PEOPLE'S TELEVISION
PARA SA BAYAN
People's Television Network, Inc
Broadcast Complex, Visayas Avenue, Diliman, Quezon City 1100
Telephone No. 3453-1097 /www.ptv.ph

BID BULLETIN NO. 1
14 March 2022

Design and Build of a Four-Legged (4) Three Hundred (300) Feet TV Broadcast Tower including the Transmitter Building with Roofdeck and Perimeter Fence for PTV Davao del Norte of the People's Television Network, Inc.
ITB NO. 2022-0005

This bulletin is being issued to revise/clarify certain portions of the bidding documents. This shall form an integral part of the bidding document for the above-stated project.

Correction	
1	Please disregard in pg. 39 of the bidding documents the "Existing Plan Second Floor".

Reminder/ Additional Requirement	
1	Please see the Geotechnical Investigation Report in Annex "A" as basis for the detailed Preliminary Design.

All other information in the Bidding Documents inconsistent with the above is hereby revised accordingly. All other provisions which are not affected shall remain in effect.

For further guidance and information of all concerned.

Thank you.

ATTY. JASON SHAHEER H. SALENDAB
Chairman
Bids and Awards Committee

"ANNEX A"

Submittal:

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GEOTECHNICAL INVESTIGATION REPORT

Subsurface Soil Investigation No. G-266 Sites:

VERIFICATION SOIL BORING TEST
PROPOSED TWO STOREY SP/LEGISLATIVE BUILDING
Davao del Norte Provincial Government Center, Mankilam, Tagum City

****

Proponent:

ENGR. GLENN A. OLANDRIA
PG DEPT. HEAD, PROVINCIAL ENGINEER'S OFFICE

&

JESSIE G. ISALES
AUTHORIZED MANAGING OFFICER
FFJJ CONSTRUCTION & TAGUM BUILDERS CONTRACTORS INC., JV

****

Prepared by:

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Structural, Geotechnical & Management Company (Since 1999)
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TABLE OF CONTENTS

EXECUTIVE SUMMARY

A subsurface soil investigation was conducted by drilling/boring one (1) test hole at a maximum depth of 12 meters from the existing ground line as shown in the borehole location plan shown (see appendix). The project site that is under consideration is an open lot inside the Davao del Norte Provincial Government Center with relatively flat slope and on this location the subsurface field testing using Standard Penetration Test was conducted to provide soil stratification data on the proposed jobsite, the written report contains the discussions, evaluation and recommendations intended for the design of structural foundation of the *Proposed Two Storey SP/Legislative Building, Davao del Norte Provincial Government Center, Mankilam, Tagum City.*

The primary objectives of this study are the following:

1. To determine subsurface soil conditions and parameters, its strength and deformation characteristics.
2. To evaluate and calculate the allowable bearing capacity of soil for specific depth and footing sizes.

Recommended values of maximum gross allowable bearing capacities are shown below using the factor of safety of (F.S.) of 3.0 to be used for the design of shallow foundation.

Depth of Excavation	Modified Allowable Bearing Capacity
1.0m	1,900 psf (90.9 KPa)
2.0m	1,801 psf (86.2 KPa)
3.0m	1,500 psf (71.8 KPa)
4.5m	1,190 psf (71.8 KPa)
6.0m	1,762 psf (84.3 KPa)
7.5m	1,906 psf (91.2 KPa)
9.0m	1,302 psf (62.3 KPa)
10.5m	1,707 psf (81.7 KPa)
12.0m	1,552 psf (74.2 KPa)

CHAPTER 1
INTRODUCTION

Background of the Study

A subsurface soil investigation was conducted by drilling/boring one (1) test hole at a maximum depth of 12 meters from the existing ground line as shown in the borehole location plan shown (see appendix). The project site that is under consideration is an open lot inside the Davao del Norte Provincial Government Center with relatively flat slope and on this location the subsurface field testing using Standard Penetration Test was conducted to provide soil stratification data on the proposed jobsite, the written report contains the discussions, evaluation and recommendations intended for the design of structural foundation of the *Proposed Two Storey SP/Legislative Building, Davao del Norte Provincial Government Center, Mankilam, Tagum City.*

Field and laboratory tests were conducted on the soil samples according to the American Society for Testing and Materials (ASTM) standards and specifications. The test hole was advanced by percussion pad rig boring/drilling with mild steel drill bits for medium to very soft soil consistency and using hard-steel drill bits percussion if rock formations are encountered.

Objective of the Study

The primary objectives of this study are the following:

1. To determine subsurface soil conditions and parameters, its strength and deformation characteristics.

2. To evaluate and calculate the allowable bearing capacity of soil for specific depth and footing sizes.

Scope of the Study

The study covers the following scope:

1. To perform the Standard Penetration Test in one (1) location for a depth of 12 meters.
2. To conduct the soil laboratory test.
3. To analyze the field data and laboratory results.
4. To provide findings, conclusions and recommendations.

Assumptions of the Study

The study made the following assumptions:

1. That the one (1) borehole are sufficient enough to describe the soil classification and parameters.

Limitations of the Study

The study is limited to the following items:

1. That the depth is limited to 12 meters subsurface exploration.
2. That at least one sample is taken in every 1.5 meters interval.
3. It should be noted that the design of footing are excluded in the scope of work of this report.

CHAPTER 2
METHODOLOGY

Field Procedures

1. Drilling Procedure

The borehole was advanced by percussion pad rig boring/drilling to the depth of 12 meters. The Standard Penetration Tests (SPT) was conducted at every 1.5 meters interval for the succeeding depth or often with the change in formation.

2. Split-Spoon Sampling Procedure

The Standard Penetration Test consisted of driving a *Standard Split-spoon sampler* of 50.8 mm (2" O.D.) diameter in three successive 152.4 mm (6") intervals using a drop hammer of 64 kilograms (140 lbs.) weight from a height of 762 mm (30"). The number of blows to penetrate 152.4 mm (6") is recorded successively until the third interval is penetrated. The first interval blow count is considered as the seating drive and is discarded. The last two blow counts from the second and third intervals are added to give what is known as the *N–value* which is a measure of the density or consistency of the underlying soils. This number is generally referred to as the *N value* (American Society for Testing and Materials, 1992, Designation D-1586-84). The consistency and unconfined compression strength of clayey soils, the approximate relative density and angle of friction for sands can be correlated to the *N-value.* The sampler is then withdrawn, and the shoe and coupling are removed. Measurements on dimension and volume are made on soil sample recovered from the tube and are then placed in a sealed container and transported for further laboratory test.

Laboratory Test Procedures

The following laboratory tests and their brief description were carried out on the soil samples obtained from site.

1. Classification of Soils for Engineering Purpose

ASTM D 2487-00 Standard Practice Classification of Soils for Engineering Purpose (Unified Soil Classification System)

2. Particle Size Analysis of Soils

ASTM D 7928 Standard Practice Methods for Particle-Size Analysis of Soils: Soil was passed through a series of sieves, the weight of soil retained on each sieve determined and recorded. For each sample analyzed, a gradation curve was drawn based on the percent finer by weight.

3. Liquid Limit, Plastic Limit & Plasticity Index of Soils

ASTM D 4318-00 Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils: The liquid limit and plastic limit of soils (along with the shrinkage limit) are often collectively referred to as the Atterberg limits. These limits distinguished the boundaries of the several consistency states of plastic soils.

4. Laboratory Determination of Moisture Content of Soils.

ASTM D 2216-98 Standard Test Methods for Laboratory Determination of Water Content (Moisture) of Soil and Rock by Mass: The ratio expressed as percentage of the weight of water in a given mass of soil to the weight of the solid particles.

CHAPTER 3

RESULTS, FINDINGS AND EVALUATION

1. Bearing Capacity

The results on bearing capacity, the angle of internal friction & the cohesion by correlation were determined from the MathCAD Geotechnical Calculations and by NAVFAC DM 7.01, AASHTO and BS77 Typical Values.

Borehole No. 1

Footing Depth (m)	Consistency or Compactness	N - Values	USCS Symbol	Corrected Allowable Bearing Capacity (KPa)
0.0 – 1.0	Loose	8.0	**SC-SM**	**121 KPa**
1.0 – 12	Very Loose, Medium and Loose	6.9	**SM**	**85 KPa**

The findings on this site for the *Proposed Two Storey SP/Legislative Building at DDN Provincial Government Center, Mankilam, Tagum City* is underlain with layers of very loose to medium of coarse-grained soils from 0 to 12m.

In borehole no.1, the soils are characterized is mixed of silty and clayey sand with classification group-symbol SC-SC and SM soil classification in accordance with ASTM D2487. The SPT N value ranges from 8 – 8 blows/ft. from 0 to 1.0 meters under GS-1 (SC-SM soil) samples and from 4 – 11 blows/ft. from 1.0 to 12 meters under GS-2 (SM soil) samples. Laboratory test results for this borehole have indicated a slightly plastic SC-SM soil and non-plastic SM soil. The natural moisture contents on the other hand, ranges from 10% to 31%

The groundwater table (GWT) was not observed at the time of boring. The summary of findings is set out in the following matrices. More details of the results are presented in the Appendix of this report.

Borehole No.1

Depth (m)	Dept h (m)	Sampling	N-value (blow/ft)	N-value (blow/ft)	UCT q_u	Material
From	To	Method	N_{range}	N_{ave}	Kg/cm^2	Type
0.0	1.0	SPT	8 - 8	8.0	------	SC-SM: Silty Clayey Sand slightly plastic fines
1.0	12	SPT	4 - 11	6.9	------	SM: Silty Sand Non-plastic fines

2. Liquefaction Evaluation

The liquefaction assessment is to be carried out in a deposit of sandy soil formations that is below the water table. The assessment is based on Seed and Idriss Simplified Method in calculating for the load in terms of maximum cyclic shear ratio (CSR) determined from the shear stress-time history during an earthquake of magnitude of 7.5 which is converted into an equivalent number of significant stress cycles. The resistance is also calculated in terms of cyclic resistance ratio (CRR) as functions of SPT blow count, Earthquake Magnitude 7.5 and vertical stress. A Liquefaction Factor of Safety (LFS) is determined by dividing the CRR with the value of CSR for a given depth of soil in each borehole. A Liquefaction Factory of Safety (LFS) value less than 1 means that the depth being considered is potential for soil liquefaction. The soil liquefaction analysis would also show the depth and location of soil liquefaction potentials when the project site is subjected to a ground motion acceleration of 0.4g and of earthquake magnitude 7.5.

As shown in the tables of LFS below, the sandy silt soil formation of all boreholes where the average liquefaction factor of safety (LFS) is less than 1 are considered to be the soil depths potential for soil liquefaction during a seismic activity. The liquefaction potential will occur at silty sand soil formation from 1.0 m to at least 12m since the average Liquefaction Factor of Safety (LFS) is less than 1 as indicated in Table 2.1. The table below as shown are summary of liquefaction potentials if water table rise near the bottom of footings and if the earthquake magnitude is at least 7.5. **Note that the average liquefaction factor of safety (LFS) is 0.72 is moderately susceptible to liquefaction.**

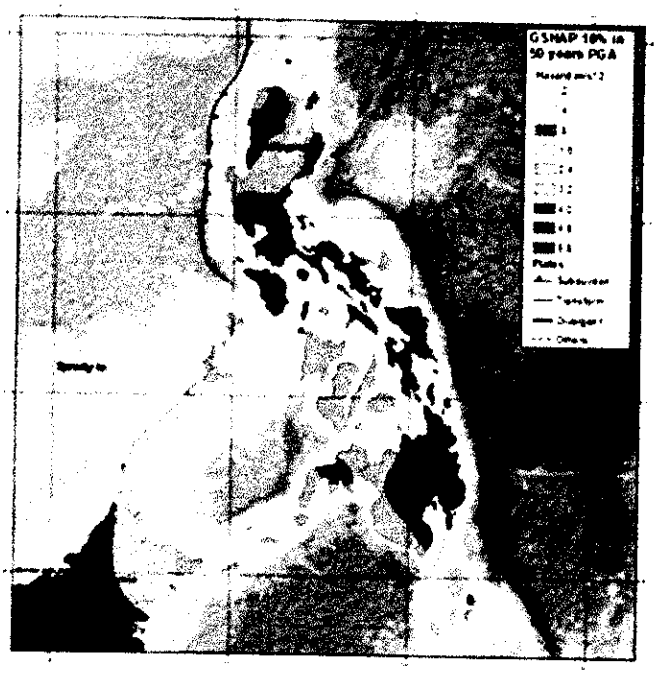
Table 2.1 Summary of Liquefaction for Borehole #1 if the Water Table will rise near the bottom of footing.

Depth (m)	Depth (m)	Average Corrected N-value (blow/ft)	Ave. Liquefaction Factor of Safety (LFS)	Material
From	To	N'	LFS	Type
0.0	1.0	24.8	1.04	SC-SM: Silty, Clayey Sand slightly plastic fines
1.0	12	10	0.65	SM: Silty Sand non plastic fines

Average Liquefaction Factor of Safety, LFS = 0.72

3.0 Seismicity of Mindanao Areas

The Philippines is situated in a tectonically active region. Accounting some of the major fault zone on Mindanao Island are the Philippine Fault and its splay faults, Philippine Trench, Cotabato Trench, Mindanao Fault, and other inferred faults. According to the Global Seismic Hazard Map of the UN/International Decade of Natural Disaster Reduction Study (1998), the Mindanao Regions has pink and red color correspond to high hazard (24% - 40% g, where g equals acceleration of gravity) with 10% chance of exceedance of some ground motion parameter for an exposure time of 50 years, corresponding to a return period of 475 years.

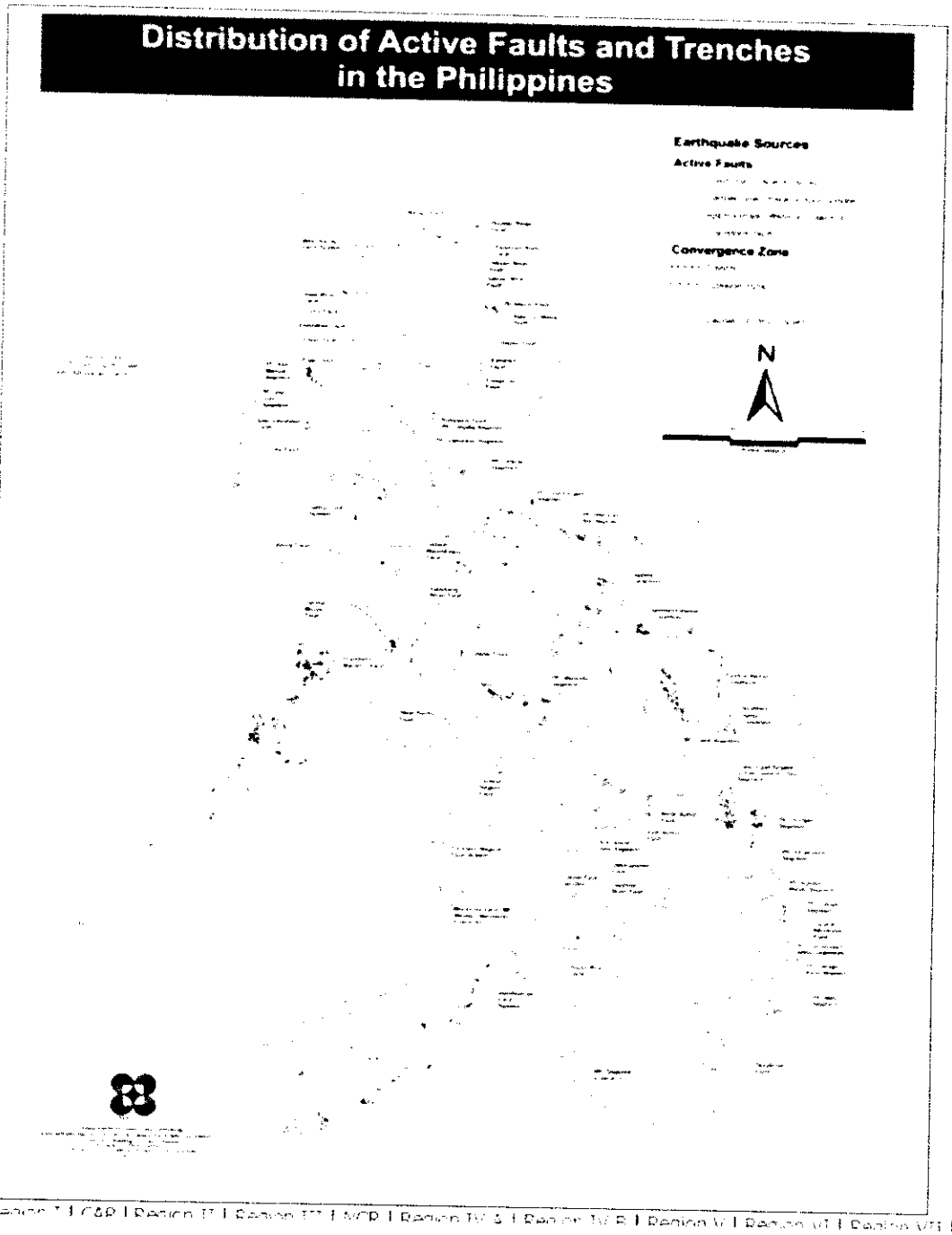


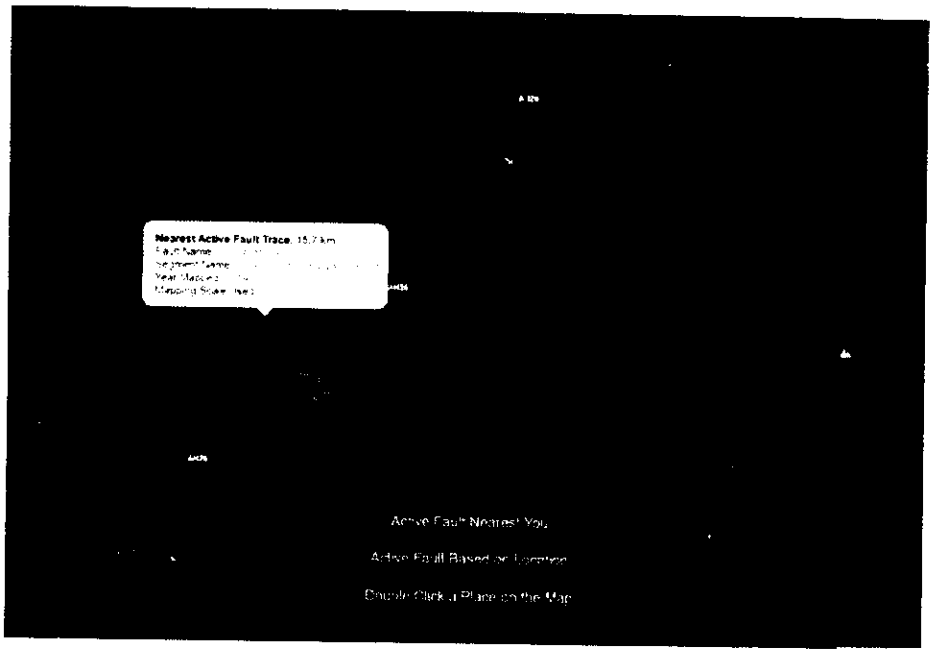
Seismicity in the Tagum City, Davao Region, Region XII and Bukidnon was relatively active for the past few months and it is noted that in Tagum City is bounded by seismic generators which are to be considered in the seismic analysis for the design of the structures. The Philippine fault zone, the following active faults near Tagum City area according to PHIVOLCS Hazard Hunter, PHIVOLCS Fault Finder and NSCP 2015:

