Society (AWS) and certified by an accredited welder.

Inspection Report of Casting – An evaluation report on activities during concrete casting to be checked by the SBMA Project Engineer or Project Inspector.

Concrete Monitoring Record – This document consists of pouring permit and report on concreting works per pouring day of a structure.

Geotechnical Investigation Report – It is a report that presents site-specific geotechnical data and consists of three major components (Background Information, Scope of Work and Data Presentation).

SCHEDULE OF MINIMUM TEST REQUIREMENTS (MTR)

Refer to the latest "Schedule of Minimum Testing Requirements" Governing Items of Work of the DPWH Standard Specifications for Public Works Structures (Building, Ports and Harbors, Floor Control and Drainage Structures and Water Supply Systems) Volume III, 2019 Edition, for the detailed list of Quality Test (Annex A) and list of Standard Test Methods (Annex B).

All Quality/Material Testing requirements shall not be measured and paid separately but shall be considered integral with the other pay items of the contract.

4. Construction As-stake & As-built Plans

Within seven (7) calendar days upon receipt of Notice to Proceed (NTP), the Contractor shall initiate joint as- stake survey with the Project-in-Charge for SBMA to make certain the work scope and quantities as originally proposed for the contract. All survey personnel including traffic personnel (if required) must have or wear necessary protective equipment, safety gears, tools, and gadgets to perform the work safely and efficiently.

The Contractor shall provide and maintain equipment necessary for this purpose.

During and after each phase of work, joint surveys shall be done which will serve as basis to every interim payment certificate being submitted by the contractor.

The Contractor is responsible for the production of the plans, and presentation of the survey data as designed and approved by the Project-in-Charge for SBMA.

As the work progresses, the Project-in-Charge for SBMA may instruct additional site inspection that may or may not be included in the project and which the Contractor must be willing to comply.

As-built plans will be based on the compiled summary of all the individual surveys for all of the completed work items.

As-Built Drawings

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. Such prints shall show changes or actual installation conditions in the project in comparison with the original drawings.

Upon request by the SBMA Project Engineer, the Contractor shall likewise submit the corresponding e-file copies free of charge.

The Item shall not be measured and paid separately but shall be considered integral with the other pay items of the contract.

Permits and Clearances

The Contractor is responsible for the application and securing of all permits necessary to complete the works at no cost to SBMA.

PART C: CIVIL WORKS

801 REMOVAL OF ACTUAL STRUCTURE AND OBSTRUCTION

Refer to Item 801, Part C of Volume III (Blue Book)

801.1 Description

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

801.2 Construction Requirements

801.2.1 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 Non-perishable material maybe disposed of 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 surroundingground and, if within the prism of construction, shall be compacted to the required density.

801.2.2 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 damage. Steel members shall be match marked unless such match marking is waived by the Engineer. All salvaged material shall be stored as specified inSubsection 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.

801.2.3 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.

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

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

801.2.4.1 Broken into pieces and used for riprap on the project, or

801.2.4.2 Broken into pieces, the size of which shall not exceed 300 mm (12 inches) inany dimension and stockpiled at designated locations on the project for use by the Government, or

801.2.4.3 Otherwise demolished and disposed of 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 of as directed.

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

801.3 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 inthe 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.

801.4 Basis of Payment

The accepted quantities, measured as prescribed in Section 801.3, shall be paid for at the Contract unit price or lump sum price bid for each of the Pay Items listed below that is included in the Bill of Quantities which price and payment shall be full compensation for removing and disposing of obstructions, including materials, labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item. The price shall also include backfilling, salvage of materials removed, their custody, preservation, storage on the right-of-way and disposal as provided herein.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
801	Removal of Structures and Obstruction	Lump Sum

900(1)c3 CONCRETE (CONCRETE CAPPING BEAM)

PART 1 – GENERAL

1.1 SCOPE OF WORK

The WORK includes furnishing all labor, materials, equipment and incidentals necessary for the construction of all concrete work.

1.2 SPECIFICATIONS AND STANDARDS

Except as otherwise indicated, the current editions of the following Standards apply to the WORK of this Section:

ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams
ASTM C94	Ready-mixed Concrete
ASTM C143	Slump of Hydraulic-Cement Concrete
ASTM C150	Portland Cement
ASTM C347	Recommended Practice for Concrete Formwork, US

	Corps of Engineers CRD C-572
ASTM C494	Chemical Admixtures for Concrete
ASTM C805	Rebound Number of Hardened Concrete

1.3 SUBMITTALS

A. Samples as required by the applicable Reference Standards and in accordance with Part 3 – EXECUTION of this Specification.

1.4 QUALITY ASSURANCE

The Contractor is responsible for the performance of all tests and inspection required by this Standard Specification. However, the owner reserves the right to perform any or all prescribed tests and inspection where such is deemed necessary to ensure that delivered materials conform to the specifications, and shall be paid for by the Contractor. The Contractor shall furnish the owner certified copies of records showing that each material has been pre-tested, and complied with all applicable requirements of this Standard. The Contractor shall, at his own expense, replace all rejected materials for failure to comply with this Specification.

