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Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
ZAMBOANGA DEL SUR 1st DISTRICT ENGINEERING OFFICE
Rizal Avenue, Balangasan District, Pagadian City, Region IX

BAGONG PILIPINAS

TERMS OF REFERENCE
FOR THE SUB-SURFACE EXPLORATION THRU CALYX DRILLING AND LABORATORY WORKS/ANALYSIS FOR CONSTRUCTION OF OWWA GYMNASIUM AND MULTIPURPOSE HALL, REGIONAL CENTER, BALINTAWAK, PAGADIAN CITY

I. INTRODUCTION

A. Abstract

Having the thrust of improving the life of every Filipino through quality infrastructures, the Department of Public Works and Highways (DPWH) is tasked to implement the construction of structurally sound and safe building projects across the country.

The DPWH Zamboanga del Sur 1st District Engineering Office has prepared these guidelines to assist the consultancy services in the planning, cost estimating and reporting of geotechnical investigation for a building project in accordance with the provision of COA Circular No. 94-013 in which OWWA and DPWH ZDS 1st DEO have mutually entered into a Memorandum of Agreement (MOA). This specific project will require the services of the Consultant that will conduct detailed geotechnical and geological surveys/investigation of building sites identified by this office listed hereunder;

Name of Project	Location	Depth(m)	No. Of Boreholes
1. Construction of OWWA Gymnasium and Multipurpose Hall, Regional Center, Balintawak, Pagadian City	Regional Center, Balintawak, Pagadian City, Zamboanga del Sur	15.00	3

B. Objectives

The objectives of this undertaking are:

1. To explore the characterization of the subsurface soil conditions of the area to provide general data relating to the project
2. To be able to evaluate general parameters necessary for analysis and design of needed structure.
3. To give an outline of the surface and subsoil geology
4. To analyse the data obtained and give engineering consideration and recommendation on the selection and design of foundation.
5. To prepare the detailed geotechnical and geological investigation of the proposed school building projects for the preparation of the foundation.
6. To be able to provide a detailed sub-soil technical report.

II. SCOPE OF CONSULTING SERVICES

A. General

1. The Consultant shall coordinate with the Planning and Design Section (PDS) during the conduct of geotechnical and geological surveys and investigations along the entire alignment of all the flood control projects.

2. The Consultant shall be responsible for carrying out the conduct of detailed geotechnical and geological investigations as stipulated in the DPWH Design Guidelines, Criteria and Standards, Volume 2C, 2015 Edition: Geological and Geotechnical Investigations and applicable provisions of existing laws, codes or Department Orders, to minimize changes or modifications in the design plans, substitutions of materials or methods and unnecessary delays in the preparation of final plans and estimates.

3. The Consultant shall identify areas with geological problems and difficulties, and water bearing stratum causing subsurface discharge, which could affect the stability of the flood control project.

4. In general, the Consultant shall conduct the following:

    4.1. Geological Survey and Investigation, consisting of, but not limited to the following:

        4.1.1. Collection of geological information such as aerial photographs, satellite imagery, relevant geological study reports, documents and maps for the project areas.

        4.1.2. Survey of the existing river basin along the project alignment specifically at slope disaster areas by conducting site ocular inspection to determine the water's highest flood elevation that may affect the structure's elevation.

        4.1.3. Identification of materials source areas for borrow, aggregate and other materials necessary for the construction of projects.

    4.2. Geotechnical investigation, consisting of, but not limited to the following:

        4.2.1. Detailed soil investigations shall be undertaken at building location with the purpose of identifying types of sub-grade soils. This should confined within the buildable area of the proposed structure only, it may extend to include side sections affected by site preparation

4.2.2. All pits and boreholes shall be properly logged and drawn in A1 size plans showing the thickness of each layer, the color, the type and visual description of each layer, depth below the surface, depth of water level (if encountered), etc. The following laboratory tests and analyses shall be made on the samples taken: Unit Weight, Specific Gravity, Natural Moisture Content, Soil Classification, Combined Sieve and Hydrometer, Atterberg Limits, Unconfined Compression Test, California Bearing Ratio (CBR). Classification of soils shall be made in accordance with AASHTO M145.

4.2.3. In-situ CBR tests should be carried out where overlays or rehabilitation is being proposed without reworking/re-compaction of any remaining soil layers including the sub-grade layer. On the other hand, proposal for appropriate modulus of resilience (Mr) testing plans complementing or replacing the CBR testing is preferable and would be an advantage.