1. South Bukidnon Fault/South Bukidnon Fault Segment, Year mapped - 2019.
2. Sawaga River Fault/Sawaga River Fault Segment, Year mapped – 2019 – Malaybalay Bukidnon
3. Tagoloan River Fault/Tagoloan Fault Segment, Year mapped – 2000 – CDO & Bukidnon
4. Cabanglasan Fault/Cabanglasan Fault Segment, Year mapped – 2000 – Claveria, Misamis Oriental
5. Central Mindanao Fault/Central Mindanao Fault Segment, Year mapped – 2000 – Gingoog to Laak (Davao de Oro).
6. Philippine Fault
    - Mati Fault Segment, Year mapped – 2014 – DOr.
    - Caraga River Segment, Year mapped – 2014 – DOr.

- East Compostela Valley Fault Segment, Year mapped – 2014 – DDO
- East Compostela Valley Fault Segment, Year mapped – 2014 – DDO
- West Compostela Valley Fault Segment, Year mapped – 2014 – DDO
- Central Compostela Valley Fault Segment, Year mapped – 2014 – DDO
- Nabunturan Fault Segment, Year mapped – Year mapped 2014 – DDO

7. Unnamed Offshore Projection – 2000 – Don Marcelino (Davao Occidental).
8. Davao River Fault/Davao River Fault Segment – Year mapped - 2000
9. Colosas Fault/Colosos Fault Segment – Year mapped 2016 – near Sto. Tomas, DDN.
10. Central Davao Fault System (CDFS), Year mapped – 2016 (Not yet included in the 2015 NSCP)
    - New Carmen Fault Segment
    - Dacudao Fault Segment
    - Lacson Fault Segment
    - Tamugan Fault Segment
    - Pangyan-Biao-Escuela Fault Segment
11. Central Digos Fault System (CDFS)/ND Segment, Year mapped – 2019
12. Unnamed Offshore Projection – 2000 – Gov. Generoso (Davao Oriental)
13. Tangbulan Fault System /ND Segment, Year mapped – 2019
14. Unnamed Fault near Koronadal City, Year mapped – 2000
15. Matalam Fault/ND Segment, Year mapped – 2019
16. Cotabato Davao Fault System (MFS), Year mapped – 2019
    - Makilala- Malungon Fault Segment (2019)
    - North Colombio Fault Segment (2019)
    - South Colombio Fault Segment (2019)
17. Mindanao Fault System (CFS), Year mapped – 2019
    - Daguma Extension (2000)
    - Mindanao Fault Segment (2000)


Distribution of Active Faults and Trenches in the Philippines
Earthquake Sources
Active Faults
Convergence Zone
N



Year mapped – 2014 by Philippine Institute Volcanology and Seismology (PHIVOLCS), Department Science and Technology (DOST), Geological Survey of Japan (GSJ) and National Institute of Advanced Industrial Science and Technology of Japan (AIST)

PHIVOLCS Hazard Hunter GeoRisk App

Nearest Active Fault Trace: **15.6 Km**

Fault Name: **Philippine Fault**

Segment Name: **West Compostela Valley Fault**

Year Mapped: **2014**

Earthquake-Induced Landslide: Data being updated

Ground Rupture: **Safe**

Ground Shaking: **Prone**

Tsunami: **Safe**

Liquefaction: **This area** Generally Susceptible to Liquefaction **per PHIVOLCS Hazard Hunter GeoRisK App but according to the Seed and Idriss Simplified Method of Liquefaction Assessment this particular location is** Moderately Susceptible to Liquefaction **(please see page 9 – page 10 on this report).**

CHAPTER 4
CONCLUSIONS AND RECOMMENDATIONS

Conclusion and Recommendations:

Conclusion on the Foundation Condition:

Based on the results and findings, the following conclusion is drawn:

That the soil upon which the *Proposed Two Storey SP/Legislative Building* Foundation is to be built is characterized by a 12 meters layer of low bearing capacity soil (1100 psf to 2000 psf). The soil formation where the proposed building will be set on silty sand soil formations.

Recommendation for Footings resting on Soil (Design):

Taking the results, findings and conclusions into considerations, the undersigned recommends the following:

1. For the proposed *Two Storey SP/Legislative Building* if shallow foundation is the option by the Structural Engineer then the maximum gross allowable soil bearing capacities are recommended for use. That the Matrix shown below, is the recommended maximum gross allowable bearing capacities from Meyerhof Equations using direct SPT Number, Terzaghi Equations and Skempton Equation using correlated shear strength parameters. These values were obtained using the factor of safety of (F.S.) of 3.0.

Depth of Excavation	Modified Allowable Bearing Capacity
1.0m	1,900 psf (90.9 KPa)
2.0m	1,801 psf (86.2 KPa)
3.0m	1,500 psf (71.8 KPa)
4.5m	1,190 psf (71.8 KPa)
6.0m	1,762 psf (84.3 KPa)
7.5m	1,906 psf (91.2 KPa)
9.0m	1,302 psf (62.3 KPa)
10.5m	1,707 psf (81.7 KPa)
12.0m	1,552 psf (74.2 KPa)

2. That interconnecting tie-beams shall be provided to minimize the differential settlement or uneven settlement of foundation due the presence of a weak soil strata.

3. That the footings shall be oversize to reduce the anticipated foundation settlement and to mitigate the soil liquefaction.

4. That foundation shall be provided by drainage for pore pressure relief as mitigation solution for potential soil liquefaction. The use of Relief Wells such as ***Gravel or Rock Drains*** to dissipate the excess water pressure during Cyclic loading.

5. That foundation improvement shall be considered by the Structural Engineer using acceptable methods.

a) Removal or Replacement of Undesirable Soil (Remove the weak & undesirable soil and Replace/Excavate & recompact it with foundation fill "good special granular materials") with Geotextile Fabric Separator

Materials shall conform below;

Maximum sieve size = 50mm ---------- 100% mass passing (max.)
#10 Sieve Size = 2mm ---------- 50% mass passing (max.)
#40 Sieve Size = 0.425mm ---------- 30% mass passing (max.)
#200 Sieve Size = 0.075mm ---------- 15% mass passing (max.)
Liquid Limit ---------- 35% maximum
Plasticity Index ---------- 6% maximum

b) Soil Reinforcement Method and may be made with a number of materials:

- Woven Geotextiles
- Polymer Geogrids of Polyethylene (usually uniaxial) & polypropylene (usually biaxial)
- Polyester and Fiberglass Geogrids (often knitted or stitched at junctions) and usually coated with a polymer such as polyethylene or PVC or with bitumen.

c) Foundation modification by Densification of In-situ material.

- Densification of the In-situ Soil by Vibroflotation.
- Densification of the In-situ Soil by Dynamic Compaction.
- Densification of the In-situ Soil by Compaction Piles.

- Densification of the In-situ Soil by Soil Displacement using Head Size Boulders at least .75 cu.m. to 1.0 cu.m. per Square Meter of the Footing Footprint and with Gravel-Sand mix to occupy the voids between boulders.

d) In-situ Soil Improvement.

- Soil Improvement by Compaction Grouting.
- Soil Improvement by Chemical stabilization.

Correlated Soil Properties & Parameters:

Taking the field results, laboratory results, evaluation analysis into considerations and the undersigned recommends the following:

1. **Shear Strength Parameters**:

Representative Values:

- Angle of Internal Friction for SC-SM (35% Fines & 65% Coarse) ---- 15°
- Angle of Internal Friction for SM (25% Fines & 75% Coarse) --------- 28°
- Cohesion for SC-SM (35% Fines & 65% Coarse) ---------- 14 KPa
- Cohesion for SM (25% Fines & 75% Coarse) ---------- 24 KPa

2. **Weight Parameters:**

- Average Unit Weight ---------- 16.7 KN/m^3

3. **Modulus of Subgrade Reaction**

- k_s for SC-SM ---------- 10,900 KPa/m (average)
- k_s for SM ---------- 9,200 KPa/m (average)

Earthquake Design:

1. **Site Geology and Soil Characteristics:**

- Soil Type: S_E for SPT N-Values is less than 15, Field SPT $N_{average}$ = 7.1 for the SC-SM and SM soils.

2. **Site Seismic Hazard Characteristics:** Based from the nearest fault lines shown in Fault Finder Maps & Hazard Hunter, a web apps from the joint collaboration between

DOST-PHILVOCS and GSJ (Japan). The proposed project site is more or less 15.6km from

Fault Name: Philippine Fault

Segment Name: West Compostela Valley Fault

Year Mapped: 2014

- NSCP 2015, Zone Factor Z = 0.40
- **If Seismic Source Type = A**
- Near Source Factor $\mathbf{N_a = 1.00}$ proposed project site is 15.6 km to known seismic source. (a) <= 2km; $N_a = 1.5$, (b) <= 5km; $N_a = 1.2$, (c) <= 10km; $N_a = 1.0$
- Near Source Factor $\mathbf{N_v = 1.00}$, proposed project site is 15.6 km to known seismic source. (a)) <= 2km; $N_v = 2.0$, (b) <= 5km; $N_v = 1.6$ (c) <= 10km; $N_v = 1.2$, (d) <= 15km; $N_v = 1.0$
- Importance Factor I = 1.0 for government buildings not to be used for Disaster Risk Reduction and Management Operation.

- NSCP 2015, Zone Factor Z = 0.40
- **If Seismic Source Type = B**
- Near Source Factor $\mathbf{N_a = 1.00}$, proposed project site is 15.6 km to known seismic source. (a) <= 2km; $N_a = 1.3$, (b) <= 5km; $N_a = 1.0$, (c) <= 10km; $N_a = 1.0$
- Near Source Factor $\mathbf{N_v = 1.00}$, proposed project site is 15.6 km to known seismic source. (a)) <= 2km; $N_v = 1.6$, (b) <= 5km; $N_v = 1.2$ (c) <= 10km; $N_v = 1.0$
- Importance Factor I = 1.0 for government buildings not to be used for Disaster Risk Reduction and Management Operation.

In preparing this report the professional services have been performed, findings obtained and recommendations have been prepared by the undersigned in accordance with generally accepted Engineering Principles and Practices.

If you require additional comment or clarification pertaining to the findings and recommendations, the undersigned will be pleased to comply.

October 2020

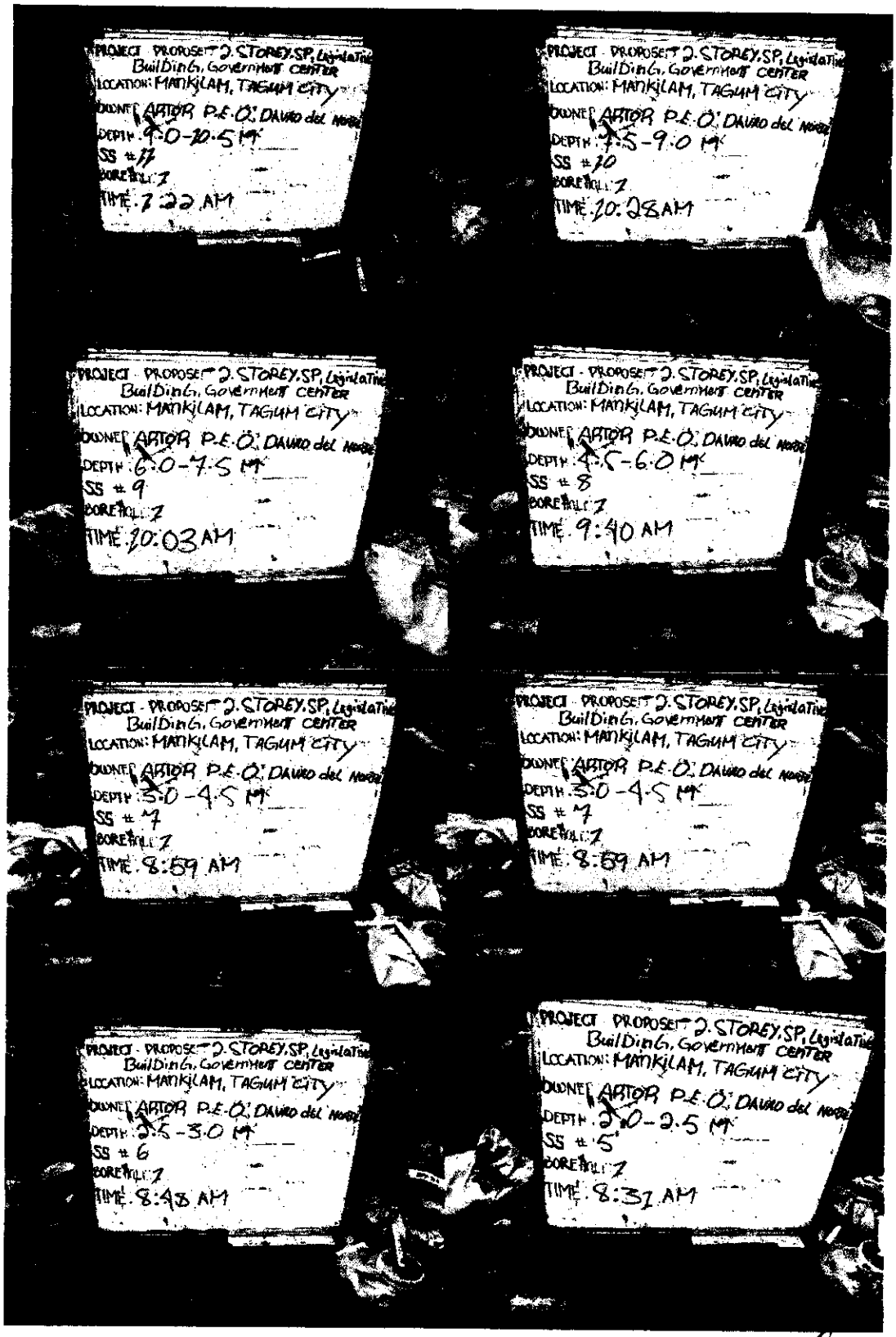
Prepared by:

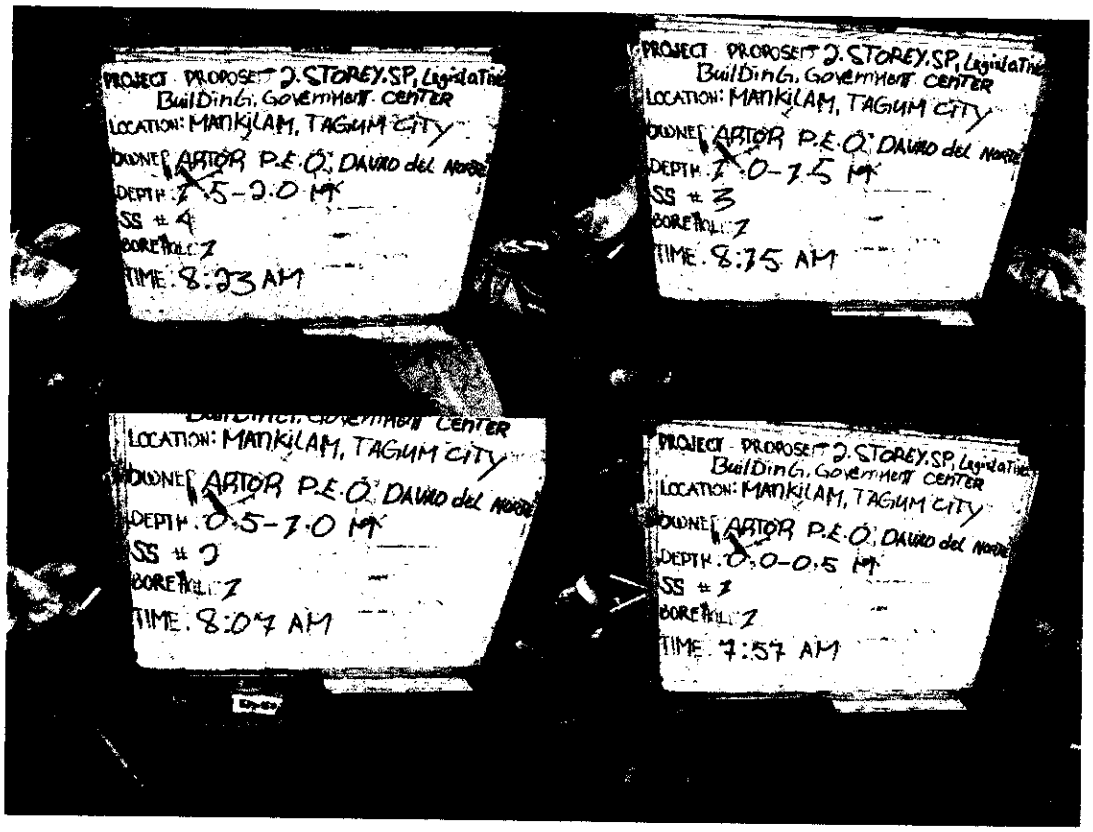
LIZARDO P. REMOJO, MEng, M.ASEP, ISSEP
Master of Engineering (Geotechnical/Structural)
Consulting Civil Engineer / I.StructS No. -038
PRC CE Reg. No 36528
Specialist in Structural Engineering
PICE Accreditation No. StE 137

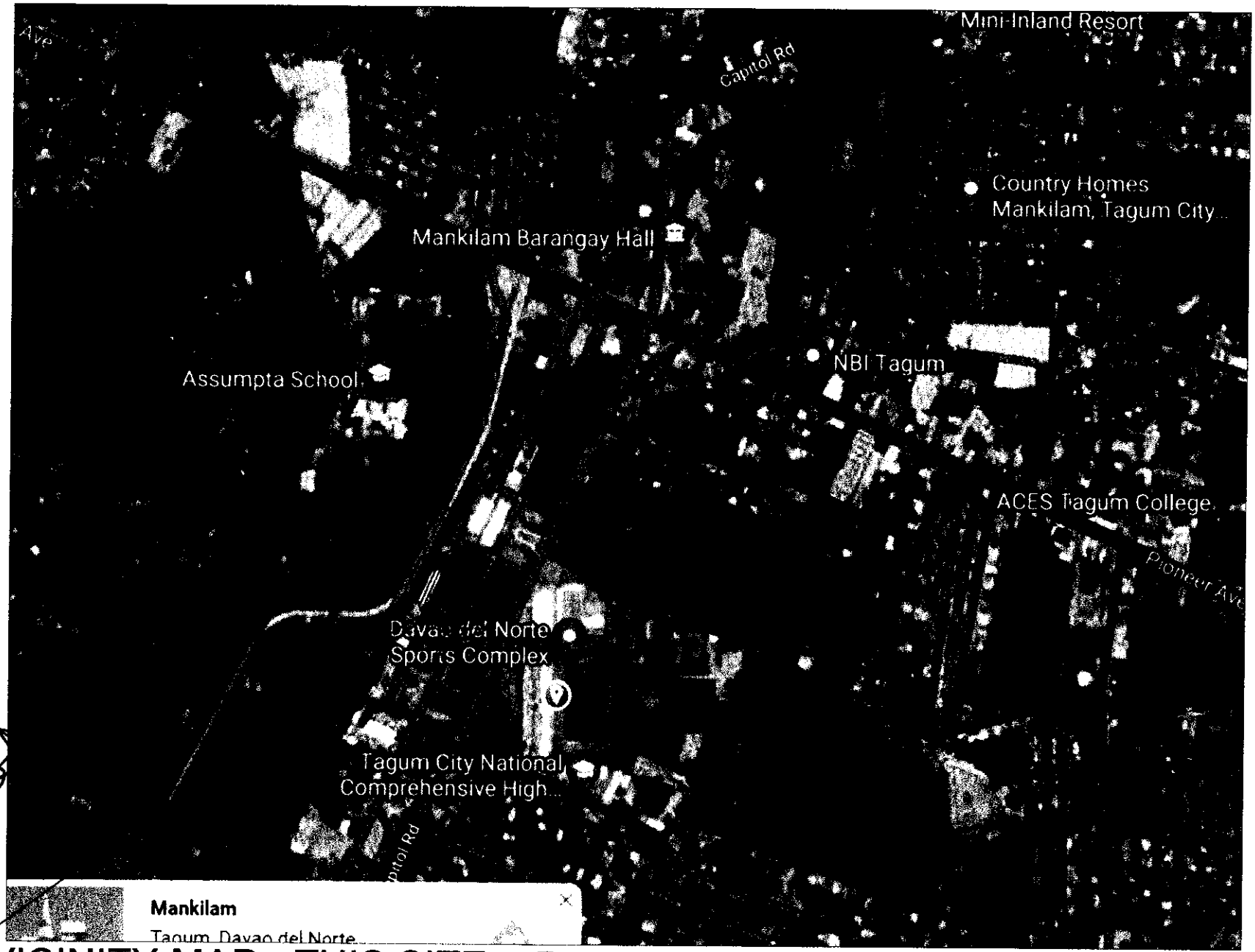
*Association of Structural Engineers of the Philippines (ASEP) – Regular Member
*Institution of Specialist Structural Engineers of the Philippines (ISSEP) - Member
*Philippine Institute of Civil Engineer (PICE) – Life Member
*PICE Specialist Member Certificate No. StE. 137 (Structural)

APPENDICES

FIELD PICTURE

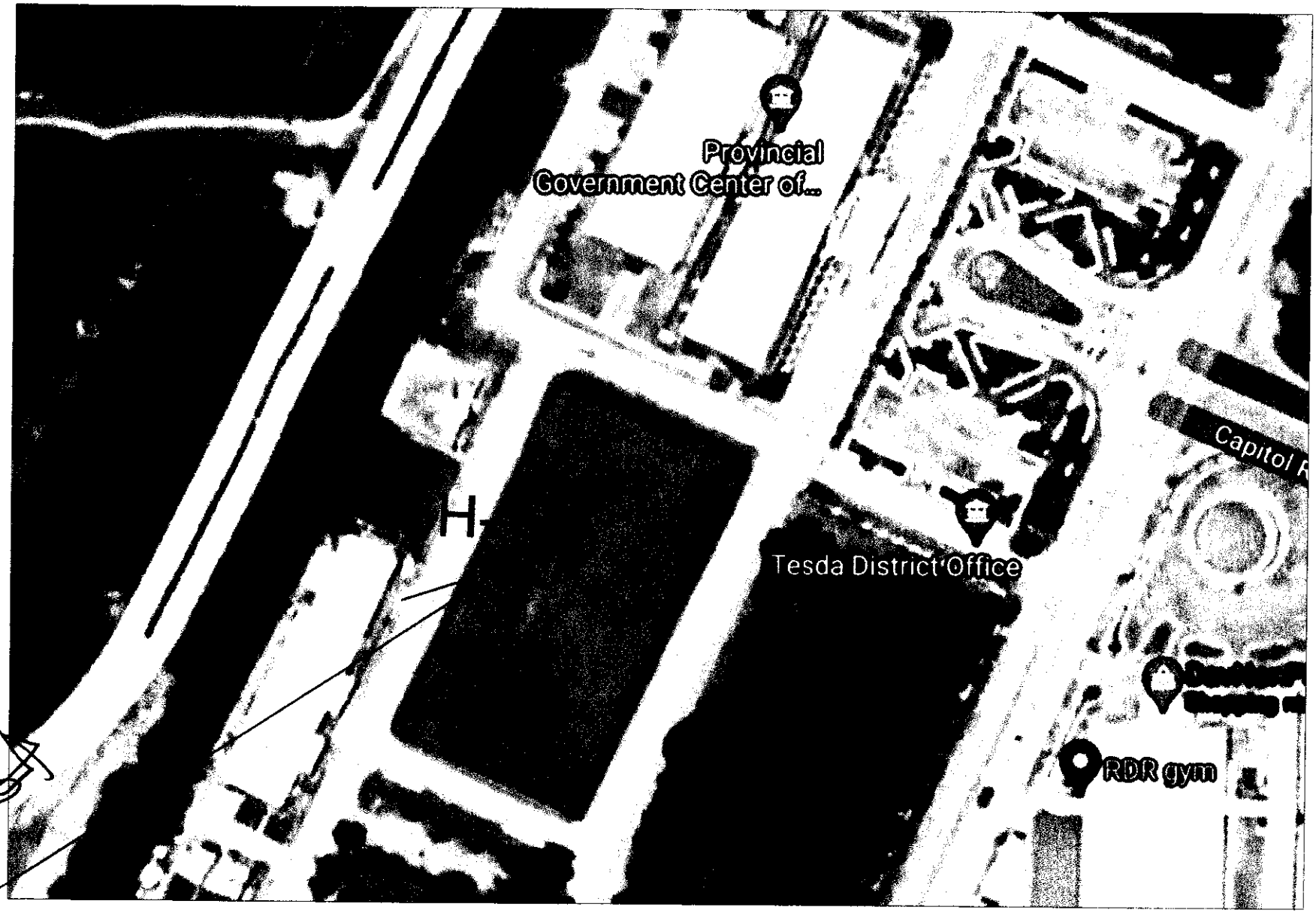



PROJECT: PROPOSED 2-STOREY SP, LEGISLATIVE BUILDING, GOVERNMENT CENTER
LOCATION: MANKILAM, TAGUM CITY
OWNER: ARTOR P.E.O. DAVAO del NORTE
DEPTH: 1.5-2.0 M
SS # 4
BOREHOLE 1
TIME: 8:33 AM
PROJECT: PROPOSED 2-STOREY SP, LEGISLATIVE BUILDING, GOVERNMENT CENTER
LOCATION: MANKILAM, TAGUM CITY
OWNER: ARTOR P.E.O. DAVAO del NORTE
DEPTH: 1.0-1.5 M
SS # 3
BOREHOLE 1
TIME: 8:15 AM
LOCATION: MANKILAM, TAGUM CITY
OWNER: ARTOR P.E.O. DAVAO del NORTE
DEPTH: 0.5-1.0 M
SS # 2
BOREHOLE 1
TIME: 8:07 AM
PROJECT: PROPOSED 2-STOREY SP, LEGISLATIVE BUILDING, GOVERNMENT CENTER
LOCATION: MANKILAM, TAGUM CITY
OWNER: ARTOR P.E.O. DAVAO del NORTE
DEPTH: 0.0-0.5 M
SS # 1
BOREHOLE 1
TIME: 7:57 AM

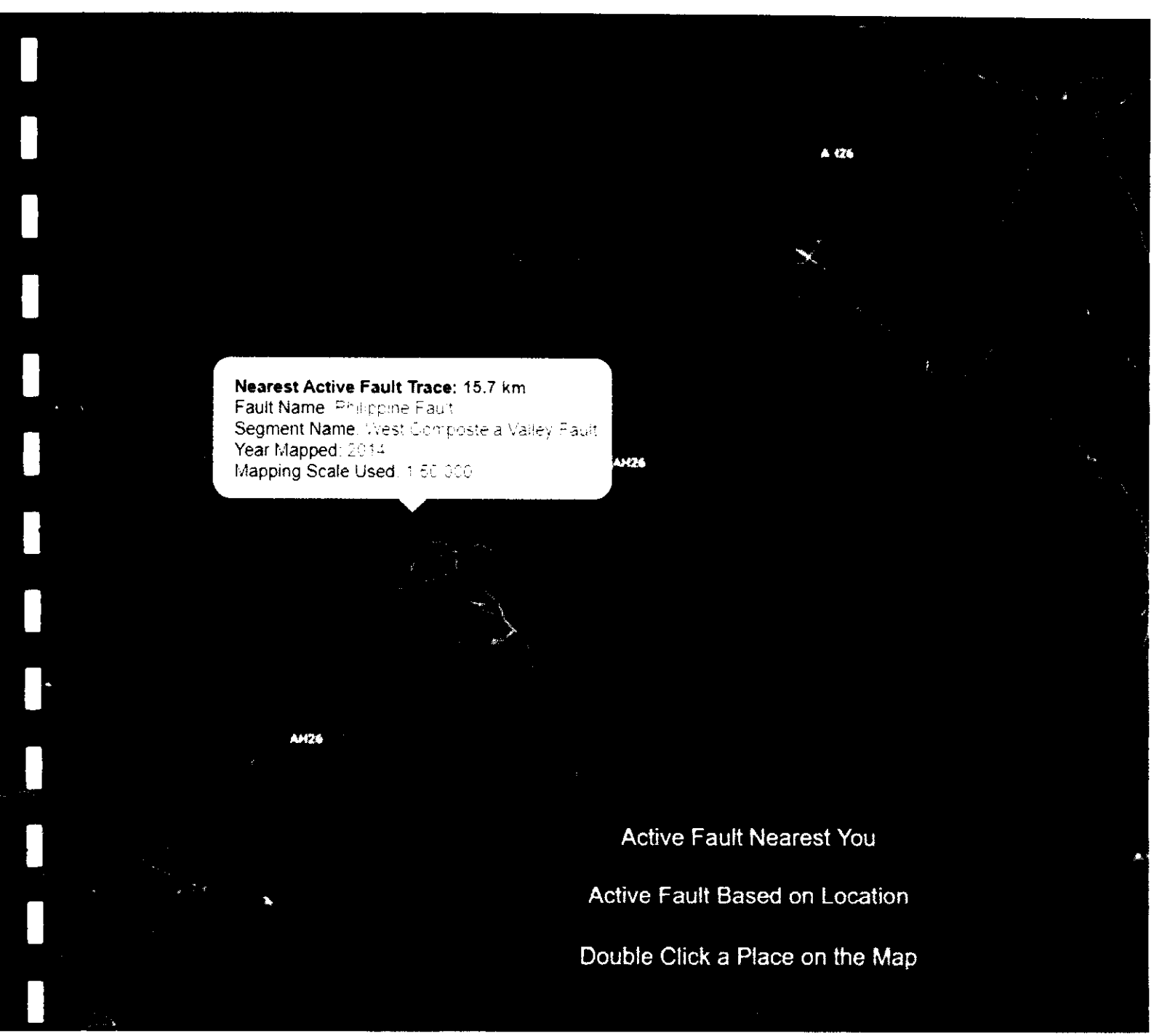


VICINITY MAP - THIS SITE - Proposed Two Storey SP/Legislative Building, DDN Provincial Government Center, Mankilam, Tagum City.

Project Proponent: DDN Provincial Government



LOCATION OF BOREHOLE- Proposed Two Storey SP/Legislative Building, DDN Provincial Government Center, Mankilam, Tagum City.
Project Proponent: DDN Provincial Government


A 426
AM26
AM26
Nearest Active Fault Trace: 15.7 km
Fault Name: Philippine Fault
Segment Name: West Compostela Valley Fault
Year Mapped: 2014
Mapping Scale Used: 1:50,000
Active Fault Nearest You
Active Fault Based on Location
Double Click a Place on the Map

Republic of the Philippines
Department of Science and Technology
PHILIPPINE INSTITUTE OF VOLCANOLOGY AND SEISMOLOGY

DATE	5 October 2020, 1:05 am
LOCATION	City of Tagum (Capital), Davao del Norte
COORDINATES	7.45616 , 125.78202

Note: When scanning the QR code, the assessment results in the website might vary from the results stated in this report due to updates in the data in the GeoRiskPH database. You may refer to the report available upon scanning the QR code for the updated assessment results

Scan to view location

SEISMIC HAZARDS ASSESSMENT

HAZARD	ASSESSMENT	EXPLANATION AND RECOMMENDATION
Ground Rupture	**Safe; Approximately 15.6 km from the West Compostela Valley Fault**	Ground rupture hazard assessment is the distance to the nearest known active fault in the area. The recommended buffer zone, or Zone of Avoidance, against ground rupture hazard is at least 5 meters on both sides of the active fault or from its Zone of Deformation. Active faults are those that have moved within the last 10,000 years. It shows evidence or has documented history of its recent movement. Ground rupture is a displacement along an active fault trace that reaches the surface.
Ground Shaking	Prone	All sites may be affected by ground shaking in the event of an earthquake and can be mitigated by following the provisions of the National Building code and the Structural code of the Philippines.
Liquefaction	Generally Susceptible	Liquefaction is a phenomenon wherein the ground, especially near the river, lake and coasts, behaves like liquid similar to quicksand due to very strong shaking. Liquefaction hazards can be mitigated by following the provisions of the National Building Code and the Structural Code of the Philippines.
Earthquake-Induced Landslide	Data are being updated	Earthquake-induced landslides are the downward slope movement of rocks, solid and other debris commonly triggered by strong shaking.
Tsunami	**Safe**	A tsunami is a series of sea waves commonly generated by under-the-sea earthquakes and whose heights could be greater than 5 meters.