PART 2 – PRODUCTS

2.1 MATERIALS

A.Cement: Cement shall be Portland Cement conforming to ASTM C150, Type I, as follows:

Table 1- Physical Requirements of Cement

Test	Requirement
Compressive Strength for ages indicated, min. 3 days 7 days	 12.0 MPa 19.0 MPa
Time Setting by Vicat Method Initial Set, minimum Final Set, maximum	 45 minutes 375 minutes
Fineness, by turbidimeter test, minimum	160 m^2/kg

B.Aggregates

1. Fine Aggregate: Fine aggregate shall be washed inert natural sand conforming to ASTM C33, and shall range in size from coarse to fine within the following limits of US Standard sieve sizes:

Table 2- Grading Requirements for Fine Aggregates

Sieve Designation	Per Cent (%) Passing
9.5 mm (3/8)	100
4.75 mm (No. 4)	95-100
2.36 mm (No. 8)	80-100
1.18 mm (No. 16)	50-85
0.60 mm (No. 30)	25-60
0.300 mm (No. 50)	5-30
0.150 mm (No. 100)	0-10
0.075 mm (No. 200)	0-3

2. Coarse Aggregate: Coarse aggregate shall be well graded crushed stone or washed gravel conforming to ASTM C33, size No. 67 as follows:

Table 3 – Grading Requirements for Coarse Aggregates

Sieve Designation	Weight Per Cent Passing
25 mm (1”)	100
19.0 mm (3/4)	90-100
9.5 mm (3/8)	20-55
4.75 mm (No. 4)	0-10
2.36 mm (No. 8)	0-5
0.075 mm (No. 200)	0-1

3. 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.

4. Admixtures
   - Admixtures conforming to ASTM C494 may be used upon approval of the Engineer in writing, to control the time setting, to effect water reduction and to increase workability. Proportioning and mixing shall be as recommended by the manufacturer.

- The admixture may be a hydroxylated carboxylic acid type or a hydroxylated polymer type, but shall contain no calcium chloride. The use of an admixture shall not change the required quantities of cement specified under Table 4 of this Section.

- The total air entrained measured at the discharge from the truck shall be 3.0 per cent maximum for finished slabs and 3.5 to 5.0 per cent for all other concrete.

2.2 QUALITY OF CONCRETE

A. Before placing any concrete, the Contractor shall discuss with the Engineer the source of materials and concrete he proposes to use. Samples of aggregate and cement shall be furnished to the Engineer for testing.

B. The Contractor shall submit to the Engineer, his proposed design mix for evaluation.

C. Compressive strength, water-cement ratio and cement factor specified in Table 4 shall apply for regular and pumped concrete.

Table 4 – Concrete Quality Requirements

Test	Requirements	
	Concrete Fill	All Structural Concrete
Minimum Compressive Strength at 28 days (Mpa)	17.0	21.0 – 42.0
Maximum Net Water Content (liters/100kg cement)	62.0	53.0
Minimum Cement Content (kg/m³)	260	330
Total Air Content (%)	3.5 – 5.0	3.5 – 5.0
Concrete Temp., Max. (°C)	32	32

D. Consistency of the concrete as measured in accordance with ASTM C143 shall be as shown in Table 5.

No excessively wet concrete will be permitted. Concrete delivered to the site having a slump more than that specified herein will be rejected.

Table 5 – Concrete Consistency

Type of Structure	Slump (mm)	
	Recommended	Range
Pavement and Slabs on Ground	50	25-75

Plain footings, gravity walls, slabs and beams	50-75	25-100
Heavy reinforced foundation walls and footings	75-100	50-125
Thin reinforced walls and columns	100	75-125

PART 3 - EXECUTION

3.1 MIXING CONCRETE

A. Ready-mixed or transit-mixed concrete shall conform to ASTM C94. The concrete supplier shall furnish to the Engineer for his approval, the dry proportions to be used, with evidence that these will produce concrete of the quality specified.

B. Ready-mixed or transit-mixed concrete shall be transported to the site in watertight agitator or mixer trucks. Discharge at the site shall be within one (1) hour after the cement was first introduced into the mix. Retempering (i.e., mixing with or without additional cement, aggregate or water) of the concrete which has partially hardened, will not be permitted.

3.2 PLACING OF CONCRETE

A. All debris, dirt and water shall be removed from the forms. Forms, reinforcement steel, pipes, conduits, sleeves, anchors and other embedded items shall be inspected and approved by the Engineer before placing any concrete. The Contractor shall advise the Engineer of his readiness to proceed at least 12 hours before each placement of concrete.

B. The surfaces of previously placed concrete, such as vertical or horizontal construction joints, shall be roughened, cleaned of foreign matter and laitance, and saturated with water.

Immediately before the new concrete is placed, all hardened surfaces shall receive a thorough coating of neat cement grout at least 5 mm thick which shall be well scrubbed in by means of stiff bristle brushes. The new concrete then shall be placed before the grout sets up.

