

**SUB SURFACE SOIL EXPLORATION FOR THE CONSTRUCTION OF SLOPE PROTECTION
ALONG PANDAY RIVER, PATEROS, METRO MANILA**

SUMMARY OF PROGRAM OF WORKS

DIRECT COSTS		
A. MOBILIZATION/DEMOBILIZATION	Php	60,000.00
B. GEOTECHNICAL INVESTIGATION	Php	1,227,600.00
C. LABORATORY SAMPLING AND TESTING	Php	127,080.00
D. GEOTECHNICAL REPORT AND MISCELLANEOUS EXPENSES	Php	66,600.00
TOTAL DIRECT COST	Php	1,481,280.00

INDIRECT COSTS		
VALUE ADDED TAX (5% OF TOTAL DIRECT COST)	Php	74,064.00
TOTAL ESTIMATED COST	Php	1,555,344.00

Prepared By:


WILSON KRISTOFFER D. RICARTE
Engineer II

Submitted By:


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Engineer III

Recommending Approval:


LAMBERTO C. DE LEON
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Approved By:


ARISTOTLE B. RAMOS
District Engineer



Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
METRO MANILA 1ST DISTRICT ENGINEERING OFFICE
2555 Westbank Road, Manggahan Floodway, Rosario, Pasig City



SUB SURFACE SOIL EXPLORATION FOR THE CONSTRUCTION OF SLOPE PROTECTION ALONG PANDAY RIVER, PATEROS, METRO MANILA

ITEMIZED PROGRAM OF WORKS

A. MOBILIZATION/DEMOBILIZATION

Item	Unit	Quantity	Unit Cost	Direct Cost	5% VAT	TOTAL
A.1 Mobilization/Demobilization	Location	6	Php 10,000.00	Php 60,000.00	3,000.00	Php 63,000.00
TOTAL OF PART A.				Php 60,000.00		Php 63,000.00

B. GEOTECHNICAL INVESTIGATION

Item	Unit	Quantity	Unit Cost	Direct Cost	5% VAT	TOTAL
B.1 Geotechnical Investigation (2 Boreholes, 30 meter depth)						
Drilling thru soil using Diamond Bit	l.m.	60	Php 3,300.00	Php 198,000.00		
Hole to Hole Transfer and Set-up	Borehole	2	Php 3,300.00	Php 6,600.00		
Sub-Total for Item B.1	Location	6	Php 204,600.00	Php 1,227,600.00	61,380.00	Php 1,288,980.00
TOTAL OF PART B.				Php 1,227,600.00		Php 1,288,980.00

C. LABORATORY SAMPLING AND TESTING

Item	Unit	Quantity	Unit Cost	Direct Cost	5% VAT	TOTAL
C.1 Standard Penetration Test						
(1 Sample every 1.5 m depth)	Samples	180	Php 100.00	Php 18,000.00	900.00	Php 18,900.00
C.2 Provision for Core Boxes						
(2 Core Boxes per Borehole)	Box	24	Php 1,600.00	Php 38,400.00	1,920.00	Php 40,320.00
C.4 Soil Grading	Samples	57	Php 350.00	Php 19,950.00	997.50	Php 20,947.50
C.5 Liquid Limit and Plastic Limit	Samples	57	Php 500.00	Php 28,500.00	1,425.00	Php 29,925.00
C.6 Moisture Content Test	Samples	57	Php 110.00	Php 6,270.00	313.50	Php 6,583.50
C.7 Specific Gravity Test	Samples	57	Php 280.00	Php 15,960.00	798.00	Php 16,758.00
TOTAL OF PART C.				Php 127,080.00		Php 133,434.00

D. GEOTECHNICAL REPORT AND MISCELLANEOUS EXPENSES

Item	Unit	Quantity	Unit Cost	Direct Cost	5% VAT	TOTAL
D.1 Geotechnical Report (2 Hard Copies and 1 Soft Copy stored in CD), 1 set of Geotechnical Report per location	set	6	Php 7,900.00	Php 47,400.00	2,370.00	Php 49,770.00
D.2 Diesel Oil for Drilling Machine, per day (15 m depth per day)	day	24	Php 800.00	Php 19,200.00	960.00	Php 20,160.00
TOTAL OF PART D.				Php 66,600.00		Php 69,930.00
TOTAL OF PART A, B, C AND D				Php 1,481,280.00		Php 1,555,344.00

Prepared By:


WILSON KRISTOFFER D. RICARTE
Engineer II

Submitted By:

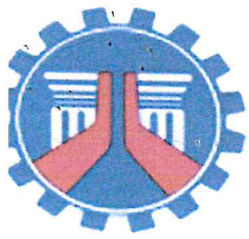

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BAGONG PILIPINAS

TERMS OF REFERENCE (TOR)

SUB SURFACE SOIL EXPLORATION FOR THE CONSTRUCTION OF SLOPE PROTECTION ALONG PANDAY RIVER, PATEROS, METRO MANILA

TERMS OF REFERENCE

SUB SURFACE SOIL EXPLORATION FOR THE CONSTRUCTION OF SLOPE PROTECTION ALONG PANDAY RIVER, PATEROS, METRO MANILA

I. INTRODUCTION

A. BACKGROUND

The Department of Public Works and Highways is implementing various construction of infrastructures for CY 2024. In line with this, a geotechnical investigation is required to provide important data necessary in the design of foundation for the mentioned construction of various infrastructures in basis with the department's quality policy to provide quality and safe infrastructure for the improvement of the lives of every Filipino.

The DPWH Geotechnical Investigation which includes field and laboratory testing is use to determine the surface and subsurface condition. This process is essential to gather samples necessary for the detailing of the structure. This is to allow Department to further enhance the design of its future projects.

B. OBJECTIVES

1. To explore the sub-surface conditions of the area to provide general data relating to the project.
2. To give an outline of the surface and subsoil geology.
3. To analyze the data obtained and give engineering consideration and recommendation on the selection and design of foundation.
4. To prepare the detailed geotechnical and geological investigation of the chosen site for the preparation of the foundation design.
5. To be able to provide a detailed sub-soil technical report.

C. PROJECT SCOPE

The proposed projects are the subject of subsurface soil exploration work including Geotechnical Report.

Name of Project	Number of Bore Holes	Depth in Linear Meters
Sub-Surface Soil Exploration for the Construction of Slope Protection along Panday River, (Phase 5), Pateros	2.00	30.00
Sub-Surface Soil Exploration for the Construction of Slope Protection along Panday River, (Phase 6), Pateros	2.00	30.00
Sub-Surface Soil Exploration for the Construction of Slope Protection along Panday River, (Phase 7), Pateros, Metro Manila	2.00	30.00
Sub-Surface Soil Exploration for the Construction of Slope Protection along Panday River, (Phase 8), Pateros, Metro Manila	2.00	30.00
Sub-Surface Soil Exploration for the Construction of Slope Protection along Panday River, (Phase 9), Pateros	2.00	30.00

Sub-Surface Soil Exploration for the Construction of Slope Protection along Panday River, (Phase 10), Pateros		2.00	30.00
TOTAL		12.00	360.00

II. SCOPE OF SERVICES

A. GENERAL

1. The Consultant shall be responsible for carrying out the necessary subsurface Soil exploration works in respect to the project stated.
2. After the receipt of Notice to Proceed (NTP), the consultant shall coordinate with Metro Manila 1st District Engineering Office, particularly on the site of the project.
3. Upon completion of the subsurface exploration work activities, the Consultant shall submit their geotechnical report to Metro Manila 1st District Engineering Office.
4. The Consultant shall be responsible for the reliability of the report presented.

B. THE SERVICES

Subsurface Soil Exploration Works

B.1 LOCATION

Before the conduct of Subsurface Soil Exploration Works, The Consultant shall coordinate with the Metro Manila 1st District Engineering Office, for proper coordination on the location of the project.

B.2 SCOPE OF PROJECT

The consultant shall provide all the labor, instrument/equipment materials and supplies, vehicles, bunkhouses, etc., necessary to perform satisfactorily the subsurface exploration herein required:

- a. Drilling and sampling
- b. In-situ Tests
- c. Laboratory Analyses
- d. Groundwater/Water Table Elevation
- e. Preparation and submission of Reports

The Consultant shall be held solely responsible for the result of this boring/drilling exploration and other activities under terms of Reference.

B.3 DETAILED EXPLORATION REQUIREMENTS / SPECIFICATIONS

Drilling and Sampling

Number and Depth of Borings

Refer to the Project Scope above for the Location, Number and Depth of Borings. It may be necessary to extend borings beyond the required depths to better define the geologic setting at the project site, to determine the depth and engineering characteristics of soft underlying soil state, or to assure that sufficient information is obtained.

Exploratory Hole Drilling

Advancing exploratory holes in soils shall be a choice from various drilling methods such as auger, wash boring and percussion technique utilizing the standard split-spoon sampler. If hole deepening is impossible with the above procedures (N-Value > 50), diamond drilling method shall be employed. Hole shall be extended 3 meters below to ascertain whether the material intercepted is really rock formation or a suspended boulder.