Note:

- All hazard assessments are based on the available susceptibility maps and the coordinates of the user's selected location.

PROJECT: Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City

Elev.	BH-1 Bearing Capacity		SPT Depth	Bearing Capacity psf by 2:1 Method		BH-1 Field SPT			Ave. Field SPT		BH-1 (assumed elevation = 0.0 m for the borehole location)							
-0.5 m	124.6 KPa	**2605 psf**	-0.5 m	90.9 KPa	1900 psf	8			8	ML	SC-SM	SC-SM	SC-SM	SC-SM	SC-SM	SC-SM	SC-SM	SC-SM
-1.0 m	116.6 KPa	**2438 psf**	-1.0 m	90.9 KPa	1900 psf	8			8	ML	SC-SM	SC-SM	SC-SM	SC-SM	SC-SM	SC-SM	SC-SM	SC-SM
-1.5 m	85.1 KPa	**1779 psf**	-1.5 m	86.2 KPa	1801 psf	4			4	ML	SM1	SM1	SM1	SM1	SM1	SM1	SM1	SM1
-2.0 m	86.2 KPa	**1801 psf**	-2.0 m	86.2 KPa	1801 psf	5			5	ML	SM1	SM1	SM1	SM1	SM1	SM1	SM1	SM1
-2.5 m	126.2 KPa	**2637 psf**	-2.5 m	71.8 KPa	1500 psf	11			11	ML	SM1	SM1	SM1	SM1	SM1	SM1	SM1	SM1
-3.0 m	104.7 KPa	**2187 psf**	-3.0 m	71.8 KPa	1500 psf	8			8	ML	SM1	SM1	SM1	SM1	SM1	SM1	SM1	SM1
-4.5 m	56.9 KPa	**1190 psf**	-4.5 m	56.9 KPa	**1190 psf**	3			3	SM	SM1	SM1	SM1	SM1	SM1	SM1	SM1	SM1
-6.0 m	84.3 KPa	**1762 psf**	-6.0 m	84.3 KPa	**1762 psf**	7			7	SM	SM1	SM1	SM1	SM1	SM1	SM1	SM1	SM1
-7.5 m	91.2 KPa	**1906 psf**	-7.5 m	91.2 KPa	**1906 psf**	9			9	SM	SM1	SM1	SM1	SM1	SM1	SM1	SM1	SM1
-9.0 m	62.3 KPa	**1302 psf**	-9.0 m	62.3 KPa	**1302 psf**	5			5	SM	SM1	SM1	SM1	SM1	SM1	SM1	SM1	SM1
-10.5 m	81.7 KPa	**1707 psf**	-10.5 m	81.7 KPa	**1707 psf**	9			9	SM	SM1	SM1	SM1	SM1	SM1	SM1	SM1	SM1
-12.0 m	74.2 KPa	**1552 psf**	-12.0 m	74.2 KPa	**1552 psf**	8			8	SM	SM1	SM1	SM1	SM1	SM1	SM1	SM1	SM1
-13.5 m			-13.5 m															
-15.0 m			-15.0 m															
-16.5 m			-16.5 m															
-18.0 m																		
-19.5 m																		
-21.0 m																		
-22.50 m																		

CL-ML -Sandy Silty Clay

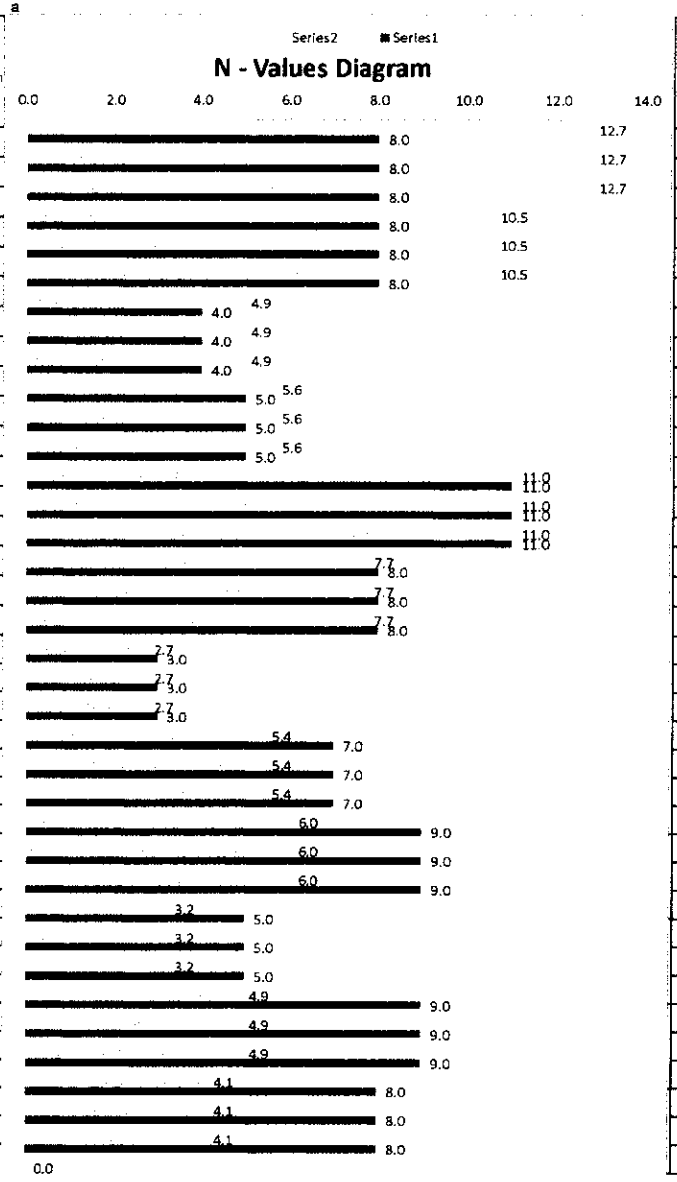
SW - Well-graded Sand
SW-SM - Well-grade Sand with silt
SM - Silty Sand
CORE Rock
Silty, Clayey Sand

ML - Sandy Silt
SM - Silty Sand with
MH -Sandy Elastic S
GM - Silty Gravel wit

BORING LOG

Name of Project : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
Location : Davao del Norte Government Center, Mankilam, Tagum City
BOREHOLE NO. 1
Type of Boring : Boring by Drilling Rig and SPT Split Sampler **Date of Boring :**
Ground Elevation : 0.0 (assumed value)

Sample No.	Group Sample	Moisture Content	Liquid Limit	Consistency or Compactness	USCS Symbol	Soil or Rock Description	GRAPH	SPT DEPTH (m)	SPT Field measured Penetration Number	SPT Corrected Penetration Number N-Values
								0		
SS1	GS-1	12.3%	23.2%	Loose	SC-SM	Silty, Clayey Sand Slightly plastic	SC-SM	0.00	8.0	12.7
		12.3%	23.2%	Loose			SC-SM	0.33	8.0	12.7
		12.3%	23.2%	Loose			SC-SM	0.50	8.0	12.7
SS2	GS-1	10.8%	23.2%	Loose	SC-SM	Silty, Clayey Sand Slightly plastic	SC-SM	0.66	8.0	10.5
		10.8%	23.2%	Loose			SC-SM	0.83	8.0	10.5
		10.8%	23.2%	Loose			SC-SM	1.00	8.0	10.5
SS3	GS-2	20.0%	0.0%	Very Loose	SM	Silty Sand Non plastic	SM	1.17	4.0	4.9
		20.0%	0.0%	Very Loose			SM	1.33	4.0	4.9
		20.0%	0.0%	Very Loose			SM	1.50	4.0	4.9
SS4	GS-2	31.6%	0.0%	Loose	SM	Silty Sand Non plastic	SM	1.67	5.0	5.6
		31.6%	0.0%	Loose			SM	1.83	5.0	5.6
		31.6%	0.0%	Loose			SM	2.00	5.0	5.6
SS5	GS-2	18.7%	0.0%	Medium	SM	Silty Sand Non plastic	SM	2.17	11.0	11.0
		18.7%	0.0%	Medium			SM	2.33	11.0	11.0
		18.7%	0.0%	Medium			SM	2.50	11.0	11.0
SS6	GS-2	28.9%	0.0%	Loose	SM	Silty Sand Non plastic	SM	2.67	8.0	7.7
		28.9%	0.0%	Loose			SM	2.84	8.0	7.7
		28.9%	0.0%	Loose			SM	3.00	8.0	7.7
SS7	GS-2	23.5%	0.0%	Very Loose	SM	Silty Sand Non plastic	SM	3.50	3.0	2.7
		23.5%	0.0%	Very Loose			SM	4.00	3.0	2.7
		23.5%	0.0%	Very Loose			SM	4.50	3.0	2.7
SS8	GS-2	26.9%	0.0%	Loose	SM	Silty Sand Non plastic	SM	5.00	7.0	5.4
		26.9%	0.0%	Loose			SM	5.50	7.0	5.4
		26.9%	0.0%	Loose			SM	6.00	7.0	5.4
SS9	GS-2	14.3%	0.0%	Loose	SM	Silty Sand Non plastic	SM	6.50	9.0	6.0
		14.3%	0.0%	Loose			SM	7.00	9.0	6.0
		14.3%	0.0%	Loose			SM	7.50	9.0	6.0
SS10	GS-2	29.2%	0.0%	Loose	SM	Silty Sand Non plastic	SM	8.00	5.0	3.2
		29.2%	0.0%	Loose			SM	8.50	5.0	3.2
		29.2%	0.0%	Loose			SM	9.00	5.0	3.2
SS11	GS-2	23.4%	0.0%	Loose	SM	Silty Sand Non plastic	SM	9.50	9.0	4.9
		23.4%	0.0%	Loose			SM	10.00	9.0	4.9
		23.4%	0.0%	Loose			SM	10.50	9.0	4.9
SS12	GS-2	21.6%	0.0%	Loose	SM	Silty Sand Non plastic	SM	11.00	8.0	4.1
		21.6%	0.0%	Loose			SM	11.50	8.0	4.1
		21.6%	0.0%	Loose			SM	12.00	8.0	4.1

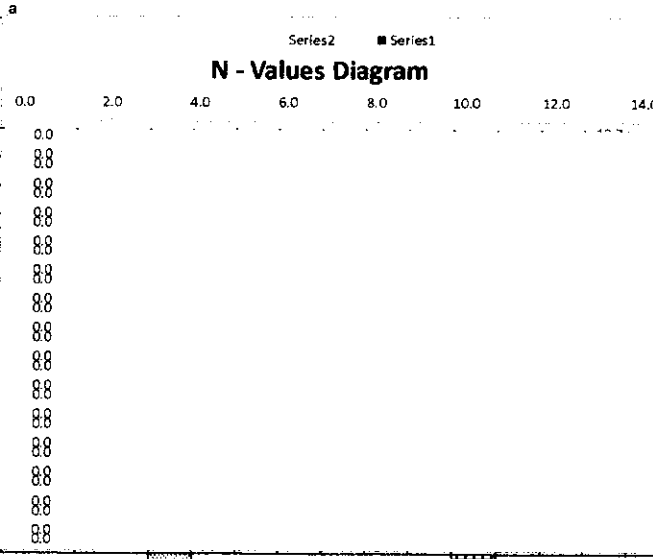


SPT Field measured Penetration Number	SPT Corrected Penetration Number N-Values
8.0	12.7
8.0	12.7
8.0	12.7
8.0	12.7
8.0	10.5
8.0	10.5
8.0	10.5
4.0	4.9
4.0	4.9
4.0	4.9
5.0	5.6
5.0	5.6
5.0	5.6
11.0	11.0
11.0	11.0
11.0	11.0
8.0	7.7
8.0	7.7
8.0	7.7
3.0	2.7
3.0	2.7
3.0	2.7
7.0	5.4
7.0	5.4
7.0	5.4
9.0	6.0
9.0	6.0
9.0	6.0
5.0	3.2
5.0	3.2
5.0	3.2
9.0	4.9
9.0	4.9
9.0	4.9
8.0	4.1
8.0	4.1
8.0	4.1

BORING LOG

Name of Project : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
Location : Davao del Norte Government Center, Mankilam, Tagum City
BOREHOLE NO. 1
Ground Elevation : 0.0 (assumed value)
Type of Boring : Boring by Drilling Rig and SPT Split Sampler **Date of Boring :**

Sample No.	Group Sample	Moisture Content	Liquid Limit	Consistency or Compactness	USCS Symbol	Soil or Rock Description	GRAPH	SPT DEPTH (m)	SPT Field measured Penetration Number	SPT Corrected Penetration Number N-Values
		0.0%	0.0%	0.0				12.50	0.0	0.0
SS13	0.00	0.0%	0.0%	0.0	0	0		13.00	0.0	0.0
-13.5		0.0%	0.0%	0.0				13.50	0.0	0.0
		0.0%	0.0%	0.0				14.00	0.0	0.0
SS14	0.00	0.0%	0.0%	0.0	0	0		14.50	0.0	0.0
-15		0.0%	0.0%	0.0				15.00	0.0	0.0
		0.0%	0.0%	0.0				15.50	0.0	0.0
SS15	0.00	0.0%	0.0%	0.0	0	0		16.00	0.0	0.0
-16.5		0.0%	0.0%	0.0				16.50	0.0	0.0
		0.0%	0.0%	0.0				17.00	0.0	0.0
SS16	0.00	0.0%	0.0%	0.0	0	0		17.50	0.0	0.0
-18		0.0%	0.0%	0.0				18.00	0.0	0.0
		0.0%	0.0%	#REF!				18.50	0.0	0.0
SS17	0.00	0.0%	0.0%	#REF!	0	0		19.00	0.0	0.0
-20		0.0%	0.0%	#REF!				19.50	0.0	0.0



SPT Field measured Penetration Number	SPT Corrected Penetration Number N-Values
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0
0.0	0.0

Legend:

SPT Field measured N-Values

SPT Corrected Values

CORING

SC	SC - Clayey SAND	CH	CH: Sandy Fat CLAY
CL	CL - Lean CLAY with Sand	MH	MH - Sandy Elastic SILT
SM	SM - Silty Sand, Moderately Plastic fines	SM	SM - Silty SAND with Gravel
		SM	SM - Silty SAND
	Silty Clayey Sand	CL-ML	CL-ML - Sandy Silty CLAY
		SW-SM	SW-SM - Well-graded Sand with Silt and Gravel

SC	SC - Clayey SAND with Gravel
CL	CL - Sandy Lean CLAY
ML	ML - Sandy SILT
GM	GM - Silt Gravel with Sand
GM	GM -Well-grade Gravel with Silt and Sand
ML	ML - Silt with Sand

GEOTECHNICAL DATA LOG (LABORATORY & CORRELATION)

PROJECT : **Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't C**
LOCATION: **Davao del Norte Government Center, Mankilam, Tagum City**
DATE: **9/20/2020**
EXPLORED BY: LPRA GEO-SOLUTIONS

Start:
Finish:

BOREHOLE NO. 1

LEGEND :

SS - SPLIT SPOON SAMPLE
ST - SHELBY TUBE SAMPLE
CS - CORE SAMPLE

N - STANDARD PENETRATION NUMBER (Blow/304.8mm)
NS - NO SAMPLE
NA - NOT APPLICABLE
NP - NON PLASTIC

FIELD DATA LOG

DEPTH (m)	SAMPLE No.	LENGTH OF SAMPLE	GROUP SAMPLE	Standard Penetration Test - Number of Blows			Measured N-Values		UNIFIED SOIL CLASSIFICATION(USCS)	
									SYMBOL	SOIL & ROCK DESCRIPTION
0.0 -0.5	SS1	23.00	GS-1	2	3	5	8	12.7	SC-SM	Silty, Clayey Sand Slightly plastic
0.5 -1.0	SS2	28.00	GS-1	6	5	3	8	10.5	SC-SM	Silty, Clayey Sand Slightly plastic
1.0 -1.5	SS3	22.00	GS-2	2	2	2	4	4.9	SM	Silty Sand Non plastic
1.5 -2.0	SS4	50.00	GS-2	2	2	3	5	5.6	SM	Silty Sand Non plastic
2.0 - 2.5	SS5	34.00	GS-2	5	5	6	11	11.0	SM	Silty Sand Non plastic
2.5 -3.0	SS6	41.00	GS-2	5	4	4	8	7.7	SM	Silty Sand Non plastic
3.0 - 4.5	SS7	50.00	GS-2	1	1	2	3	2.7	SM	Silty Sand Non plastic
4.5 -6.0	SS8	50.00	GS-2	3	3	4	7	5.4	SM	Silty Sand Non plastic
6.0 - 7.5	SS9	50.00	GS-2	4	4	5	9	6.0	SM	Silty Sand Non plastic
7.5 - 9.0	SS10	50.00	GS-2	2	2	3	5	3.2	SM	Silty Sand Non plastic
9.0 - 10.5	SS11	50.00	GS-2	4	4	5	9	4.9	SM	Silty Sand Non plastic
10.5 - 12.0	SS12	50.00	GS-2	4	4	4	8	4.1	SM	Silty Sand Non plastic
12.0 - 13.5	SS13									
13.5 - 15.0	SS14									
15.0 - 16.5	SS15									
16.5 - 18.0	SS16									
18.0-20.0	SS17									

