SPECIAL BIDS AND AWARDS COMMITTEE
Design and Build of the Three-Storey HLURB-NTRFO Building

BID BULLETIN No. 01
19 December 2018

Notice is hereby given that Bid Bulletin No. 01 is issued to amend Section VI. Specifications in the Bidding Documents to insert the Soil Boring Test Result including the Lot Dimensions in Annex_ToR_H. Accordingly, this shall form an integral part of the Bidding Documents.

THREE-STOREY OFFICE BUILDING

BRGY. MAIMPIS, CITY OF SAN FERNANDO, PAMPANGA

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1. INTRODUCTION

This assessment of geotechnical conditions for The Proposed Three (3) Storey Office Building at Brgy. Maimpis, San Fernando City, Pampanga site was based on the findings gathered from the field and laboratory test conducted by Smart-K Materials and Testing Laboratory.

The geotechnical investigation consisted of drilling two (2) borehole within the project site and is shown in Table 1.1

Borehole Number	**Structure**	**Boring Depth (m)**	**Water Level Below Ground (m)**
1	Office Building	15.0	3.0
2			

Table 1.1 Summary of Borehole Location

In this report are soil properties & strength parameters, seismic design criteria of the site, allowable bearing capacity for foundation design, lateral earth pressure coefficient, and among other geotechnical information.

2. FIELD AND LABORATORY TESTS

For soil-type materials, Standard Penetration Test (SPT) are perform at regular interval and disturbed soil samples are then retrieved after the test. Upon encountering rock-type formation, coring will then be employ to penetrate through the hard strata and extract rock samples.

All recovered soil and/or rock samples are taken to the soil laboratory for various laboratory tests conforming to ASTM standards.

2.1 In-Situ Tests

<u>Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils (ASTM D 1586)</u>

This test method describes the procedure, generally known as the Standard Penetration Test (SPT), for driving a split-barrel sampler to obtain a representative soil sample and a measure of the resistance of the soil to penetration of the sampler.

The SPT is perform by driving a standard split spoon sampler into the ground by blows from a drop hammer of mass 63.5kg falling 760mm (Figure 3.7). Sampler is driven 152 mm (6 in) into the soil at the bottom of a borehole, and the number of blows (N) required to drive it at additional 304 mm is counted. The number of blows (N) is called the standard penetration number.

<u>Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation</u>

Rock cores are samples of record of the existing subsurface conditions at given borehole locations. The samples was expected to yield significant indications about the geological, physical, and engineering nature of the subsurface for use in the design and construction of an engineered structure.

2.2 Laboratory Tests

Retrieved soil or cored samples at every interval are subject to the following laboratory tests in conformance with the procedures given in the current ASTM standards as described below:

Standard Test Method for Particle-Size Analysis of Soil (ASTM D 422)
This test method covers the quantitative determination of the distribution of particle sizes in soils. The distribution of particle sizes larger than 75µm (retained on the No. 200 sieve) is determined by sieving.

Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (ASTM D 2216)
These test methods cover the laboratory determination of the water (moisture) content by mass of soil, rock, and similar materials where the reduction in mass by drying is due to loss of water except as noted in 1.4, 1.5 and 1.7 of ASTM D 2216.

Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318)
These test methods cover the determination of the liquid limit, plastic limit, and the plasticity index of soils as defined in below.

Liquid Limit
The water content, in percent, of a soil at the arbitrarily defined boundary between the semiliquid and plastic states.

Plastic Limit
The water content, in percent of a soil at the boundary between the plastic and semi-solid states.

Plasticity Index
The range of water content over which a soil behaves plastically. Numerically, it is the difference between the liquid limit and the plastic limit.

Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) (ASTM D 2487)
This practice describes a system for classifying mineral and organo-mineral soils for engineering purposes based on laboratory determination of particle-size characteristics, liquid limit, and plasticity index and shall be used when precise classification is required.

Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core (ASTM D 6032)
This test method covers the determination of the rock quality designation (RQD) as a standard parameter in drill core logging.