Care shall be observed in moving the drilling rig from one site to another to prevent destroying plants. The drilling site shall be kept clean during and after drilling the holes. No oil and grease shall be disposed of the site. Only biodegradable drilling additives shall be used when diamond drilling method is employed, specifically for loose water condition. The use of diesel fuel as an additive for drilling fluid is strictly prohibited.

Sampling

Typically, the intervals selected are 1.5 meters or less in homogenous strata with test and sampling locations at every change of strata or as may be determined by recovered sample shall be placed in double plastic bags with the one containing the sample. The one containing the sample will be properly labeled with the following information: site location, borehole number, depth of the sample was taken and date of sampling. The samples shall be transported to the laboratory as soon as possible and shall be properly stored while waiting to be transported in such a way to prevent moisture loss.

Cohesive soil Sampling

Disturbed sample of Cohesive Soils shall be obtained from the standard split spoon sampler used in SPT and should be done at depth intervals of 1.5 m and every change of strata. Moreover, undisturbed samples shall be taken as boring progresses for soft soils (N-Value < 5) that may greatly influence foundation design. This shall be made by replacing the split-spoon sampler with specifically fabricated thin walled seamless steel tube (610 mm in length by 51 mm in diameter). After retrieval of the thin-wall sampler, the ends shall be immediately sealed with melted wax (candle).

Rock Sampling

Rock Core samples shall be retrieved from diamond drilling for rock identification, recognition of discontinuities, and laboratory testing. For best

core samples, the minimum bit size to be used shall be NX (56 mm diameter) or equivalent. In addition, the core barrel to be utilized shall be double or multiple tube.

Care shall be observed when removing core samples from the barrel to recover continuous and good samples. This is for better identification of discontinuities, which largely control rock stability.

Core samples shall be placed in core boxes arranged and labelled in accordance to depth as soon as these are extracted from the boreholes.

In-situ tests

The conventional **Standard Penetration Test (SPT)** shall be carried out in the proposed exploratory holes. This shall be performed to estimate density, strength and compressibility of soils. The conduct of test shall be in conformity with ASTM D1586, Standard Test Method for penetration and Split-Barrel Sampling of Soils. The test shall be performed by driving the split spoon sampler 450 mm into the soil at the bottom of particular drill run. The number of blows to drive at least 300 mm represents the N-Value. The sampler is driven to the ground using a 63.6 kg. (140 lbs.) Hammer falling freely at a height of 760 mm (30 inches). SPT shall be performed at 450 mm sampling depth every 1.5-meter interval in homogenous strata and every change of strata until the desired depth is attained.

Refusal of the split-spoon sampler is considered when:

- a. Fifty (50) blows are necessary to driver any 150 mm increment
- b. One Hundred (100) blows are obtained to drive the required 300 mm
- c. Ten (10) consecutive blows produce no advance

In such occasion when the sampler refuses to penetrate, core drilling shall be performed to advance the boring.

Laboratory Analyses

The laboratory tests shall be made in accordance with American Society for Testing and Materials (ASTM) designated standard for particular analysis. The test shall be performed are:

- a. Routine Soil Classification Tests
 1. Particle Size Analysis
 2. Liquid Limit
 3. Plastic Limit
 4. Natural Moisture Content
 5. Specific Gravity
 6. Organic Content of Impurities
- b. Permeability Test
- c. Unconfined Compressive Test
- d. Consolidation Test
- e. Direct Shear or Triaxial Compression Test

For Rock Samples, unconfined compressive test shall be made. Chemical and Physical Analyses for soil and groundwater shall include chloride sulfate and pH.

Groundwater/Water Table Elevation

Groundwater has significant effects on foundation design and construction. Hence, depth to water table must be established accurately. Determination of Groundwater elevation shall be made in all the proposed exploratory holes.

Water table elevation shall be observed and recorded in the borehole after at least 2 hours from its completion.

Measurement for each hole shall be carried out at least 1 day after completing the bore to ensure that the water level has stabilized. In clayey and silty soils, the measurement shall be made at least 3 days since permeability is low in these types of soil. While in the site, water level in the completed bores shall be monitored daily.

C. REPORT OUTPUTS/DELIVERABLES

Investigation Report

The Consultant shall prepare the **Geotechnical Investigation Report** containing geotechnical reports & analysis in **Two (2) hard bound copies** and **One (1) soft copy (CD)** in the form and substance to be submitted to Metro Manila 1st District Engineering Office. The report shall be signed and sealed by a geotechnical engineer and shall include the following.