LABORATORY DATA LOG

DEPTH (m)	SAMPLE No.	GRAIN SIZE % R-RETAINED		GRAIN SIZE % F-PASSING		GRAIN SIZE ANALYSIS % COARSE			Uniformity Coefficient C_u	Coefficient of Gradation C_c	Liquid Limit LL %	Plastic Limit PL %	Plastic Index from Test PI %	Plastic Index from Chart A-Line % PI= 73(LL-20)	Plastic Index from Chart U-Line % PI= 9(LL-8)	Water Content %	Unit Weight KN/m^3
		R_4	R_{200}	$.5R_{200}$	F_{200} (Fines)	Gravel Fraction	Sand Fraction	SF/GF									
0.0 -0.5	SS1			32.7%	34.6%			3.5						2.30%	13.64%	12.31%	16.44
0.5 -1.0	SS2	14.4%	65.4%	32.7%	34.6%	14.4%	51.0%	3.5	18.26	0.46	23.2%	19.9%	3.25%	2.30%	13.64%	10.76%	15.67
1.0 -1.5	SS3			37.4%	25.3%			19.0			0.0%	0.0%	0.00%	NP	NP	20.04%	14.73
1.5 -2.0	SS4	3.7%	74.7%	37.4%	25.3%	3.7%	71.0%	19.0	18.26	1.81	0.0%	0.0%	0.00%	NP	NP	31.62%	14.92
2.0 - 2.5	SS5	3.7%	74.7%	37.4%	25.3%	3.7%	71.0%	19.0	18.26	1.81	0.0%	0.0%	0.00%	NP	NP	18.72%	17.46
2.5 -3.0	SS6	3.7%	74.71%	37.4%	25.3%	3.74%	70.98%	19.0	18.26	1.81	0.00%	0.00%	0.00%	NP	NP	28.65%	18.14
3.0 - 4.5	SS7	3.7%	74.71%	37.4%	25.3%	3.74%	70.98%	19.0	18.26	1.81	0.00%	0.00%	0.00%	NP	NP	23.50%	16.09
4.5 -6.0	SS8	3.7%	74.7%	37.4%	25.3%	3.7%	71.0%	19.0	18.26	1.81	0.0%	0.0%	0.00%	NP	NP	26.88%	17.39
6.0 - 7.5	SS9	3.7%	74.7%	37.4%	25.3%	3.7%	71.0%	19.0	20.45	1.81	0.0%	0.0%	0.00%	NP	NP	14.30%	17.77
7.5 - 9.0	SS10	3.7%	74.7%	37.4%	25.3%	3.7%	71.0%	19.0	20.45	1.81	0.0%	0.0%	0.00%	NP	NP	29.17%	16.90
9.0 - 10.5	SS11	3.7%	74.7%	37.4%	25.3%	3.7%	71.0%	19.0	20.45	1.81	0.0%	0.0%	0.00%	NP	NP	23.36%	17.66
10.5 - 12.0	SS12	3.7%	74.7%	37.4%	25.3%	3.7%	71.0%	19.0	20.45	1.81	0.0%	0.0%	0.00%	NP	NP	21.64%	17.39
12.0 - 13.5	SS13																
13.5 - 15.0	SS14																
15.0 - 16.5	SS15																
16.5 - 18.0	SS16																
18.0-20.0	SS17																

SC-SM	16	2	8.0
SM	69	10	6.9
	85	12.0	7.1

SM 201

GEOTECHNICAL DATA LOG (LABORATORY & CORRELATION)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
EXPLORED BY: LPRA GEO-SOLUTIONS

BOREHOLE NO. 1

COMPUTED VALUES BY CORRELATION													
DEPTH (m)	SPT NUMBER N_c	USCS Symbols	For Granular Soil ϕ from (Peck,Hanson & Thornburn, Wolf 1989), (Schmertmann 1975 & Mayne/Kulhawy 1990), (Hatanaka & Uchida - 1996)	For Coarse Grained-Soil ϕ from Joseph Bowles Correlation	Typical Values ϕ from AASHTO T99 & 85 B77 1975	Representative Values for Soil Type ϕ Angle of Internal Friction	For Clay Soil C_u from (Stroud - 1974) , Hara - 1971)	For Fine-Grained Soil C_u from NAVFAC DM 7.01	Typical Values C_u from AASHTO T99 & 85 B77-1975 Compacted to Saturated	Representative Values for Soil Type C_u Cohesion - Kpa	Fined-grained Soils SOIL CONSISTENCY	Granular Soil Compactness
0.0 -0.5	8	SC-SM		29.20	30	31			29	29		Loose
0.5 -1.0	8	SC-SM		29.20	30	31			29	29		Loose
1.0 -1.5	4	SM		27.50	28	28			22	22		Very Loose
1.5 -2.0	5	SM		28.00	28	29			23	23		Loose
2.0 - 2.5	11	SM		30.50	29	31			27	27		Medium
2.5 -3.0	8	SM		29.20	28	30			25	25		Loose
3.0 - 4.5	3	SM		27.00	27	27			22	22		Very Loose
4.5 -6.0	7	SM		28.80	28	29			24	24		Loose
6.0 - 7.5	9	SM		29.60	28	29			25	25		Loose
7.5 - 9.0	5	SM		28.00	28	27			23	23		Loose
9.0 - 10.5	9	SM		29.60	28	28			25	25		Loose
10.5 - 12.0	8	SM		29.20	28	28			25	25		Loose
	1			26.00				6.58				
											Very Soft	Very Loose
16.7	12.00				SC-SM	31	2	15.5	SC-SM	29	2	14.3
					SM	285	10	28.5	SM	241	10	24.1

WATER CONTENT

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
TESTING BY : LPRA GEO-SOLUTIONS

BOREHOLE NO. 1

Sample	WT. of Empty Can (grams)	WT. of Wet Sample plus Can (grams)	WT. of Dry Sample plus Can (grams)	WT. of Water (grams)	WT. of Dry Sample (grams)	Water Content w, %
SS1	8.70	*63.24*	*57.26*	5.98	48.56	**12.31%**
SS2	8.89	*47.19*	*43.47*	3.72	34.58	**10.76%**
SS3	8.78	*61.50*	*52.70*	8.80	43.92	**20.04%**
SS4	8.76	*54.21*	43.29	10.92	34.53	**31.62%**
SS5	8.83	*61.59*	53.27	8.32	44.44	**18.72%**
SS6	8.48	*57.38*	46.43	10.95	37.95	**28.85%**
SS7	8.90	*76.07*	63.29	12.78	54.39	**23.50%**
SS8	8.74	*50.80*	41.89	8.91	33.15	**26.88%**
SS9	8.60	*64.48*	57.49	6.99	48.89	**14.30%**
SS10	8.64	*56.73*	45.87	10.86	37.23	**29.17%**
SS11	8.60	*62.99*	52.69	10.30	44.09	**23.36%**
SS12	8.84	*53.07*	45.20	7.87	36.36	**21.64%**
SS13						
SS14						
SS15						
SS16						
SS17						

UNIT WEIGHT OF SOIL

Start:
Finish

SYMBOL	GROUP SAMPLE	N- value	Length (cm)	Volume (m^3)	Total Wt. Soil plus Can (grams)	Empty Can of Empty Can (grams)	Wt. of soil (KN)	Unit Weight of Soil (γ) - Calculated (KN/m^3)	Unt Weight of Soil (γ) - from Table (KN/m^3)	Ave. Unt Weight of Soil (γ) ($KN/m3$)
SC-SM	GS-1	8	23.00	0.00026	448.94	8.89	0.00432	16.54	*16.33*	**16.44**
SC-SM	GS-1	8	28.00	0.00032	494.44	8.61	0.00476	15.00	*16.33*	**15.67**
SM	GS-2	4	22.00	0.00025	605.94	8.40	0.00586	15.27	*14.20*	**14.73**
SM	GS-2	5	50.00	0.00057	866.94	9.01	0.00841	14.84	*15.00*	**14.92**
SM	GS-2	11	34.00	0.00039	707.94	8.77	0.00686	17.78	*17.13*	**17.46**
SM	GS-2	8	41.00	0.00046	953.94	8.64	0.00927	19.94	*16.33*	**18.14**
SM	GS-2	3	50.00	0.00057	1094.94	9.01	0.01065	18.78	*13.40*	**16.09**
SM	GS-2	7	50.00	0.00057	1114.94	9.30	0.01084	19.12	*15.67*	**17.39**
SM	GS-2	9	50.00	0.00057	1080.94	8.81	0.01051	18.54	*17.00*	**17.77**
SM	GS-2	5	50.00	0.00057	1095.44	8.74	0.01066	18.79	*15.00*	**16.90**
SM	GS-2	9	50.00	0.00057	1067.94	8.80	0.01039	18.32	*17.00*	**17.66**
SM	GS-2	8	50.00	0.00057	1075.44	8.80	0.01046	18.45	*16.33*	**17.39**

200.55

ATTERBERG LIMITS TESTS

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
EXPLORED BY: LPRA GEO-SOLUTIONS

SAMPLE NO.: GS-1 BH-1

LIQUID LIMIT

Can Description	LL1 (grams)	LL2 (grams)	LL3 (grams)	LL4 (grams)
Mass of Wet Soil + Can	11.93	11.63	11.68	
Mass of Dry Soil + Can	11.33	11.02	11.06	
Mass of Can	8.78	8.59	8.70	8.59
Mass of Dry Soil, Ws	2.55	2.43	2.36	-8.59
Mass of Moisture, Ww	0.60	0.61	0.62	0.00
No. of Blows, N	23	18	12	
Water Content, w(%)	23.53%	25.10%	26.27%	0.00%
	0.2353	0.2510	0.2627	0.0000
	1	2	3	4

LL_{ave} = **24.97%** 3

COMPUTATION :

Flow Index:

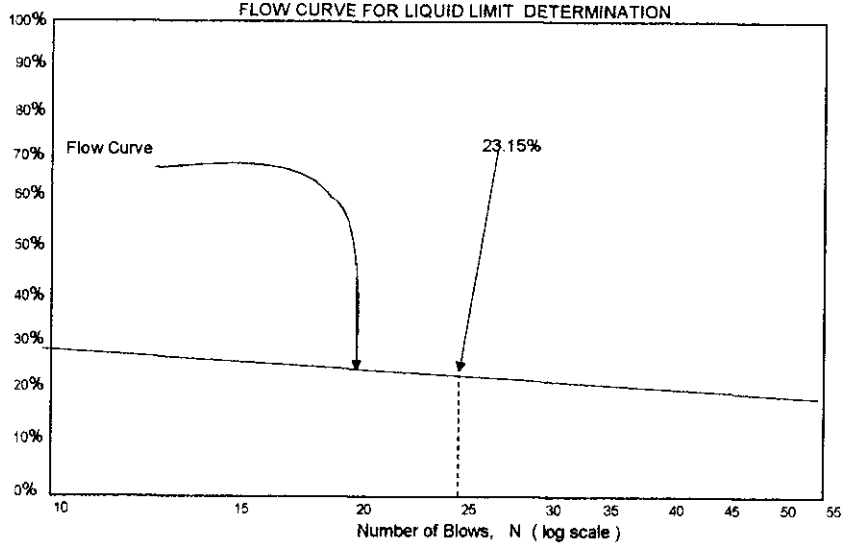
Flow Index, $I_F = \frac{(w1-w2)}{\log(N2/N1)}$

I_{F1} = 0.1478
I_{F2} = 0.0663
I_{F3} = 0.0970
I_{ave} = 0.10373

Equation of Flow Line:

$w = -I_F \log(25/N1) + w1$

w1 = 23.53%
N1 = 23
w @ 25 = 23.15%
Liquid Limit @ 25 Blows = 23.15% 3



Liquid Limit, LL = **23.15%**
Plastic Limit, PL = **19.90%**
Plasticity Index, PI = **3.26%**

PLASTIC LIMIT

Can Description	PL1 (grams)	PL2 (grams)	PL3 (grams)	PL4 (grams)
Mass of Wet Soil + Can	11.62	11.51	11.52	
Mass of Dry Soil + Can	11.13	11.09	11.06	
Mass of Can	8.61	8.96	8.82	8.80
Mass of Dry Soil	2.52	2.13	2.24	-8.80
Mass of Moisture	0.49	0.42	0.46	0.00
Water Content, w(%)	19.44%	19.72%	20.54%	0.00%

w_{ave} = **19.90%** 3

SAMPLE NO.: **GS-2** **BH-1**

LIQUID LIMIT

Can Description	LL1 (grams)	LL2 (grams)	LL3 (grams)	LL4 (grams)
Mass of Wet Soil + Can				
Mass of Dry Soil + Can				
Mass of Can	8.72	8.68	8.51	8.89
Mass of Dry Soil, Ws	-8.72	-8.68	-8.51	-8.89
Mass of Moisture, Ww	0.00	0.00	0.00	0.00
No. of Blows, N	18	14	10	0
Water Content, w(%)	0.00%	0.00%	0.00%	0.00%
	0.0000	0.0000	0.0000	0.0000
	1	2	3	4

LL_{ave} = **0.00%** | 3

COMPUTATION :

Flow Index:

Flow Index, $I_F = \frac{(w1-w2)}{\log(N2/N1)}$

I_{F1} = 0.0000

I_{F2} = 0.0000

I_{F3} = 0.0000

I_{ave} = 0.00000

Equation of Flow Line:

$w = -I_F \log(25/N1) + w1$

w1 = 0.00%

N1 = 18

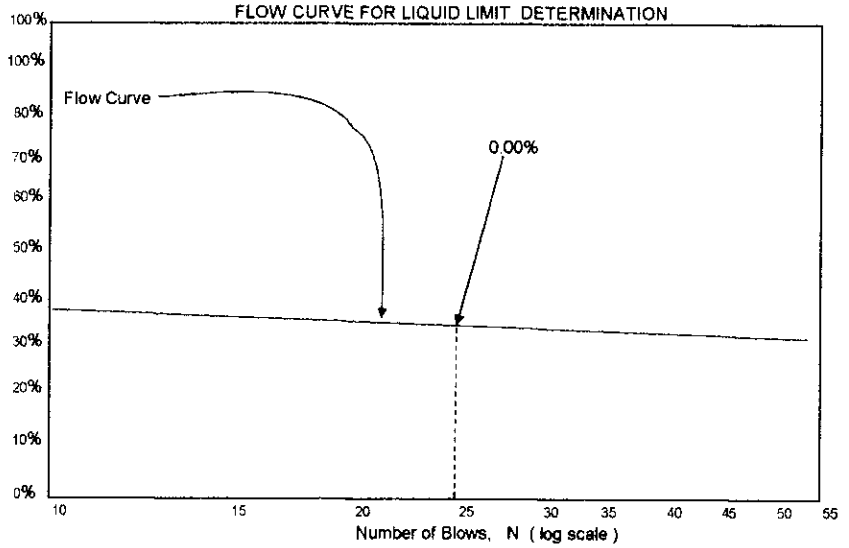
w @ 25 = 0.00%

Liquid Limit @ 25 Blows = 0.00% | 3

PLASTIC LIMIT

Can Description	PL1 (grams)	PL2 (grams)	PL3 (grams)	PL4 (grams)
Mass of Wet Soil + Can				
Mass of Dry Soil + Can				
Mass of Can	9.14	8.60	8.77	9.13
Mass of Dry Soil	-9.14	-8.60	-8.77	-9.13
Mass of Moisture	0.00	0.00	0.00	0.00
Water Content, w(%)	0.00%	0.00%	0.00%	0.00%

W_{ave} = **0.00%** | 3



Liquid Limit, LL = **0.00%** **NON PLASTIC**

Plastic Limit, PL = **0.00%** **NON PLASTIC**

Plasticity Index, PI = **0.00%** **NON PLASTIC**

PARTICLE SIZE ANALYSIS (ASTM D422)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
EXPLORED BY: LPRA GEO-SOLUTIONS

SAMPLE NO. BH-1 GS-1
PHYSICAL DESCRIPTION :

WT. OF UNWASHED SAMPLE+CAN	337.00	Grams	
WT. OF WASHED SAMPLE+CAN	230.00	Grams	
WT. OF CAN	25.00	Grams	
WT. OF UNWASHED SAMPLE	312.00	Grams	
WT. OF WASHED SAMPLE	205.00	Grams	
LOOSES :		By Weight	107.00

Sieve No.	Sieve Size mm	Weight of Empty Sieve gms	Weight of Sieve+ Soil Retained	Weight Retained gms	Percent retained %	CUMMULATIVE Wt. Passing gms	Passing %	Retained %	REMARKS	
1-1/2"	37.500				0.000%	312.000	100.00%	0.00%	Gravel	100%
1"	25.400				0.000%	312.000	100.00%	0.00%	Gravel	100%
3/4"	19.050				0.000%	312.000	100.00%	0.00%	Gravel	100%
1/2"	12.700				0.000%	312.000	100.00%	0.00%	Gravel	100%
3/8"	9.530				0.000%	312.000	100.00%	0.00%	Gravel	100%
# 4	4.760	507.0	552.0	*45.000*	14.423%	267.000	85.58%	14.42%	Gravel	100%
# 8	2.360				0.000%	267.000	85.58%	14.42%	Sand	100%
# 10	2.000	482.0	504.5	*22.500*	7.212%	244.500	78.37%	21.63%	Sand	100%
# 16	1.180				0.000%	244.500	78.37%	21.63%	Sand	100%
# 20	0.840	408.0	430.0	*22.000*	7.051%	222.500	71.31%	28.69%	Sand	100%
# 30	0.590				0.000%	222.500	71.31%	28.69%	Sand	100%
# 40	0.420	382.5	410.0	*27.500*	8.814%	195.000	62.50%	37.50%	Sand	100%
# 50	0.297				0.000%	195.000	62.50%	37.50%	Sand	100%
# 60	0.274	366.0	395.0	*29.000*	9.295%	166.000	53.21%	46.79%	Sand	100%
# 100	0.149	342.5	374.0	*31.500*	10.096%	134.500	43.11%	56.89%	Sand	100%
# 200	0.074	359.5	386.0	*26.500*	8.494%	108.000	34.62%	65.38%	Sand	100%
PAN	0.001	405.0	406.0	*1.000*	34.615%	0.000	0.00%	100.00%	Silt & Clay	100%
Wash Passing No. 200				107.00						
Total Weight			205.0	312.000						
			205.0				Passing	Retained		
			0.0							