Concrete shall be uniformly placed during the process of depositing until the completion of the layer to maintain an approximately horizontal plastic surface. The rate of placing concrete in forms shall not exceed 0.60 meter of vertical rise per hour. The spreading of mounds of concrete with vibrator or by shoveling will not be permitted.

Cold joints shall be avoided by ensuring that placement of the new concrete is done 1.5 hours after placement of the first.

C. Concrete shall not be placed in water or stay submerged within 24 hours after placing, except for curing nor shall running water be permitted to flow over concrete surfaces within four days after the placing of concrete.

D. Chutes for conveying concrete shall be of U-shaped metal and provided with a baffle plate at the end. Chutes shall be placed at an angle of not less than 25 degrees, nor more than 45 degrees from horizontal and shall be kept clean and free from hardened concrete. Maximum length of chute to be traveled by plastic concrete shall not be more than 1.50 meters.

E. In thin walls or columns of considerable height, the concrete shall be placed in such a manner as to prevent segregation and accumulation of hardened concrete on the forms or the reinforcement steel located above the concrete mass. Free fall of concrete shall not be permitted to exceed 1.50 meters below the ends of hoppers, chutes, ducts, tremies, or "windows" in wall forms, without approval of the Engineer.

F. Where waterstop type construction joints are provided, the concrete shall be properly worked by rodding and vibrating around the waterstops to produce watertight joints, before any concrete is poured on the upper surfaces, particularly in the case of horizontal waterstops in slabs.

Waterstops shall be accurately positioned and securely held in place, and shall be protected at all times to prevent damage or displacement. Any damage to, or displacement of waterstops shall be corrected by the Contractor to the satisfaction of the Engineer.

3.3 TAMPING AND VIBRATING

A. During and immediately after placing the concrete, compaction shall be carried out by experienced operators using high-speed internal mechanical vibrators. Care shall be taken to ensure that vibration is continued long enough to produce optimum consolidation without segregation of the aggregates or migration of air.

B. At least one vibrator shall be used for every eight cubic meters of concrete placed per hour. One spare vibrator in operating condition shall be available on the site.

C. Vibrators shall be supplemented with proper wooden spade, puddling adjacent to forms and rodding around embedded fixtures, to remove trapped air bubbles and to prevent honeycombing.

3.4 CURING AND PROTECTION

A. All concrete work shall be properly cured. Details of the Contractor's curing procedures and curing compounds intended to be used shall be subject to the approval of the Engineer.

B. All exposed surfaces including finished surfaces shall be treated immediately after concrete has been poured, to provide continuous moist curing for at least 7 days. Walls and vertical surfaces may be covered with continuously saturated burlap or kept moist by other approved means. Horizontal surfaces, slabs, etc. shall be ponded to a depth of 15mm or kept continuously wet by means of sprinklers or other approved methods.

C. Formed surfaces shall be thoroughly soaked with water at least twice each day until the forms are removed. Curing shall continue as specified above.

D. Where finishing of concrete surfaces is performed before the end of the curing period, the concrete shall not be permitted to dry out and shall be kept continuously damp by means of a fog of water from the time the concrete has been placed until the end of the curing period.

E. The Contractor shall protect all concrete work against injury from the elements and defacements of any nature during construction operations.

3.5 REMOVAL OF FORMS

A. The Contractor shall not remove any forms for at least 48 hours or until the concrete has attained a strength of at least 30 per cent of the ultimate 28-day strength. This is equivalent to approximately 50-day-degrees of moist curing. Day degree represents the total number of days times the average daily air temperature in °C at the surface of the concrete, e.g. 2 days at an average temperature of 25°C equals 50 day-degrees.

B. Forms for beams and slabs shall not be stripped for at least 150-day degrees and supports shall not be removed until the concrete has attained at least 60% of the specified 28-day strength and is capable of safely supporting its own weight. Construction live loads shall not be placed upon it until the concrete has attained its specified 28-day strength.

C. Removal of forms shall be in accordance with ACI – 347. Forms shall be stripped such that they will not damage the concrete. No forms shall be removed until the concrete has gained sufficient strength to support itself. The Contractor is responsible for the safety of all structures.

3.6 REPAIR OF DEFECTIVE CONCRETE

A. Defective or honeycombed areas, as determined by the Engineer, shall be chipped down to at least 25mm deep into sound concrete by means of chisels or chipping hammers. If honeycombs exist around reinforcement steel a clear space, at least 10mm wide shall be chipped all around the steel.

B. For areas less than 40mm deep, the patch may be made as in filling form-tie holes.

C. Thicker repairs will require build-up in successive 40mm deep layers on successive days, and each layer shall be applied with neat cement pastes.

D. For very deep patches, a non-shrink aggregate, with or without the addition of pea gravel, may be the used subject to the approval of the Engineer.

E. The materials shall be mixed as recommended by the manufacturer of the non-shrink aggregate or as directed by the Engineer.