The RQD denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summoned and divided by the total length of the core run.

$$RQD = \frac{[\Sigma \text{ (length of intact and sound pieces)} > 100 \text{ mm (4 in.)}] \times 100\%}{\text{total core run length, mm}}$$

Rock Quality Designation (RQD)	Classification of Rock Quality
0-25 %	Very Poor
25-50 %	Good
50-75 %	Fair
75-90 %	Good
90-100 %	Excellent

Standard Test Method for Unconfined Compressive Strength of Intact Rock Core Specimens (ASTM D 2938)
A rock core sample is cut to length and the ends are machined flat. The specimen is placed in a loading frame and, if required, heated to the desired test temperature. Axial load is continuously increased on the specimen until peak load and failure are obtained.

Unconfined compressive strength of rock is used in many design formulas and is sometimes used as an index property to select the appropriate excavation technique.

It should be noted that no UCS were performed for rock samples which did not pass the requirement as tested specimen, e.g. not intact sample to fulfill the specified dimensioning.

3. SUBSURFACE SOIL CONDITION

The result of the site specific geotechnical investigation suggests that the idealized ground stratigraphy as shown in Table 3.1

Stratum	Depth (m)	Description
1	0.0 - 3.0	Medium Dense Silty Sand
2	3.0 - 6.0	Dense Silty Sand
3	6.0 – 15.0	Very Dense Silty Sand

Table 3.1 Idealized Ground Stratigraphy for BH-1 to BH-3

Ground Water Table (GWT) was encountered at 3.0 meters below the top of the boreholes.

4. GEOTECHNICAL PARAMETERS BASED ON TEST RESULTS

The SPT N-value are correlated to various properties and parameters of soil like; unit weight (Y_{wet} & Y_{sat}), relative density & consistency, angle of internal friction (φ), undrained compression strength (qu; $c=\frac{qu}{2}$), and stress-stain modulus (E).

SPT N-valued of cohesionless soils are correlated using Peck, Hanson, and Thornburn to determine its internal angle of friction, while for cohesive soils correlation were made using Terzaghi and Peck to determine the undrained cohesion. Other properties of soils were correlated to commonly used correlations in the literature.

Values are summarized in Table 4.1.

Stratum	Depth (m)	Y_{wet} (kN/m^3)	Y_{sat} (kN/m^3)	φ (deg)	c (kPa)	k_s (MPa/m)
1	0.0-3.0	17	19	30	-	10/B
2	3.0-6.0	-	21	32	-	20/B
3	6.0-15.0	-	22	38	-	40/B

Table 4.1 Summary of Geotechnical Properties and Parameters for BH-1 to BH-3

In lieu of any project-specific data, Poisson’s Ratio can be considered conservatively as μ=0.15 as suitable for design purposes.

5. FINDINGS AND EVALUATION

5.1 Recommended Seismic Design Criteria

Based on National Structural Code of the Philippines (NSCP 2015) 7th edition, the soil underneath the project site can be classified as shown in Table 5.1.1. The Philippine archipelago is located in a seismically active region. Thus, most of the country, except for Palawan, can be classified as under Seismic Zone IV (Z=0.4).

Parameters	Value
Soil Profile Type	S_D
Seismic Zone	4
Seismic Source Type	A

Table 5.1.1 Recommended Seismic Design Parameters

The nearest seismic source that may directly affect the project site is the East Zambales Fault and is approximately 40 kilometers from the site. Other seismic design parameters should be obtained by the design engineer.

5.2 Shallow Foundations

The various foundation types appropriate for this development are dependent upon the size of the structure, its anticipated structural loads, the tolerable (total and differential) settlement of the proposed structure and the ground conditions occurring at the project’s location.

The net allowable bearing capacity of shallow foundation with embedment depth (D) to foundation least dimension (B) ratio of (D/B < 2.0) was calculated using Meyerhof’s Method for shallow foundation with a Factor of Safety (FS) of 3.0 as shown in Table 5.2.1.