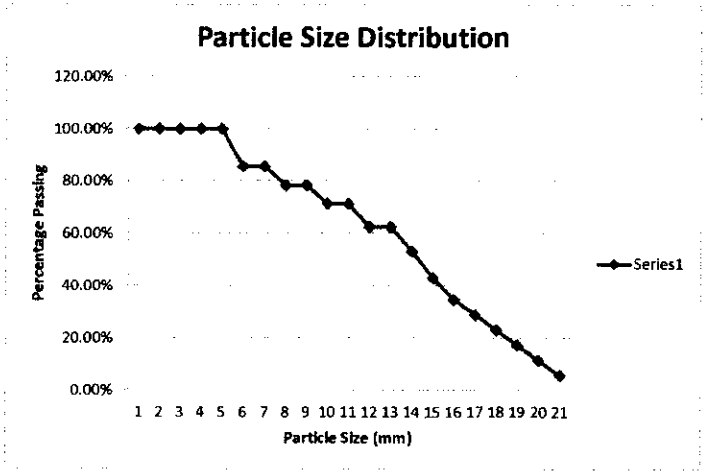
GRAIN SIZE DIAMETERS D_{10} = 0.02209 mm D_{30} = 0.06427 mm D_{60} = 0.40324 mm

	D_{10}	D_{30}	D_{60}
x1 =	0.001	0.001	0.001
x2 =			
x3 =	0.074	0.074	0.420
Diameter =	0.022088889	0.064266667	0.40324

	D_{10}	D_{30}	D_{60}	
y1 =	0.00%	0.00%	0.00%	passing
y2 =	19.50%	50.06%	50.00%	passing
y3 =	34.62%	34.62%	62.50%	passing

	Cummulative	Fraction %		
% Gravel (GF) =	14.42%	22.06%		
% Sand (SF) =	50.96%	77.94%	R_4 =	14.42%
% Fines =	34.62%		R_{200} =	65.38%
Coefficient of Uniformity, $C_u = D_{60}/D_{10}$ =	18.26		F_4 =	85.58%
Coefficient of Concavity, $C_c = D_{30}^2/(D_{10} D_{60})$ =	0.46		F_{200} =	34.62%

GRAVEL:		SAND:		SILT:	CLAY:
Coarse	3" - 3/4"	Coarse	#4 - #10	#200 - .005mm	< .005mm
Fine	3/4" - #4	Medium	#10 - #40		
		Fine	#40 - #200		



PARTICLE SIZE ANALYSIS (ASTM D422)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
EXPLORED BY: LPRA GEO-SOLUTIONS

SAMPLE NO. BH-1 GS-2
PHYSICAL DESCRIPTION :

WT. OF UNWASHED SAMPLE+CAN	373.00	Grams
WT. OF WASHED SAMPLE+CAN	287.00	Grams
WT. OF CAN	25.00	Grams
WT. OF UNWASHED SAMPLE	348.00	Grams
WT. OF WASHED SAMPLE	262.00	Grams
LOOSES :	By Weight	86.00

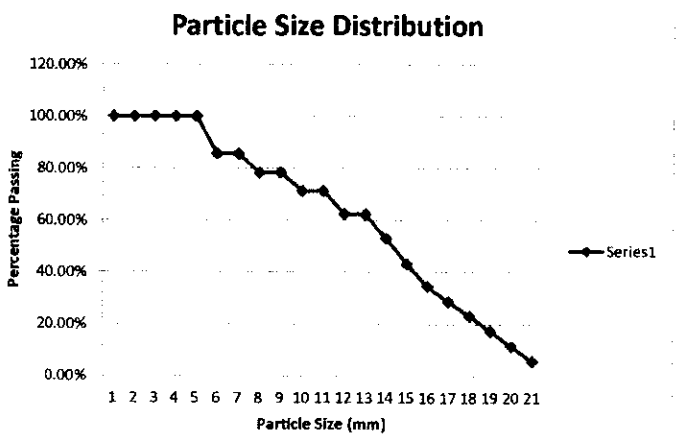
Sieve No.	Sieve Size mm	Weight of Empty Sieve gms	Weight of Sieve+ Soil Retained	Weight Retained gms	Percent retained %	CUMMULATIVE Wt. Passing gms	CUMMULATIVE Passing %	CUMMULATIVE Retained %	REMARKS	Cummulative Cummulative	Fraction % Fraction %
1-1/2"	37.500				0.000%	348.000	100.00%	0.00%	Gravel	100%	
1"	25.400				0.000%	348.000	100.00%	0.00%	Gravel	100%	
3/4"	19.050				0.000%	348.000	100.00%	0.00%	Gravel	100%	
1/2"	12.700				0.000%	348.000	100.00%	0.00%	Gravel	100%	
3/8"	9.530				0.000%	348.000	100.00%	0.00%	Gravel	100%	
# 4	4.760	507.0	520.0	*13.000*	3.736%	335.000	96.26%	3.74%	Gravel	100%	
# 8	2.360				0.000%	335.000	96.26%	3.74%	Sand	100%	
# 10	2.000	482.0	487.5	*5.500*	1.580%	329.500	94.68%	5.32%	Sand	100%	
# 16	1.180				0.000%	329.500	94.68%	5.32%	Sand	100%	
# 20	0.840	408.0	422.0	*14.000*	4.023%	315.500	90.66%	9.34%	Sand	100%	
# 30	0.590				0.000%	315.500	90.66%	9.34%	Sand	100%	
# 40	0.420	382.5	432.5	*50.000*	14.368%	265.500	76.29%	23.71%	Sand	100%	
# 50	0.297				0.000%	265.500	76.29%	23.71%	Sand	100%	
# 60	0.274	366.0	453.0	*87.000*	25.000%	178.500	51.29%	48.71%	Sand	100%	
# 100	0.149	342.5	404.5	*62.000*	17.816%	116.500	33.48%	66.52%	Sand	100%	
# 200	0.074	359.0	387.5	*28.500*	8.190%	88.000	25.29%	74.71%	Sand	100%	
PAN	0.001	405.0	407.0	*2.000*	25.287%	0.000	0.00%	100.00%	Silt & Clay	100%	
Wash Passing No. 200				86.00							
Total Weight			262.0	348.000							
			262.0				Passing	Retained			
			0.0								

% Gravel (GF) =	3.74%	5.00%	
% Sand (SF) =	70.98%	95.00%	R_4 = 3.74%
% Fines =	25.29%		R_{200} = 74.71%
Coefficient of Uniformity, $C_u = D_{60}/D_{10}$ =	11.07		F_4 = 96.26%
Coefficient of Concavity, $C_c = D_{30}^2/(D_{10} D_{60})$ =	1.81		F_{200} = 25.29%

GRAVEL:		SAND:		SILT:	CLAY:
Coarse	3" - 3/4"	Coarse	#4 - #10	#200 - .005mm	< .005mm
Fine	3/4" - #4	Medium	#10 - #40		
		Fine	#40 - #200		

GRAIN SIZE DIAMETERS D_{10} = 0.02987 mm D_{30} = 0.13363 mm D_{60} = 0.33052 mm

	D_{10}	D_{30}	D_{60}		D_{10}	D_{30}	D_{60}	
x1 =	0.001	0.001	0.001	y1 =	0.00%	0.00%	0.00%	passing
x2 =				y2 =	10.00%	30.00%	60.00%	passing
x3 =	0.074	0.149	0.420	y3 =	25.29%	33.48%	76.29%	passing
Diameter =	0.029868182	0.133628326	0.3305186					



Meyerhof Bearing Capacity Calculation for Shallow Foundation by Direct SPT No. and Skempton Bearing Capacity (1951)

ORIGIN=1

Project: Verfication Soil Boring Test Proposal Bo. 20-330 Proposed 2 Storey SP/ Legis Building
Location: Davso del Norte Provincial Center, Mankilam, Tagum City
Borehole no. 1

Definition :

N - SPT blows
D - Depth (meters)
s - Footing Settlement (mm)

N - measured penetration number
N_{60} - standard penetration number corrected to field conditions with 60
$N_{1(60)}$ - value of N_{60} corrected to standard value of σ_0' with p_a =100 KPa & 2000 psf
ηh - hammer efficiency (%)
ηb - correction for boreholes diameter
ηs - sampler correction
ηr - correction for a rod length
D - Depth (meters)
s - Footing Settlement (mm)
γ - unit weigth of soil (KN/m^3)

INPUT BORING DATA:

$$N := \begin{bmatrix} 8 \\ 8 \\ 4 \\ 5 \\ 11 \\ 8 \\ 3 \\ 7 \\ 9 \\ 5 \\ 9 \\ 8 \end{bmatrix} \quad D := \begin{bmatrix} 0.5 \\ 1.0 \\ 1.5 \\ 2.0 \\ 2.5 \\ 3.0 \\ 4.5 \\ 6.0 \\ 7.5 \\ 9.0 \\ 10.5 \\ 12.0 \end{bmatrix} \quad \gamma := \begin{bmatrix} 16.33 \\ 16.33 \\ 14.20 \\ 15 \\ 17.13 \\ 16.33 \\ 13.40 \\ 15.67 \\ 17 \\ 15 \\ 17 \\ 16.33 \end{bmatrix}$$

$\eta h := 45$

$\eta b := 1$

$\eta s := 1$

$\eta r := 1$

iter := 12 i := 1 .. iter

Compute the Standard Penetration Number

$$N60_i := \frac{N_i \cdot \eta h \cdot \eta b \cdot \eta s \cdot \eta r}{60}$$

Suggested by STROUD for insensitive Clay (1974)

K := 4.4 KN /m^2 $cu1_i := K \cdot N60_i$ KN /m^2

Suggested by HARA et al for Clay(1971)

K := 29 KN /m^2

$N60c_i := \left[(N60_i)^{.72} \right]$

$cu2_i := K \cdot N60c_i$ KN /m^2

Suggested by LIAO & WHITMAN Relationship for Granular Soil(1986)

$pa := 100$ KN /m^2

Cn = correction factor for overburden

$\sigma o'_i := \gamma_i \cdot D_i$ $\quad Cn_i := \left[\frac{1}{\left(\frac{\sigma o'_i}{pa}\right)}\right]^{.5}$ $\quad N1'60a_i := Cn_i \cdot N60_i$

Suggested by Skempton's for Granular Soil(1986)

$pa := 100$ KN /m^2

Cn = correction factor for overburden

$Cn_i := \left[\frac{2}{1 + \frac{\sigma o'_i}{pa}}\right]$ $\quad N1'60b_i := Cn_i \cdot N60_i$

Suggested by Seed et al for Granular Soil(1975)

$pa := 100$ KN /m^2

Cn = correction factor for overburden

$Cn_i := 1 - 1.25 \cdot \log\left(\frac{\sigma o'_i}{pa}\right)$ $\quad N1'60c_i := Cn_i \cdot N60_i$

Suggested by Peck et al for Granular Soil(1974)

$pa := 100$ KN /m^2

Cn = correction factor for overburden

$Cn_i := .77 \cdot \log\left[\frac{20}{\left(\frac{\sigma o'_i}{pa}\right)}\right]$ $\quad N1'60d_i := Cn_i \cdot N60_i$

$N^T =$

8	8	4	5	11	8	3	7	9	5	9	8

$N60^T =$

6	6	3	3.8	8.3	6	2.3	5.3	6.8	3.8	6.8	6

$N1'60a^T =$

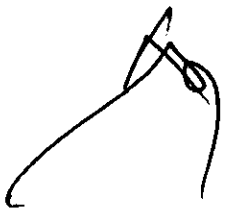
21	14.8	6.5	6.8	12.6	8.6	2.9	5.4	6	3.2	5.1	

$N1'60b^T =$

11.1	10.3	4.9	5.8	11.6	8.1	2.8	5.4	5.9	3.2	4.8	

$N1'60c^T =$

14.2	11.9	5.5	6.2	12	8.3	2.9	5.4	5.9	3.1	4.6	



$$N1'60d^{T} = \begin{bmatrix} 11 & 9.6 & 4.6 & 5.3 & 10.6 & 7.4 & 2.6 & 5.4 & 6.2 & 3.4 & 5.5 \end{bmatrix}$$

$$N1'60ave_i := \frac{\left(N1'60a_i + N1'60b_i + N1'60c_i + N1'60d_i\right)}{4}$$

$$N1'60ave^{T} = \begin{bmatrix} 14.3 & 11.7 & 5.4 & 6 & 11.7 & 8.1 & 2.8 & 5.4 & 6 & 3.2 & 5 \end{bmatrix}$$

$$N1'60min_i := \min\left(\begin{bmatrix} N1'60a_i \\ N1'60b_i \\ N1'60c_i \\ N1'60d_i \\ N60_i \end{bmatrix}\right) \qquad N1'60_i := \frac{\left(\left(N1'60ave_i \cdot 4 + N1'60min_i \cdot 1\right)\right)}{5}$$

$$N1'60min^{T} = \begin{bmatrix} 6 & 6 & 3 & 3.8 & 8.3 & 6 & 2.3 & 5.3 & 5.9 & 3.1 & 4.6 & 3.8 \end{bmatrix}$$

$$N^{T} = \begin{bmatrix} 8 & 8 & 4 & 5 & 11 & 8 & 3 & 7 & 9 & 5 & 9 & 8 \end{bmatrix}$$

$$N1'60^{T} = \begin{bmatrix} 12.7 & 10.5 & 4.9 & 5.6 & 11 & 7.7 & 2.7 & 5.4 & 6 & 3.2 & 4.9 \end{bmatrix}$$

Suggested by Peck, Hanson and Thomburn , Wolf (1989) page 83- B.Das-Foundation Eng'g 5th

$$\phi'1_i := 27.1 + .3 \cdot N1'60_i - .00054 \cdot \left(N1'60_i\right)^2$$

Suggested by Schmertmann (1975), Mayne & Kulhawy (1990) page 83-84 B.Das Foundation Engg 5th

$$a_i := \left[\frac{N1'60_i}{12.2 + 20.3 \cdot \left(\frac{\sigma o'_i}{pa}\right)}\right]^{0.34} \qquad \phi'2_i := \operatorname{atan}\left(a_i\right) \cdot \frac{180}{\pi}$$

Suggested by Hatanaka and Uchida (1996) page 84 - B.Das-Foundation Engg 5th

$$\phi'3_i := \sqrt{\left(20 \cdot N1'60_i\right)} + 20$$

$$cu1^{T} = \begin{bmatrix} 26.4 & 26.4 & 13.2 & 16.5 & 36.3 & 26.4 & 9.9 & 23.1 & 29.7 & 16.5 \end{bmatrix}$$

$$cu2^{T} = \begin{bmatrix} 105.4 & 105.4 & 64 & 75.1 & 132.5 & 105.4 & 52 & 95.7 & 114.7 \end{bmatrix}$$

$$\phi'1^{T} = \begin{bmatrix} 30.8 & 30.2 & 28.6 & 28.8 & 30.3 & 29.4 & 27.9 & 28.7 & 28.9 & 28.1 \end{bmatrix}$$

$$\phi'2^{T} = \begin{bmatrix} 44.1 & 41.2 & 33.5 & 33.7 & 38.8 & 34.9 & 25.3 & 28.8 & 28 & 23.1 \end{bmatrix}$$

$\phi'3^T =$ [redacted]
35.9 34.5 29.9 30.6 34.8 32.4 27.3 30.4 30.9 28

$cuave_i := \frac{(cu1_i + cu2_i)}{2}$ $\phi'ave_i := \frac{(\phi'1_i + \phi'2_i + \phi'3_i)}{3}$

$cuave^T =$ [redacted]
65.9 65.9 38.6 45.8 84.4 65.9 30.9 59.4 72.2 45.8

$\phi'ave^T =$ [redacted]
36.9 35.3 30.7 31 34.7 32.2 26.8 29.3 29.3 26.4

$cumin_i := \min\left(\begin{bmatrix} cu1_i \\ cu2_i \end{bmatrix}\right)$ $\phi'min_i := \min\left(\begin{bmatrix} \phi'1_i \\ \phi'2_i \\ \phi'3_i \end{bmatrix}\right)$

$cumin^T =$ [redacted]
26.4 26.4 13.2 16.5 36.3 26.4 9.9 23.1 29.7 16.5

$\phi'min^T =$ [redacted]
30.8 30.2 28.6 28.8 30.3 29.4 25.3 28.7 28 23.1

$cu_i := \frac{(cuave_i \cdot 2 + cumin_i \cdot 1)}{3}$ $\phi'_i := \frac{(\phi'ave_i \cdot 3 + \phi'min_i \cdot 1)}{4}$