Where a metallic non-shrink aggregate is utilized, the final 15mm of the patch shall be composed of 1 to 1-1/2 cement / sand mortar without the non-shrink aggregate to prevent rust staining of the surface. After hardening, the patch shall be rubbed as for filling form-tie voids, in accordance with Section 33010, Rubbed Finish.

F. All exposed concrete surfaces and adjoining work stained by spilling or leakage of concrete shall be cleaned to the satisfaction of the Engineer.

3.7 INSPECTION

Installation of reinforcing steel, pipes, sleeves, anchors and other embedded items, batching, mixing, transportation, placing, curing and finishing of concrete shall at all times be subject to the inspection of the Engineer. No concrete shall be placed without the prior approval of the Engineer.

3.8 FIELD CONTROL

A. Sets of six (6) cylinder specimens shall be taken at random by the Contractor in the presence of the Engineer in accordance with ASTM C31. One (1) set per 50 cubic meters of concrete, or fraction thereof, poured during the day shall be made for the compressive strength test. At least one set of samples for strength test shall be made for each class of concrete.

B. Two (2) cylinders shall be tested after 7 days and two cylinders after 28 days. Should the average strength of the 28-day test specimens be less than the specified value, a verification test shall be conducted on the remaining two (2) cylinder samples, after 28 to 45 days. Compressive tests shall be in accordance with ASTM C39 and shall be performed by a laboratory engaged by the Owner. Testing fees shall be paid by the Contractor.
C. The Contractor shall assist, cooperate and provide the concrete for the test cylinders and such auxiliary personnel and equipment needed to take the test specimens.

D. Ready-mixed concrete shall be sampled and tested in accordance with the following methods.

Table 9 – Sampling and Test Methods for Ready-Mixed Concrete

Sampling/Test Method	Applicable ASTM Standard
Compressive Test Specimens	C31
Compression Tests	C39
Yield, Unit Weight	C138
Air Content	C138/C173/C231
Slump	C143
Sampling Fresh Concrete	C172
Temperature	C1064

3.9 FIELD TESTING

A. Should the average strength of the verification test specimens be less than the specified value, the Engineer may take further core samples from the portion of the structure which was determined by the Engineer to represent the deficient 28-day/verification test specimens.

B. If the strength of any core samples is less than the minimum requirements shown in Table 4, the Contractor shall strengthen or replace the portions of the structure concerned at no additional cost and to the satisfaction of the Engineer.

C. The Contractor shall also deduct from payments otherwise due to him, the actual cost to the Owner for taking all core samples extracted from that portion of the Work.

D. Slump tests, temperature and entrained air measurements shall be made when specimens for strength tests are taken and during placement of concrete, as often as necessary for control checks. If measured slump or air content falls outside the specified limits, a check test shall be made immediately on another portion of the same composite sample. In the event of a second failure, the concrete shall be considered to have failed the requirements of the specification and the whole batch shall be rejected.

3.10 BASIS OF ACCEPTANCE / REJECTION

Final acceptance of all concrete will be based on satisfactory results of compressive strength tests.

Strength tests representing each class of concrete must meet the following two requirements:

- The average of the compressive strength tests shall be equal to or greater than the specified strength.
- No individual strength test shall be more than 15% below the specified strength.

Except as provided below, acceptance criteria will be as outlined in ASTM C94 and ACI 318. Concrete which achieves the required compressive strength will be accepted as satisfactory for payment provided placement, finish and tolerance meet the specified requirements.

Concrete with average strength deficient by not more than fifteen per cent (15%) of the required strength may be accepted, subject to cost reduction given in the following schedule:

Per Cent (%) Deficiency In Average Strength	Per Cent (%) of Unit Price Reduction
Less than 3	0
0 to less than 5	15
5 to less than 10	30
10 to 15	40
more than 15	100

Concrete represented by test results wherein the average strength indicated a deficiency of not more than fifteen percent (15%) but with an individual test deficient by more than fifteen percent (15%) will not be eligible for payment but may be accepted or ordered replaced at the discretion of the Engineer.

Concrete represented by compressive strength tests that fail to achieve the required strength as specified, shall be liable to rejection and subsequent removal and replacement.

However, if any strength tests falls below the specified value by more than 15%, or an individual test is deficient by more than 15%, and load carrying capacity has been significantly reduced, tests of cores drilled from the area in question may be required in accordance with ASTM C42, wherein L/D ratio is not less than 1.25 prior to capping. In such cases, three (3) cores shall be taken for each strength test more than 15% below the required value.

If concrete in the structure will be dry under service conditions, cores shall be air dried for 7 days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 40 hours and be tested wet.

Concrete in an area represented by core tests shall be considered structurally adequate if the average of three (3) cores is equal to at least 85% of the specified strength, and if no single core is less than 75% of the minimum requirement. Additional testing of cores extracted from locations represented by erratic core strength results shall be permitted.