4.2.4. Sources of construction materials shall be investigated and identified to determine the adequacy of suitable materials. Samples from identified sources shall be subjected to laboratory testing.

4.2.5. At each proposed construction materials source, two (2) test pits shall be made and sufficient samples shall be taken for laboratory testing.

5. The Consultant shall provide all the labor, instrument/equipment materials and supplies, vehicles, bunkhouses, etc., necessary to perform satisfactorily the sub-surface exploration.

6. The consultant must accomplish all obligated tasks without delay, keeping the Department of Public Works and Highways, Zamboanga del Sur 1st District Engineering Office advised of all progress in terms of survey preparation, execution and processing.

7. The Consultant shall be held solely responsible for the result of this boring/drilling exploration and other activities under this Terms of Reference (TOR).

B. DETAILED EXPLORATION REQUIREMENTS/SPECIFICATIONS

1. Site Inspection

The geotechnical site inspection is conducted to acquire first-hand knowledge of the soil and geologic condition of the project area as a basis for review of the

geotechnical investigation program and the data included in the geotechnical investigation report.

The site inspection is ideally conducted before or during the conduct of soil exploration of a project (road, bridge, slope protection and structure projects). It should contain among others the description of the site, observations, expected site geology and soil type, topography, vegetation, findings, comments and recommendations. The reason for any significant deviation from the geotechnical program must be addressed in writing to the head of the design office.

2. Borehole Spacing

The geotechnical investigation shall also include a geotechnical assessment of the site with at least two boreholes at the proposed location of the school building structure. For buildings of large area, a minimum of four borings should be conducted. Additional borings should be provided in areas of complex or variable subsurface conditions. This shall be made upon the instruction of the Geotechnical/Materials Engineer.

3. Borehole Location

Borings are to be conducted base on the footprint area of the building: when the area is less than or equal to 50 m^2, 1 boring is conducted; when the area is greater than 50 m^2 but less than or equal to 500 m^2, 2 borings are conducted; when the area is greater than 500 m^2 but less than or equal to 6000 m^2, 2 borings plus the area divided by 1000 are conducted; when the area is greater than 6000 m^2 , consulting Geotechnical/Materials Engineer can recommend fewer borings subject to review by Building Official but for a minimum of 8.

4. Borehole Depth

If foundation type has not been specified, boring shall be carried out to a minimum depth of 15 m in ordinary soil or to 3 m into sound rock if rock is encountered above the depth.

In case bearing layer is not encountered beyond 15 m, boring shall be continued until preferred layer is encountered and/or upon the instruction of the geotechnical/materials engineer.

5. Procedure

5.1. Deep drilling with Standard Penetration Test (SPT) shall be conducted at 7.30 meter from centerline of building footprint. Minimum depth shall be determined based on confirmation of hard strata or bed rock. Drilling can be stopped after three (3) meters minimum penetration into hard strata or bed rock.

5.2. The Consultant shall perform analysis and testing on disturbed and undisturbed soil samples. These analyses and testing shall be performed in accordance with AASHTO and ASTM standards.

5.3. The soil samples for foundation design shall be tested for the determination of the main characteristics (grain size distribution and classification, moisture content, atterberg limits, etc.)

5.4. Submit design recommendations, foundation condition scheme, bearing capacity and settlement, groundwater table, hydrological influences, excavation stability, seismic design consideration and liquefaction potential

5.5. Geological structure, especially active faults which might traverse the area, should be delineated and potential mass movement areas should be identified. Analysis for liquefaction potential during earthquake and consolidation due to soft ground should be included.

6. Handling and Core Samples

The Consultant shall provide all the materials, equipment and labor necessary for preserving samples.

C. LABORATORY TESTING

The preparation of samples for testing shall be made in accordance with AASHTO.

The following tests shall be made on samples obtained from boring and drilling.

1. Standard Penetration Test

SPT indicates that the blow count correlates with the variable density and/or consistency of the material being penetrated thus, probable shear strength and bearing capacity is determined. The result of this test shall be used only to describe granular soil density and clayey soil consistency. When sampling clays, this test can be used in the field in conjunction with the unconfined compression test.

The test shall be carried out through ordinary soil encountered to the depths specified above. Standard penetration test shall be performed using 5.00 cm (2.0 inch) outside diameter split spoon sampler, driven by a 63.60 kg (140 lbs) hammer falling 76.00 cm (30 inch) at 1.50 meter interval or closer if necessary.