$cu^T =$ [redacted]
52.7 52.7 30.1 36 68.4 52.7 23.9 47.3 58 36 58

$\phi'^T =$ [redacted]
35.4 34 30.1 30.4 33.6 31.5 26.5 29.1 29 25.6 27 25.8

$N1'60^T =$ [redacted]
12.7 10.5 4.9 5.6 11 7.7 2.7 5.4 6 3.2 4.9

$D^T =$ [redacted]
0.5 1 1.5 2 2.5 3 4.5 6 7.5 9 10.5

$n := 1..21$ $i := 1..14$ $Bo := .75$ $B_n := Bo + .25 \cdot n$

$F1_n := .05 \cdot \frac{n}{n}$ $F2_n := .08 \cdot \frac{n}{n}$ $F3_n := .3 \cdot \frac{n}{n}$ $F4_n := 1.2 \cdot \frac{n}{n}$

$ni := 1$ $N60cor := N1'60_{ni}$ $N60cor = 12.7$ $D_{ni} = 0.5$

$$Kd_n := if\left[\left(1 + .33 \cdot \frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33 \cdot \frac{D_{ni}}{B_n}\right)\right]$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$$qa'25 := qa2'25 \qquad qa'25_1 := qa1'25_1 \qquad qa'40 := qa'25\cdot\frac{40}{25} \qquad qa'50 := qa'25\cdot\frac{50}{25}$$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

B^T = 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

Kd^T = 1.2 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1 1

$qa'25^T$ = 196.6 183.6 168.6 158.4 151 145.4 141.1 137.5 134.7

$qa'40^T$ = 314.6 293.8 269.8 253.4 241.6 232.7 225.7 220.1

$qa'50^T$ = 393.2 367.2 337.2 316.8 302 290.8 282.1 275.1 269.3

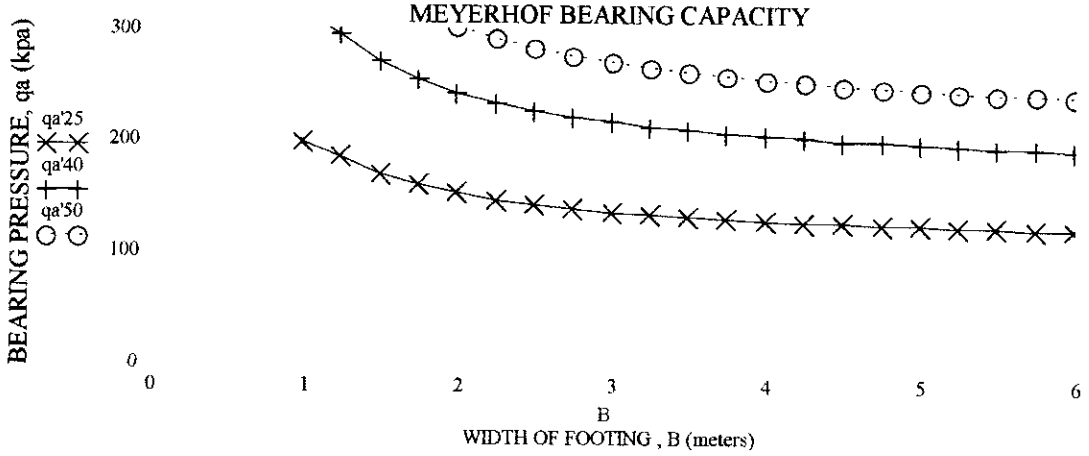
qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

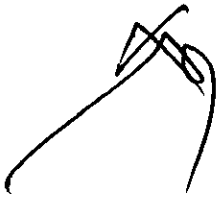
$N1'60_{ni}$ = 12.7 Corrected SPT Number

D_{ni} = 0.5 Depth of Boring in meters



ni = 2 $N60cor := N1'60_{ni}$ N60cor = 10.5 D_{ni} = 1

$$Kd_n := if\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right]$$



$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$$qa'25 := qa2'25 \qquad qa'25_1 := qa1'25_1 \qquad qa'40 := qa'25\cdot\frac{40}{25} \qquad qa'50 := qa'25\cdot\frac{50}{25}$$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

B^T = 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

Kd^T = 1.3 1.3 1.2 1.2 1.2 1.1 1.1 1.1 1.1 1.1 1.1 1.1

$qa'25^T$ = 187 170.7 154.3 143.3 135.4 129.4 124.8 121 118

$qa'40^T$ = 299.1 273.2 246.9 229.3 216.6 207 199.6 193.7 188.8

$qa'50^T$ = 373.9 341.5 308.7 286.6 270.7 258.8 249.5 242.1 236

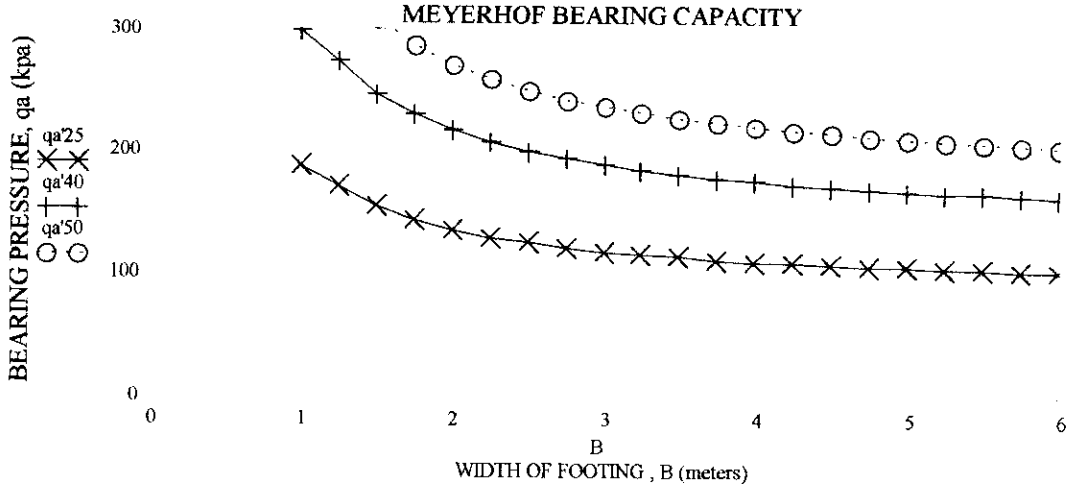
qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

$N1'60_{ni} = 10.5$ Corrected SPT Number

$D_{ni} = 1$ Depth of Boring in meters



$ni := 3$ $N60cor := N1'60_{ni}$ $N60cor = 4.9$ $D_{ni} = 1.5$

$$Kd_n := \text{if}\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right]$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$$qa'25 := qa2'25 \qquad qa'25_1 := qa1'25_1 \qquad qa'40 := qa'25\cdot\frac{40}{25} \qquad qa'50 := qa'25\cdot\frac{50}{25}$$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

B^T = 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

Kd^T = 1.3 1.3 1.3 1.3 1.2 1.2 1.2 1.2 1.2 1.2 1.1 1.1

$qa'25^T$ = 87 83.6 78.3 71.9 67.4 64 61.4 59.3 57.6 56.2 55

$qa'40^T$ = 139.2 133.7 125.2 115.1 107.9 102.5 98.3 94.9 92.2

$qa'50^T$ = 173.9 167.2 156.5 143.9 134.9 128.1 122.8 118.6

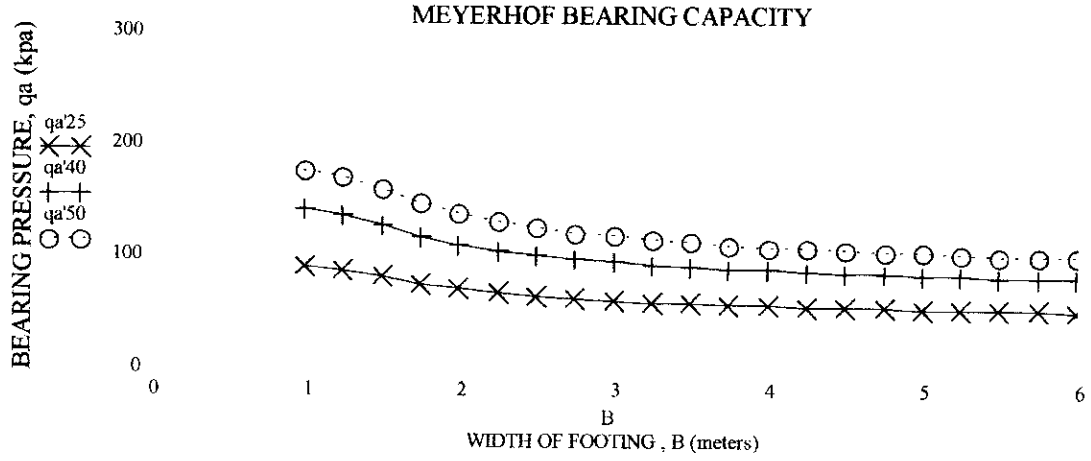
qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

$N1'60_{ni}$ = 4.9 Corrected SPT Number

D_{ni} = 1.5 Depth of Boring in meters



ni := 4 N60cor := $N1'60_{ni}$ N60cor = 5.6

$$Kd_n := if\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right] \qquad D_{ni} = 2$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$$qa'25 := qa2'25 \qquad qa'25_1 := qa1'25_1 \qquad qa'40 := qa'25\cdot\frac{40}{25} \qquad qa'50 := qa'25\cdot\frac{50}{25}$$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

$B^T =$ 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

$Kd^T =$ 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.2 1.2 1.2 1.2 1.2

$qa'25^T =$ 98.7 94.9 88.8 84.7 81.6 77.1 73.6 70.8 68.5 66.6

$qa'40^T =$ 157.9 151.8 142.2 135.5 130.6 123.3 117.7 113.2

$qa'50^T =$ 197.4 189.7 177.7 169.3 163.2 154.1 147.1 141.5 137

qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

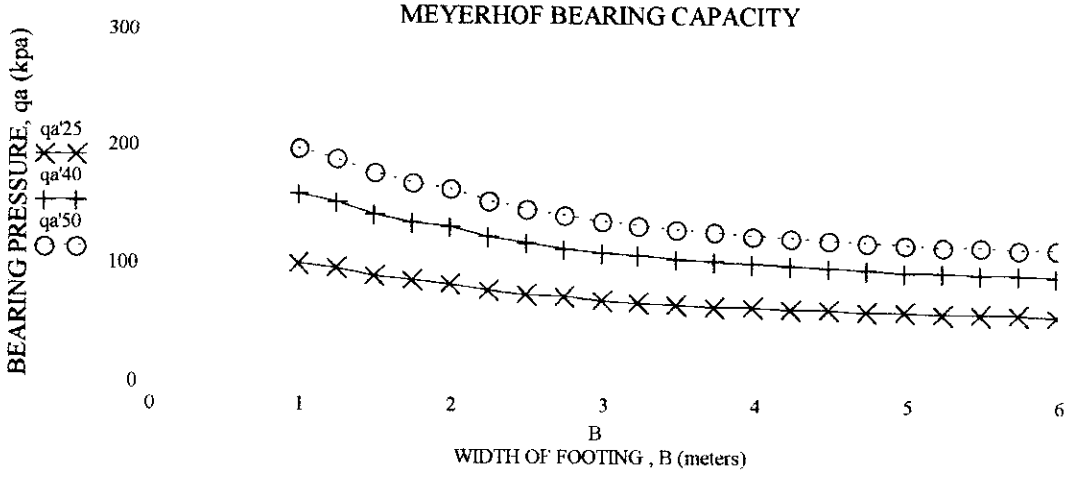
qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

$N1'60_{ni} = 5.6$ Corrected SPT Number

$D_{ni} = 2$ Depth of Boring in meters

MEYERHOF BEARING CAPACITY



$ni := 5$ $N60cor := N1'60_{ni}$ $N60cor = 11$ $D := 2.5$

$$Kd_n := if\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right]$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$$qa'25 := qa2'25 \qquad qa'25_1 := qa1'25_1 \qquad qa'40 := qa'25\cdot\frac{40}{25} \qquad qa'50 := qa'25\cdot\frac{50}{25}$$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

B^T = 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

Kd^T = 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.2 1.2

$qa'25^T$ = 195.3 187.7 175.8 167.5 161.4 156.8 153.1 146.8

$qa'40^T$ = 312.5 300.3 281.2 268 258.3 250.8 245 234.8 226.5

$qa'50^T$ = 390.6 375.3 351.5 335 322.8 313.5 306.2 293.5 283.2

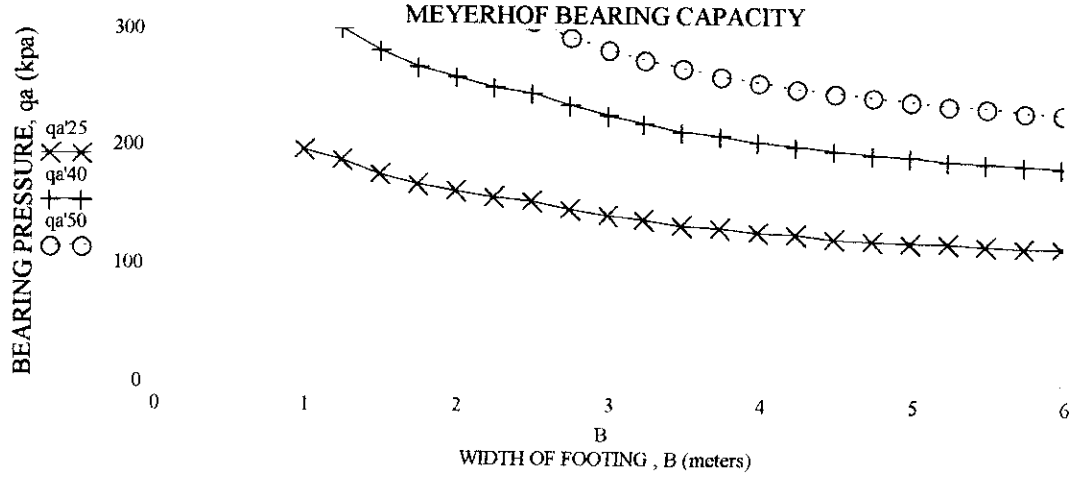
qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

$N1'60_{ni}$ = 11 Corrected SPT Number

D_{ni} = 2.5 Depth of Boring in meters



$ni := 6$ $N60cor := N1'60_{ni}$ $N60cor = 7.7$ $D_{ni} = 3$

$$Kd_n := if\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right]$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$qa'25 := qa2'25$ $qa'25_1 := qa1'25_1$ $qa'40 := qa'25\cdot\frac{40}{25}$ $qa'50 := qa'25\cdot\frac{50}{25}$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

B^T = 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

Kd^T = 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3

$qa'25^T$ = 136.2 130.9 122.6 116.8 112.6 109.3 106.8 104.7 103

$qa'40^T$ = 217.9 209.4 196.1 186.9 180.1 174.9 170.8 167.5

$qa'50^T$ = 272.3 261.7 245.1 233.6 225.1 218.6 213.5 209.4 206

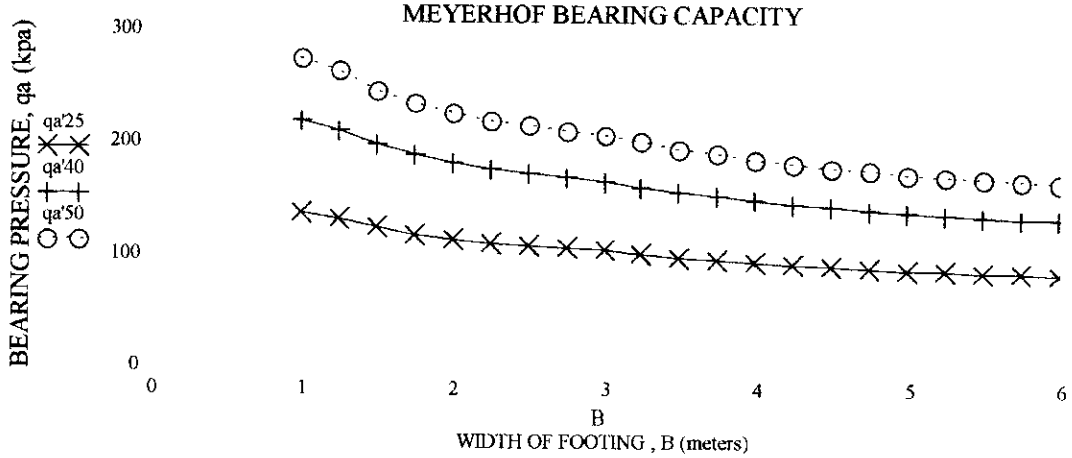
qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

$N1'60_{ni} = 7.7$ Corrected SPT Number

$D_{ni} = 3$ Depth of Boring in meters



$ni := 7$ $N60cor := N1'60_{ni}$ $N60cor = 2.7$ $D_{ni} = 4.5$

$$Kd_n := if\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right]$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$qa'25 := qa2'25$ $qa'25_1 := qa1'25_1$ $qa'40 := qa'25\cdot\frac{40}{25}$ $qa'50 := qa'25\cdot\frac{50}{25}$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