Acceptance and subsequent payment of concrete in question shall be based on the results of such tests, provided the complete operation has been supervised by the Engineer.

Rebound hammer test (ASTM C805) may be carried out by the Contractor prior to drilling core samples from structure in question, but the results of such rebound tests shall not be used as basis for acceptance or rejection of the concrete.

Method of Measurement and Basis of Payment

The accepted quantities, measured as prescribed, shall be paid for based on the contract unit price for each of the particular pay items that are listed in the Bill of Quantities. The payment shall constitute full compensation including all labor, tools and incidentals necessary to complete the works prescribed in this section.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
900(1)c3	Concrete (Concrete capping beam)	Cubic Meter

902(1)a REINFORCEMENT (CONCRETE CAPPING BEAM)

PART 1 – GENERAL

1.1 SCOPE OF WORK

The WORK includes fabrication and installation of all steel bars and steel tie wire, clips, supports, chairs, and spacers required for the reinforcement of concrete as shown on the Drawings.

1.2 SPECIFICATIONS AND STANDARDS

Except as otherwise indicated, the current editions of the following Standards apply to the WORK of this Section:

ASTM A82	Steel Wire, Plain, for Concrete Reinforcement
ASTM A615/A615M ASTM A706/A706M	Deformed and Plain Billet – Steel Bars for Concrete Reinforcement
PNS 49	Philippine National Standard – Steel Bars for Concrete Reinforcement

1.3 SUBMITTALS

B. Detailed working drawings and bending schedules of all reinforcement.

C. Samples and test certificates as required by the applicable Reference Standards.

1.4 QUALITY ASSURANCE

The Contractor is responsible for the performance of all tests and inspection required by this Standard Specification. However, the owner reserves the right to perform any or all prescribed tests and inspection where such is deemed necessary to ensure that delivered materials conform to the specifications, and shall be paid for by the Contractor. The Contractor shall furnish the owner certified copies of records showing that each material has been pre-tested, and complied with all applicable requirements of this Standard. The Contractor shall, at his own expense, replace all rejected materials for failure to comply with this Specification.

PART 2 – PRODUCTS

2.1 MATERIALS

Reinforcement steel shall be deformed, new billet steel bars conforming to ASTM A615, Grade 60 and 40, substantially free from mill scale, rust dirt, grease or other foreign matter.

Chemical Composition: The percentages of carbon, manganese, phosphorus, sulfur and silicon on finished bars shall conform to the specified values in PNS 49 as shown in Table 2.

Rail –steel bars will not be permitted in the Work.

Table 2 – Chemical Requirements

Element	Chemical Composition, Per Cent Maximum	
	Hot-Rolled Non-Weldable Deformed Steel Bar	Hot-Rolled Weldable Deformed or Plain Steel Bar
Carbon	-	0.38
Manganese	-	1.26

Phosphorus	0.0625	0.058
Sulfur	0.0625	0.058
Silicon	-	-

Reinforcement steel shall bear a mill identification symbol, shall be tagged with the size and mark number so that different types may be identified, and shall be stored off the ground to protect the steel from moisture and dirt until placed in final position.

Steel wire for tying reinforcing bars and waterstops shall conform to ASTM A82.

The following reinforcing steel bar sizes shall be used for all reinforced concrete design under this Contract.

Bar Designation	Approximate Cross Sectional Area (mm^2)	Approximate Unit Weight (kg/m)
#10	78	0.616
#12	113	0.888
#16	201	1.579
#20	314	2.466
#25	492	3.854
#28	615	4.833
#32	804	6.313
#36	1018	7.991

Should the Contractor wish to use reinforcing steel bars having areas different from those shown (with consequent different designations), the following requirements shall apply:

- If the proposed substitute bar has an area from 97% to 105% of the designated bar, a direct substitution may be made without changes to bar spacing.

- If the proposed substitute bar has an area less than 97% of the designated bar, substitution may be allowed provided bar spacing is reduced to not more than the minimum clear distance between bars.

- If the proposed substitute bar has an area more than 105% of the designated bar, changes in spacing is limited to a maximum spacing of 300mm. All proposed changes shall be submitted to the Engineer for approval.

- Changes shall be implemented upon approval by the Engineer of the reinforcing arrangement Drawings, required as shop drawings, which shall be finalized upon issuance by the Engineer of the guidelines on related criteria, as maximum and minimum spacing and bond strength.

- Approval by the Engineer of bar size substitutions does not relieve the Contractor of other specified requirements, including steel grade and bar deformations.

PART 3 - EXECUTION

3.1 FABRICATION OF REINFORCEMENT

Reinforcement steel shall be accurately fabricated to the dimensions shown on the shop drawings and bar schedules.

All reinforcing bars shall be bent cold around a pin with a free revolving collar having a diameter of the bar of not less than the following:

- Four times for stirrups
- Six times for bars up to and including 25mm diameter
- Eight times for bars over 25mm diameter
- Ten times for bars 43mm and 57mm diameter

Reinforcement steel shall not be straightened nor rebent. Bars with kinks or bends not shown on the Drawings will not be accepted.