- a. Letter of Submittal
- b. Table of Contents
- c. Project Location and Description
- d. Narrative Description of work done, method of investigation and recommendations, including exploratory hole location plan, boring sections
- e. Borehole location plan (shall include geographic coordinates per borehole/test pit location)
- f. Appendices containing Boring logs, laboratory test results and other relevant information.
- g. Geotagged photographs of each borehole location indicating the following data:
 - a. Geographic coordinates
 - b. Date
 - c. Time
- h. Objectives and Scope of Work
- i. Geology
 - a. Regional Geology
 - b. Geologic Map (Scale of 1:50,000 or more detailed)
 - c. Field Photographs of Geologic Mapping (showing outcrops, geologic structures)
- j. Seismicity
 - a. Active Fault Map (determine the 3 nearest active faults from the site, give emphasis on the nearest active fault)
 - b. Historical Records of Seismicity within the area (3 nearest earthquake source, give emphasis on the nearest earthquake source)
 - c. Length of Active Fault (based on PHIVOLCS Map)
 - d. Deterministic Seismic Hazard Approach (DSHA) using Fukushima and Tanaka Equation from Design Guidelines Criteria and Standards (DGCS) Volume 2A (Ground motion parameters: Peak Ground Acceleration

- (PGA), Seismic horizontal coefficient (K_h), Seismic vertical coefficient (K_v)
- k. Geomorphology, Topography, Climate and vegetation
 - l. Geologic Hazards
 - a. Volcanic Hazard Maps
 - b. Rainfall-induced landslide Map
 - c. Earthquake-induced landslide Map
 - d. Flood Hazard Maps and Discussion on Fluvial Hazards
 - e. Liquefaction Hazard Map
 - f. Tsunami, Seiches and Storm Surge Hazard Maps
 - g. Mining Tenement Maps (Locations of previous open pits, underground portals, etc.)
 - m. Discussion on Problematic Soils (if the site contains)
 - n. Field and Laboratory Tests
 - o. Results of Field Investigation and Laboratory Testing including recommendations (Global Stability for Slope Protection for slope protection projects)
 - p. Subsurface soil profile along existing structures (if any) showing boring logs
 - q. Photographs (Related to Geologic/Geotechnical Investigation such as, Project Location, Boring Operation/Sampling, Samples in Core Boxes, etc.)
 - r. References

III. IMPLEMENTATION

A. KEY EXPERTS' QUALIFICATION AND REQUIREMENTS

The following experts/professionals and their member shall be required to carry out the Consulting Services for the project and should have appropriate educational degree, relevant training and adequate years of experience in the conduct of sub-surface soil exploration.

Position/Key Staff	No. of Staff	Detailed Tasks/ Responsibilities	Required Qualifications
Geotechnical Engineer (Team Leader)	1	<ul style="list-style-type: none"> Overall guidance, direction, supervision and coordination of members of the Team Collection and evaluation of geological information on the project sites Perform necessary subsoil investigations on representative sections of the road with samples to be taken at suitable intervals Investigate the physical properties of materials to facilitate the design of structures 	<ul style="list-style-type: none"> BS in Civil Engineering; Masters or Doctoral degree in Geotechnical Engineering is an added advantage; Duly licensed/registered civil engineer; At least 5-year experience on soil, sub-surface and geotechnical survey and study of roads, bridges and related structures;
Laboratory Technician	1	<ul style="list-style-type: none"> Perform necessary Laboratory Tests from the gathered Soil from the site Study and determination of items and method of soil investigation and laboratory test 	<ul style="list-style-type: none"> BS in Civil Engineering Duly licensed/registered civil engineer At least 5-year experience on soil, sub-surface and geotechnical survey and study of roads, bridges and related structures

The Consultant shall provide technical and administrative support staff as may require.

B. CONTRACT PERIOD

The consultant's contract period for undertaking the soil investigation/exploration shall be **Forty-Five (45) calendar days** and the Consultant shall commence work after receipt of Notice to proceed.

C. ASSISTANCE TO BE PROVIDED BY THE CLIENT

The DPWH shall ensure that the Consultant has access to all relevant information necessary to the performance of the above services. The Consultant is expected to provide office space, equipment, permit applications and all other resources for completing the service.

Prepared by:



WILSON KRISTOFFER D. RICARTE

Engineer II

Approved by:



ELINO V. CASTRO

Chief, Planning and Design Section
BAC Chairperson