Meyerhof’s Bearing Capacity Equation:

$$q_{ult} = cN_c s_c d_c + qN_q s_q d_q + 0.5yB'N_y s_y d_y$$

Bearing Capacity Factor:

$$N_q = e^{\pi \tan\phi}\tan^2 \; 45 + \frac{\phi}{2}$$

$$N_c = \; N_q - 1 \; \cot\phi$$

$$N_y = \; N_q - 1 \; \tan \; 1.4\phi$$

Shape Factor:

$$s_c = 1 + 0.2K_p\frac{B}{L} \qquad \textbf{Any } \phi$$

$$s_q = s_y = 1 + 0.1K_p \frac{B}{L} \qquad \phi > 10$$

$$s_q = s_y = 1 \qquad \phi = 10$$

Depth Factor:

$$d_c = 1 + 0.2 = \sqrt{K_p}\frac{D}{B} \qquad \text{Any } \phi$$

$$d_q = d_y = 1 + 0.1 = \sqrt{K_p}\frac{D}{B} \qquad \phi > 10$$

$$d_q = d_y = 1 \qquad \phi = 0$$

Embedment Depth (m)	Net Allowable Bearing Capacity (kPa)
0.5-1.0	115
1.0-1.5	180
1.5-3.0	250

Table 5.2.1 Net Allowable Bearing Capacity of Shallow Foundation for BH-1 to BH-3 (isolated, combined, and strip footing)

It is recommended to integrate footing tie beams in the design of foundations to prevent differential settlement.

For footings located near or on slopes, the net allowable bearing capacity shown in Table 5.2.1 should be reduced by half.

For the design of foundations as elastic beams based on Winkler slab analysis, the modulus of subgrade reaction (k_s) are shown Table 4.1

5.3 Lateral Earth Pressure

The Coefficient of Lateral Earth Pressure (K_o, K_a and K_p) was calculated using effective shear strength parameters of the soil. The calculated coefficients assumes a level ground, vertical back-faced wall and the friction angle between wall and soil (δ) δ=0.33φ.

Depth (m)	Coefficient of Lateral Earth Pressure		
	At Rest (K_o)	Active (K_a)	Passive (K_p)
0.0	0.50	0.33	4.13

Table 5.3.1 Coefficient of lateral earth pressure for BH-1 to BH-3

For cast-in-place walls, passive pressure may be neglected due to disturbance of soil during foundation excavation. Calculated active pressure should be increased by 20% to account for additional compaction stress during construction. At rest lateral earth pressure coefficient (K_o) should be used when structures adjacent to the wall are sensitive to lateral displacement.

Internal Drainage System under and behind the retaining wall should be provided to ensure that there will be no buildup of pore water pressure and water will be drained off.

5.4 Slab on Grade and Pavement Design

Subbase or subgrade soils beneath the slab on grade and pavement should be free from organic and unsuitable materials. It should be compacted in lift (at most 300mm) to a minimum of 95% of MDD (Maximum Dry Density). Other necessary specifications should conform to DPWH Manual of Standard Specification (Vol. II Highways, Bridges and Airports, 2004).

6. LIMITATIONS

This report is based on the subsurface investigation carried out by Smart-K Materials and Testing Laboratory. Should there be any differences in the soil stratifications encountered during the construction phase, or any differences in understanding of the requirements of the project, the undersigned should be reached at jbmamburam@yahoo.com so that additional recommendations and/or corrections can be made.