3.2 INSTALLATION OF REINFORCEMENT

All reinforcing bars shall be accurately placed as shown on the Drawings, and in accordance with the shop drawings and bar schedules. The reinforcing bars shall be secured against displacement with annealed iron wire ties of minimum GA#16 GI Wire (i.e. 1.39mm diameter) or suitable clips at the intersections.

Except as otherwise indicated on the Drawings reinforcement steel shall be installed with a clearance for concrete cover as follows:

▪ Concrete placed directly on earth	75 mm
▪ Formed surfaces in contact with the soil, water or exposed to the weather	75 mm
▪ Concrete cover of main reinforcement steel for columns and beams	40 mm
▪ Walls not in contact with the soil, water or exposed to the weather ▪ Top of slabs exposed to weather for Ø16 and smaller	40 m

▪ Underside of slabs over water surface, but not in contact with the water ▪ Top of slabs exposed to weather for Ø20mm and above	50 mm
▪ All other slab surfaces	20 mm

No reinforcing bars shall be welded.

All reinforcing bars in slabs shall be supported on concrete cubes or chairs of the correct height, containing soft steel wires embedded therein for fastening to the reinforcement steel. Such spacers or chairs shall have a minimum compressive strength of 24 MPa.

Reinforcing bars for vertical surfaces in beams, columns and walls shall be properly and firmly positioned from the forms by means of stainless steel (tipped) bolsters or other equal methods approved by the Engineer.

Reinforcement steel projecting from structures that are to be concreted or where concrete has already been poured shall not be bent out of its correct position.

Method of Measurement and Basis of Payment

The accepted quantities, measured as prescribed, shall be paid for based on the contract unit price for each of the particular pay items that are listed in the Bill of Quantities. The payment shall constitute full compensation including all labor, tools and incidentals necessary to complete the works prescribed in this section.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
902(1)a	Reinforcement (Concrete capping beam)	Kilogram

903(2) FORMWORKS (CONCRETE CAPPING BEAM)

Description

Forms shall be made of either steel or new lumber approved by the Engineer and shall be free from roughness and imperfections, substantially watertight, adequately braced and tied to prevent movement when concrete is placed and vibrated. No wooden spreaders will be allowed in the concrete. Forms shall be thoroughly cleaned before using and shall be treated with non-staining oil or other approved material and allowed to dry before placement of the reinforcing steel.

Form ties in concrete exposed to view shall be the cone-washer type. Through bolts or common wire shall not be used for form ties.

Molding or bevels shall be built into the forms to produce a 20-mm chamfer on all exposed projecting corners.

Forms for walls shall have removable panels at the bottom for cleaning, inspection and scrubbing-in of bonding paste.

Method of Measurement and Basis of Payment

The accepted quantities, measured as prescribed, shall be paid for based on the contract unit price for each of the particular pay items that are listed in the Bill of Quantities. The payment shall constitute full compensation including all labor, tools and incidentals necessary to complete the works prescribed in this section.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
903(2)	Formworks (Concrete capping beam)	Square Meter

1300(6/12) STRUCTURAL STEEL SHEET PILES, FURNISHED AND DRIVEN

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D-5882-96 Low-Strain Dynamic Method

ASTM D4945-97 High-Strain Dynamic Method

ASTM A 328
(AASHTO M 202)
AASHTO M 223 Sheet Piles

1.2 SUBMITTALS

1.2.1 Test Piles
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. 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.

1.2.2 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.

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.

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.

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.

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.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 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.

2.1.2 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.

2.1.3 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.

PART 3 EXECUTION

3.1 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.

3.2 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.

3.3 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.

3.4 Splicing

Splicing when permitted shall be made as shown on the Plans and in accordance with this Subsection.

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.

3.5 Painting

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. This protection shall extend from the elevation shown on the Plans to the top of the exposed steel.

Method of Measurement and Basis of Payment

The accepted quantities, measured as prescribed, shall be paid for based on the contract unit price for each of the particular pay items that are listed in the Bill of Quantities. The payment shall constitute full compensation including all labor, tools and incidentals necessary to complete the works prescribed in this section.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
1300(6/12)	Structural Steel Sheet Piles, Furnished and Driven	Meter

SPL-1 Fabrication of Concrete Blocks

A. Description

This work item shall consist of constructing/installing Interlocking Precast Concrete Blocks for paving and for the protection of coastal areas and riverbeds, in conformity with the lines, grades, and dimensions shown in the plans and specifications.

The works will involve incidental excavation/trimming and embankment build-up; slope stabilization and installation of appropriate Interlocking Precase Concrete Blocks for protection of coastal areas and riverbeds.

B. Material Requirements

Articulated Concrete Blocks

Articulated concrete blocks shall conform to the requirements of ASTM D6684, Standard Specification for Materials and Manufacture of Articulated Concrete Block (ACB) Revetment Systems.