2. Moisture-Density Rotation

This test method determines the relationship between the moisture content and the density of soils compacted in a mold. The contractor shall conduct this procedure according to ND T 99 or ND T 180.

3. Bearing Capacity Test

The test method covers estimation of the bearing capacity of soil in place by means of field loading tests. This test method can be used as part of a procedure for soil investigation for foundation design. It gives information on the soil only to a depth equal to about two diameters of the bearing plate, and takes into account only part of the effect of time.

4. Sieve Analysis

To determine the percentage of various grain sizes. The grain size distribution is used to determine the textural classification of soils (i.e., gravel, sand, silty clay, etc.) which in turn is useful in evaluating the engineering characteristics such as permeability, strength, swelling potential, and susceptibility to frost action.

Sieve analysis determines the gradation or distribution of aggregate particles within a given sample in order to determine compliance with design and production standards.

The contractor shall conduct this test in accordance with AASHTO T 27 and materials finer than No. 200 (75 µm) in accordance with AASHTO T 11. The procedure combines the two test methods.

Accurate determination of material smaller than No. 200 (75 µm) cannot be made with AASHTO T 27 alone. If quantifying this material is required, it is recommended that AASHTO T 27 be used in conjunction with AASHTO T 11. Following AASHTO T 11, the sample is washed through a No. 200 (75 µm) sieve. The amount of material passing this sieve is determined by comparing dry sample masses before and after the washing process. This procedure covers sieve analysis in accordance with AASHTO T 27 and materials finer than No. 200 (75 µm) in accordance with AASHTO T 11. The procedure includes two method choices, A and B.

5. Liquid Limit

Liquid Limit test shall be performed on material passing the 0.425 mm (No. 40) sieve. AASHTO T 89 & T 90 27. There are two methods approved by AASHTO, any of the two method can be used by the contractor. Blow count must be within 22-28 blows. Liquid Limit is a calculation based on moisture content and number of blows to closure.

6. Soil Classification

This standard classifies soils from any geographic location into categories representing the results of prescribed laboratory tests to determine the particle-size characteristics, the liquid limit, and the plasticity index.

III. DELIVERABLES

The Consultant shall prepare the following reports and deliverables:

1. Final Report

The Consultant is required to prepare and submit the final Geotechnical Report in two (2) bound copies to the DPWH Zamboanga del Sur 1st District Engineering Office, Pagadian City, Zamboanga del Sur, within fourteen (14) calendar days from the commencement of work. The final report shall not be limited to the following:

1.1. Field Investigation and Methodology
1.2. Borehole Drilling and Sampling
1.3. Laboratory Testing
1.4. Final Boring Logs (BL)
1.5. Final Laboratory Tests Results (FLTR)
1.6. Borehole Location Plan
1.7. Soil Profile along structures showing boring/drilling logs
1.8. Soil Liquefaction Investigation Report
1.9. Soil Bearing Capacity
1.10. Recommendation if called for such as type of measure/structure of work

2. Other Data to be Submitted

2.1. Boring Logs
2.1.1. Job, boring, hole number, date, time, boring/drilling, foreman, supervisor
2.1.2. Weather condition
2.1.3. Depth of boring at start of day
2.1.4. Water level in casing at start of day
2.1.5. Method of penetration and flushing system
2.1.6. Description of soil strata encountered
2.1.7. Depth of soil boundaries
2.1.8. Size, type and depth of samples and sample number
2.1.9. Type and depth of in-situ tests
2.1.10. Standard Penetration Tests Resistance, "N" Value
2.1.11. Recovery ratios of samples
2.1.12. Detailed notes on boring/drilling procedure, casing sizes and resistance to driving, description of wash water or spoil from boring/drilling tools
2.1.13. Depth of boring at end of day
2.1.14. Other relevant information such RQD, percent core recovery, angle of friction etc.

2.2. Photographs

Photographs showing the borehole drilling and sampling at each proposed sites shall be taken by the Contractor and incorporated in the report. Photographs shall be taken at each borehole location depicting the following:

2.2.1. Equipment used
2.2.2. Core drilling operation
2.2.3. Water level measurements
2.2.4. Performance of SPT and Shelby tube sampling
2.2.5. All cores in the core boxes, SPT and Shelby tube samples
2.2.6. Date photographs was taken

3. Duration of Consultancy Services

The Consultant's contract period for undertaking the geological and geotechnical investigation is fourteen (14) calendar days and the Consultant shall commence work upon receipt of Notice to Proceed (NTP).

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