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7. REFERENCES

American Society for Testing and Materials International (ASTM)

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http://faultfinder.phivolcs.dost.gov.ph/

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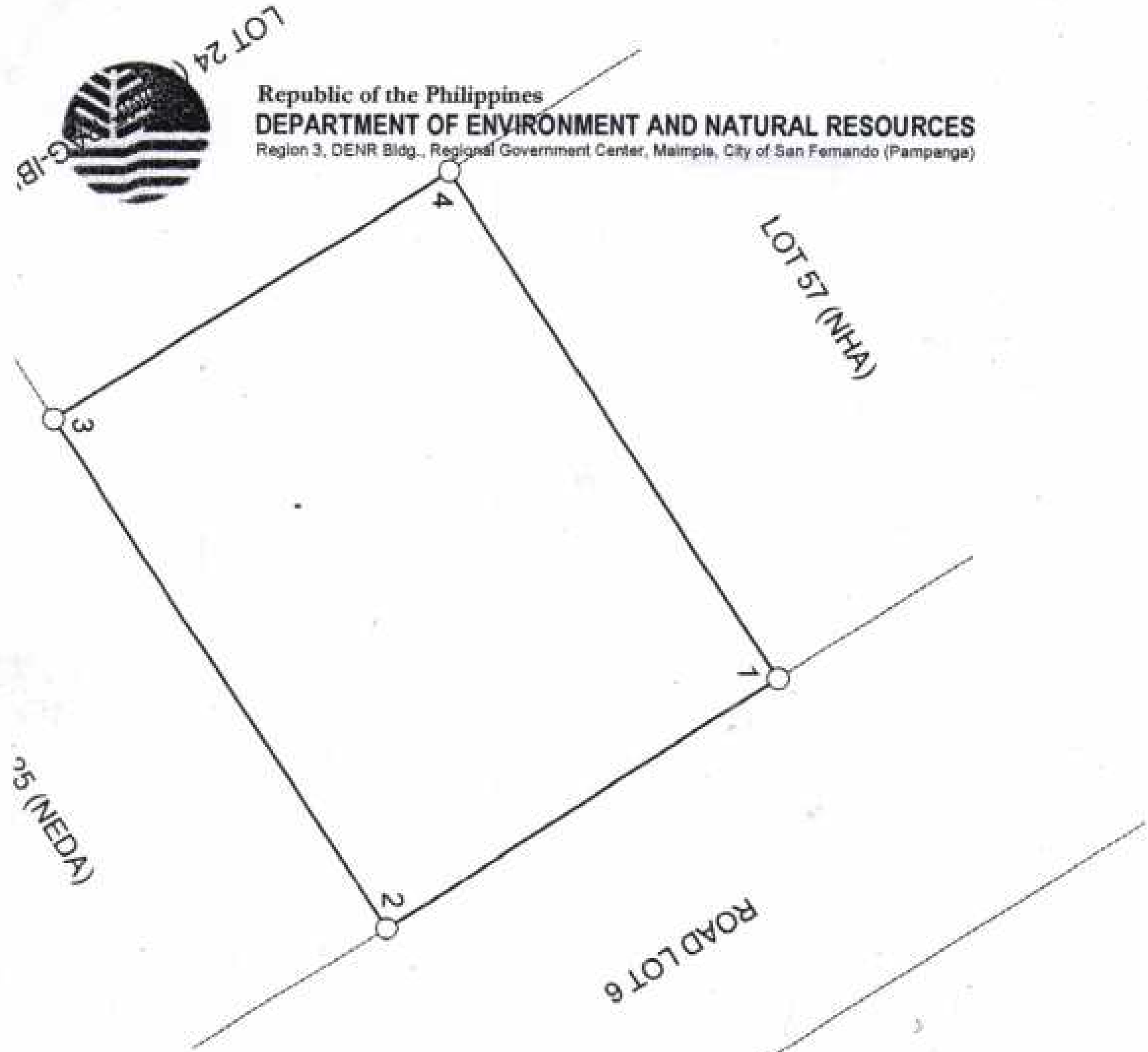

TECHNICAL DESCRIPTIONS

Lines	Bearings	Distances
58 (HLURB), A=630 Sq.M.		
1-2	S.32°55'E.	21.95 M.
2-3	S.57°05'W.	28.71 M.
3-4	N.32°55'W.	21.95 M.
4-1	N.57°05'E.	28.71 M.

TIE LINE: N.23°57'E.,
426.83 M.; From MBM No. 37,
Cad. 71, San Fernando Cadastre