Minimum Compressive Strength, MPa		Maximum Water Absorption, kg/m^3		Maximum Density (in air), kg/m^3	
Average of 3 units	Individual unit	Average of 3 units	Individual unit	Average of 3 units	Individual unit
28	24	146	187	2082	2002

Width, height, and length of articulated concrete blocks shall not differ by more than +/-3.2mm from the specified standard dimension.

Interlocking articulated concrete blocks for coastal and riverbank protection shall be open-cell type having a void rate of approximately 15% to 17% to allow re-vegetation.

The articulated concrete blocks, considering proper installation and well compacted subgrade, shall maintain hydraulic stability of approximately 6.10 m/s under high velocity of flow, with corresponding bed shear stresses of 1.44 kN/m^2 to 1.92 kN/m^2.

Aggregate Base Material

Aggregate base materials shall conform to the applicable requirements of Item 703, Aggregates.

Bedding Sand

Bedding sand shall be clean, washed natural, or manufactured sand which conforms to ASTM C33M, Standard Specification for Concrete Aggregates.

Joint Sand

Joint sand shall conform to ASTM C144, Standard Specification for Aggregate for Masonry Mortar.

Geotextile

Geotextile shall conform to the applicable requirements of Item 715, Geotextiles.

Revetment Cable

Cable shall be made of high tenacity and low elongated wires that exhibit good to excellent resistance to most concentrated acids, alkalis, and solvents. It shall be impervious to rot, mildew, and degradation associated with marine organisms with high resistance to deterioration for long period of fresh/saltwater immersion.

Anchors

Anchors shall be provided to fix blocks on the slope. These are usually reinforced concrete, one (1) meter in length, inserted through its centrally disposed holes at certain interval. GI pipe filled with concrete, reinforced by steel bars may be used as alternative. Installation shall be in accordance with the specifications shown on the Plan.

Method of Measurement and Basis of Payment

The accepted quantities, measured as prescribed, shall be paid for based on the contract unit price for each of the particular pay items that are listed in the Bill of Quantities. The payment shall constitute full compensation including all labor, tools and incidentals necessary to complete the works prescribed in this section.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
SPL-1	Fabrication of Concrete Blocks	Pieces

SPL-2 Installation of Concrete Blocks

A. Installation

The subgrade shall be well-compacted; and free of voids, pits, and depressions. Obstructions such as roots and projecting stones larger than 2.5 cm left visible on the surface, shall be removed. Soft or low density pockets of material removed shall be filled with granular fill, ¾" gravel and compacted up to the desired minimum proctor density.

The base foundation shall be designed considering actual site conditions and slope stability analysis is considered. Base footing shall be made of interlocking block layers, assembled horizontally on the seabed from the toe of the embankment extended down to a specified length towards the river centerline, interconnected using revetment cable. The shall proceed after graded foundation bed is fully covered with geotextile.

The foundation bed shall also be prepared by providing excavation at the base of the slope and thereby, the initial layer of assembled blocks shall be positioned 1-meter below the seabed. The excavated area shall follow the designed embankment H:V ratio from the baseline up to the desired excavation depth. Upon preliminary block installation, excavated trench shall be backfilled with soil and compacted to a minimum required compaction ratio.
Areas where geotextile and interlocking articulated concrete blocks are to be placed shall be laid parallel to the lines and grades as specified in the Plans. Prior to articulated concrete block installation, geotextile shall be placed and anchored on a smooth graded surface approved by the Engineer. The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch of tear the geotextile. Coverage area for the geotextile shall be equal to the computed slope area subject for block installation.

Interlocking articulated concrete blocks shall be placed within the limits as described on the Plans. The blocks shall be well-fastened to prevent vertical or horizontal displacement. No more than 61 linear meter of geotextile shall be laid before covered with interlocking blocks. Geotextile installed more than two (2) days not covered by blocks shall be lifted and the surface of the slope shall be inspected for slope defects.

The interlocking articulated concrete blocks shall be installed in the field by the use of revetment cables. These cables shall be extended up to a required length. Anchors shall be provided to fix blocks on the slope. these are usually installed at 2-meter interval upon placing the blocks with cable. Anchor depth may vary depending on the computed length as required from the conducted slope stability analysis.

B. Sampling and Testing

Sampling and Testing for Interlocking Concrete Blocks shall conform to ASTM C140M, Sampling and Testing Concrete Masonry Units and Related Units.

C. Delivery, Storage, and handling

Materials delivered to the site shall be inspected for damage, unloaded and stored atleast through proper handling. The Contractor shall designate storage site ready for use before the materials are delivered. Avoid leaving the delivered materials placed unattended on the ground where probable contact and/or exposure to dirt and debris may occur. Materials shall be so handled with utmost care to ensure undamaged condition upon delivery.

C. Delivery, Storage, and handling

Materials delivered to the site shall be inspected for damage, unloaded and stored atleast through proper handling. The Contractor shall designate storage site ready for use before the materials are delivered. Avoid leaving the delivered materials placed unattended on the ground where probable contact and/or exposure to dirt and debris may occur. Materials shall be so handled with utmost care to ensure undamaged condition upon delivery.

Method of Measurement and Basis of Payment

The accepted quantities, measured as prescribed, shall be paid for based on the contract unit price for each of the particular pay items that are listed in the Bill of Quantities. The payment shall constitute full compensation including all labor, tools and incidentals necessary to complete the works prescribed in this section.

Payment will be made under:

Pay Item No.	Description	Unit of Measurement
SPL-2	Installation of Concrete Blocks	Square meter

ANNEX A
CONSTRUCTION METHODOLOGY

1.1 SCOPE

This Part specifies the step by step procedure and execution of works.

1.2 PREPARATION OF SITE

(a) Construct temporary fence within the vicinity of the construction site.

(b) Removal of concrete blocks along the proposed sheet piles alignment.

(c) Free the underlying surface from ruts or protrusions. Remove unwanted materials such as grubs and unnecessary vegetation. Scrape off loose and unwanted soil.

1.3 PILE DRIVING

(a) Allocate ample space for pile driving equipment and stockpile of all necessary materials required in the pile driving works.

(b) Removal of concrete blocks along the proposed sheet piles alignment.

(c) Set out points along the proposed sheet pile alignment 1 meter away fromthe edge of the top of the revetment or as specified in the drawings.

(d) The sheet pile is a U-section and will be installed by means of a Silent Piler Machine.

(e) All sheet piles are 12 meters in length, welding shall be used to join the sheet piles if a longer length is required.

(f) The sheet pile shall be installed between two

(g) guides of I–beam and a short temporary sheet pile location as a guide to install the sheet pile.

(h) A silent piler machine will push the sheet pile to the desired depth.

(i) All sheet piles shall be driven to practical refusal. Practical refusal is defined as 20 blows per 25m with the hammer operating at the highest setting or setting determined by the Engineer and less than 6mm reboundper blow. Sheet pile driving shall stop as soon as the Engineer determines

that the sheet pile has reached practical refusal.

(j) The top of the sheet piling shall be driven or cut-off to a straight line using an oxy-acetylene at the elevation indicated on the plans.

(k) Construct concrete pile cap beam on top of the sheet pile as shown in the drawings.

(l) On completion of the works, all temporary structures and machinery areto be removed. The revetment shall be restored to its previous condition and level.

1.4 CONSTRUCTION OF CAPPING BEAM

a) Allocate ample space for concreting materials, tools, and equipment and stockpile of all necessary materials required in the capping beam construction.

b) Set out points along the proposed capping beam alignment as specified in the drawings.

c) The top of the capping beam shall be as indicated on the plans.

1.5 EXTRACTION OF EXISTING MATERIALS

a) Allocate ample space adjacent to the revetment as stationing for the lift crane. Properly anchor lift crane and ensure that area is free from obstruction as the extracting and placing of rocks takes place.

b) Extract Concrete Blocks and misaligned concrete stoppers/buttresses from the revetment by means of a lift crane.

c) Store the concrete blocks on a temporary staging area within the vicinity before disposing or transferring to another storage facility as instructed by the Owner.

1.6 SUBGRADE PREPARATION AND REGRADATION

a) Subgrade shall be excavated to proper lines and grades based on constructionplans..

b) Any over-excavated areas should be filled with granular fill, ¾" gravel, and any depressions should be filled so that there are no depressions that exceed 15 cm in depth.

c) The subgrade shall be fairly smooth and free of sharp objects and debris that maydamage the geotextile.

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d) The soils should be proof rolled prior to geotextile and backfill placement.

e) The soils should be compacted to 95 percent of the relative density.

f) For each layer of the slope, repeat these preparation steps before laying the geotextile.

1.7 GEOTEXTILE INSTALLATION

a) Before unrolling the geotextile, verify the roll for size, damage, and installation orientation according to construction plans

b) Geotextile should be placed in correct orientation as shown on the construction plans and approved by the Engineer. The Contractor should verify the orientation. The orientation of the geotextile should be such that it is rolled in the direction of the slope – not perpendicular to it.

c) The geotextile should be cut to length based on construction plans using an Engineer approved cutting tool.

d) Each sheet of geotextile should be pulled taut by hand to get rid of any wrinkles.

e) The minimum overlap of adjacent sheets shall be 900mm.

f) On the installation of geotextle under water, immediately place a layer of rock on the geotextile to ballast it.

1.8 CONCRETE BLOCKS RESTORATION WORKS

a) Underlayer of granular fill, ¾" gravel, shall be spread and compacted to the required grade.Slope shall confirm to what is shown on the drawings.

b) The placing of blocks shall commence at the lower end first (sea side) and proceed inwards towards the upper end (land side).

c) It is very critical that the blpcks shall be lowered into place and not dropped as doing so can possibly puncture the underlying geotextile.

d) On completion of the works, all temporary structures and machineries are to be removed. The revetment shall be restored to its previous condition and level.

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