$B^T =$ 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

$Kd^T =$ 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3

$qa'25^T =$ 47.7 45.9 43 40.9 39.5 38.3 37.4 36.7 36.1 35.6

$qa'40^T =$ 76.4 73.4 68.7 65.5 63.1 61.3 59.9 58.7 57.8 56.9

$qa'50^T =$ 95.5 91.7 85.9 81.9 78.9 76.6 74.8 73.4 72.2 71.2

qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

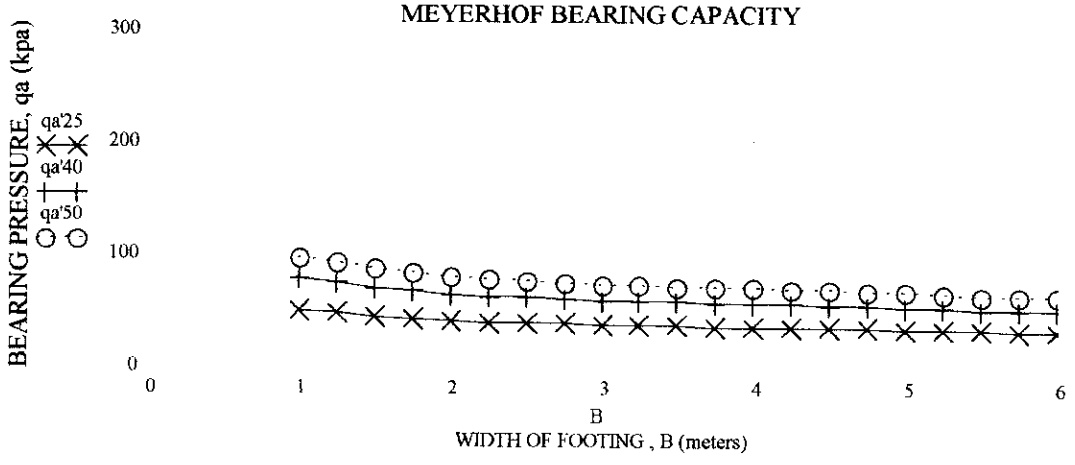
qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

$N1'60_{ni} = 2.7$ Corrected SPT Number

$D_{ni} = 4.5$ Depth of Boring in meters

MEYERHOF BEARING CAPACITY



$ni := 8$ $N60cor := N1'60_{ni}$ $N60cor = 5.4$ $D_{ni} = 6$

$$Kd_n := if\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right]$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$qa'25 := qa2'25$ $qa'25_t := qa1'25_t$ $qa'40 := qa'25\cdot\frac{40}{25}$ $qa'50 := qa'25\cdot\frac{50}{25}$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

$B^T =$ 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

$Kd^T =$ 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3

$qa'25^T =$ 95.3 91.6 85.8 81.7 78.8 76.5 74.7 73.3 72.1 71.1

$qa'40^T =$ 152.5 146.5 137.2 130.8 126 122.4 119.5 117.2 115.3

$qa'50^T =$ 190.6 183.2 171.5 163.5 157.5 153 149.4 146.5 144.1

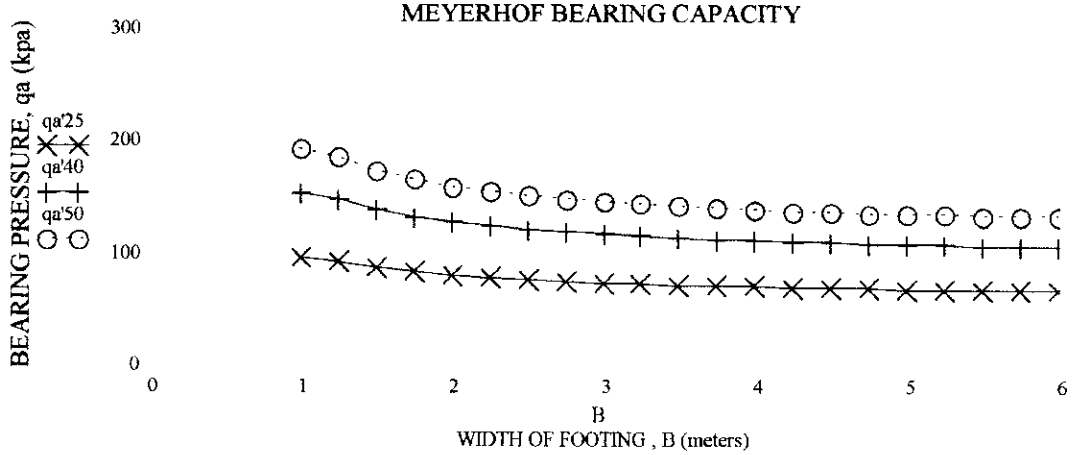
qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

$N1'60_{ni} = 5.4$ Corrected SPT Number

$D_{ni} = 6$ Depth of Boring in meters



$ni := 9$ $N60cor := N1'60_{ni}$ $N60cor = 6$ $D_{ni} = 7.5$

$$Kd_n := if\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right]$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$qa'25 := qa2'25$ $qa'25_1 := qa1'25_1$ $qa'40 := qa'25\cdot\frac{40}{25}$ $qa'50 := qa'25\cdot\frac{50}{25}$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

$B^T =$ 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

$Kd^T =$ 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3

$qa'25^T =$ 105.9 101.7 95.3 90.8 87.5 85 83 81.4 80 78.9

$qa'40^T =$ 169.4 162.8 152.4 145.3 140 136 132.8 130.2 128.1

$qa'50^T =$ 211.7 203.4 190.5 181.6 175 169.9 166 162.8 160.1

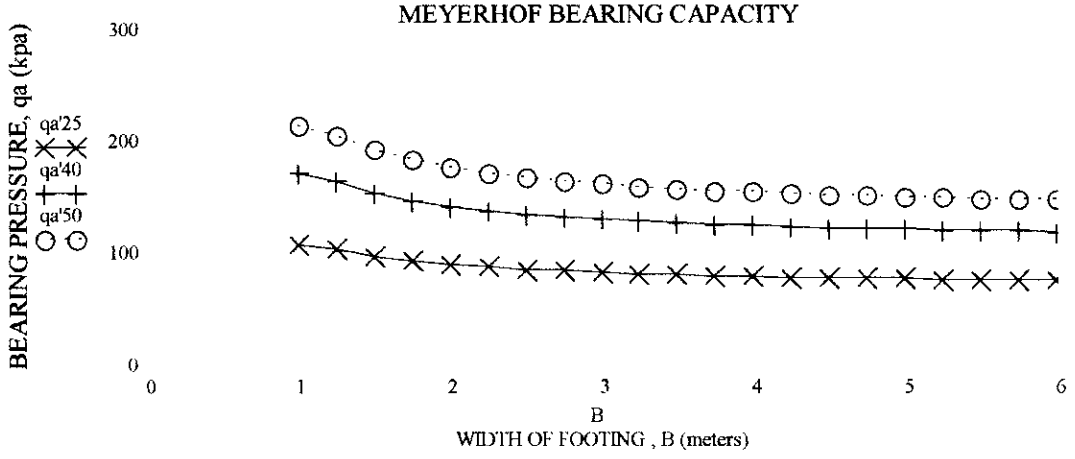
qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

$N1'60_{ni} = 6$ Corrected SPT Number

$D_{ni} = 7.5$ Depth of Boring in meters



$ni := 10$ $N60cor := N1'60_{ni}$ $N60cor = 3.2$ $D_{ni} = 9$

$$Kd_n := if\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right]$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$qa'25 := qa2'25$ $qa'25_1 := qa1'25_1$ $qa'40 := qa'25\cdot\frac{40}{25}$ $qa'50 := qa'25\cdot\frac{50}{25}$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

$B^T =$ 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

$Kd^T =$ 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3

$qa'25^T =$ 57 54.8 51.3 48.9 47.1 45.8 44.7 43.8 43.1 42.5 42

$qa'40^T =$ 91.2 87.7 82.1 78.2 75.4 73.2 71.5 70.1 69 68 67.2

$qa'50^T =$ 114 109.6 102.6 97.8 94.3 91.6 89.4 87.7 86.2 85

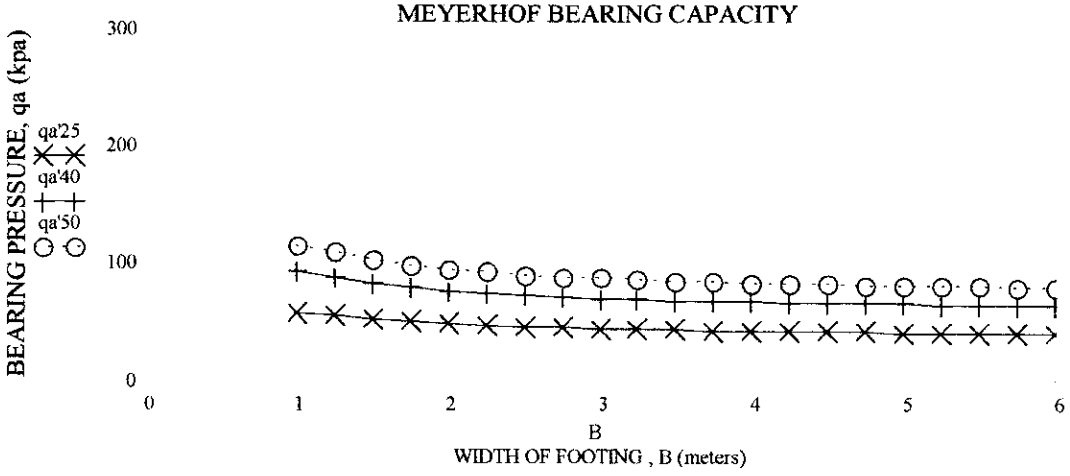
qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

$N1'60_{ni} = 3.2$ Corrected SPT Number

$D_{ni} = 9$ Depth of Boring in meters



$ni := 11$ $N60cor := N1'60_{ni}$ $N60cor = 4.9$ $D_{ni} = 10.5$

$$Kd_n := if\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right]$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$qa'25 := qa2'25$ $qa'25_I := qa1'25_I$ $qa'40 := qa'25\cdot\frac{40}{25}$ $qa'50 := qa'25\cdot\frac{50}{25}$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

$B^T =$ 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

$Kd^T =$ 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3

$qa'25^T =$ 87.3 83.9 78.5 74.9 72.1 70.1 68.4 67.1 66 65.1

$qa'40^T =$ 139.6 134.2 125.7 119.8 115.4 112.1 109.5 107.4

$qa'50^T =$ 174.5 167.7 157.1 149.7 144.3 140.1 136.8 134.2 132

qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

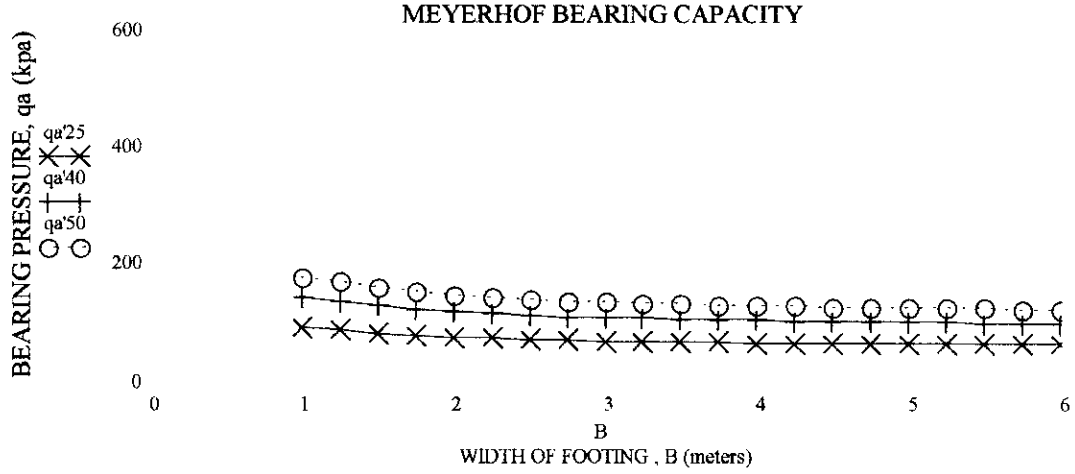
qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

$N1'60_{ni} = 4.9$ Corrected SPT Number

$D_{ni} = 10.5$ Depth of Boring in meters

MEYERHOF BEARING CAPACITY



$ni = 12$ $N60cor := N1'60_{ni}$ $N60cor = 4.1$ $D_{ni} = 12$

$$Kd_n := if\left[\left(1 + .33\cdot\frac{D_{ni}}{B_n}\right) > 1.33, 1.33, \left(1 + .33\cdot\frac{D_{ni}}{B_n}\right)\right]$$

$$qa1'25_n := \frac{N60cor}{F1_n}\cdot\frac{Kd_n}{1.5} \qquad qa2'25_n := \frac{N60cor}{F2_n}\cdot\left(\frac{B_n + F3_n}{B_n}\right)^2\cdot\frac{Kd_n}{1.5}$$

$$qa'25 := qa2'25 \qquad qa'25_i := qa1'25_i \qquad qa'40 := qa'25\cdot\frac{40}{25} \qquad qa'50 := qa'25\cdot\frac{50}{25}$$

MEYERHOF BEARING CAPACITY CALCULATION USING DIRECT SPT NO.

B^T = 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

Kd^T = 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3

$qa'25^T$ = 73.1 70.3 65.8 62.7 60.4 58.7 57.3 56.2 55.3 54.5

$qa'40^T$ = 117 112.4 105.3 100.4 96.7 93.9 91.7 90 88.5 87.3

$qa'50^T$ = 146.3 140.6 131.6 125.4 120.9 117.4 114.7 112.4

qa'25 = Meyerhof Bearing Capacity for 25 mm Settlement in x's lines

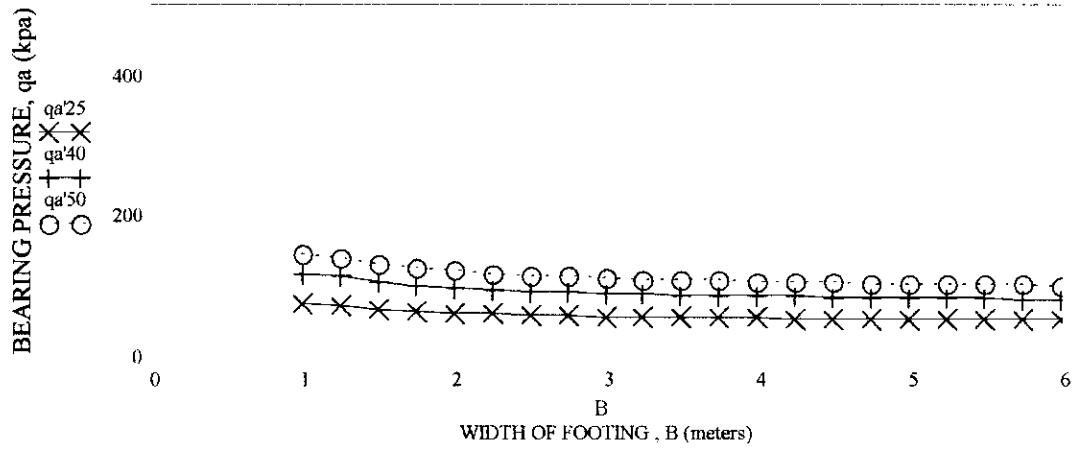
qa'40 = Meyerhof Bearing Capacity for 40 mm Settlement in +'s lines

qa'50 = Meyerhof Bearing Capacity for 50 mm Settlement in x's lines

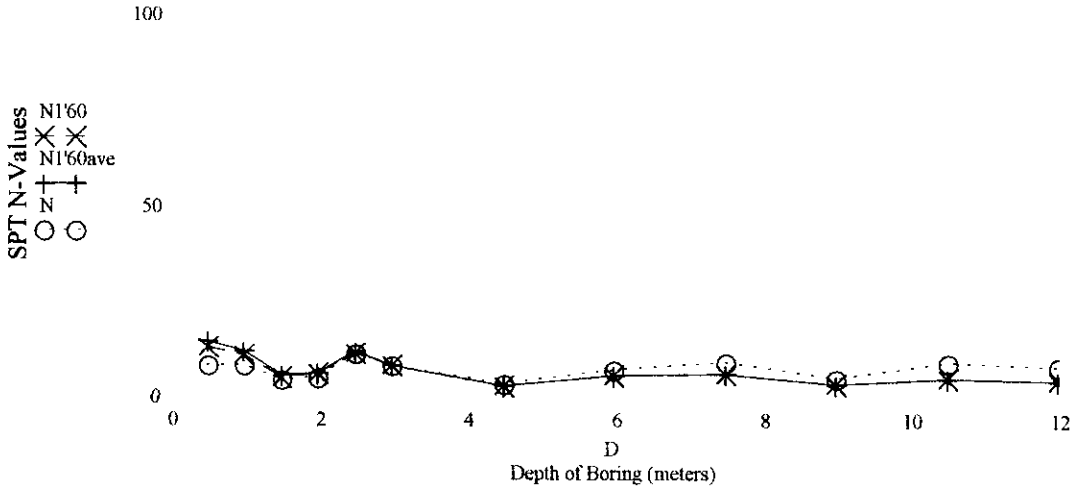
$N1'60_{ni} = 4.1$ Corrected SPT Number

$D_{ni} = 12$ Depth of Boring in meters

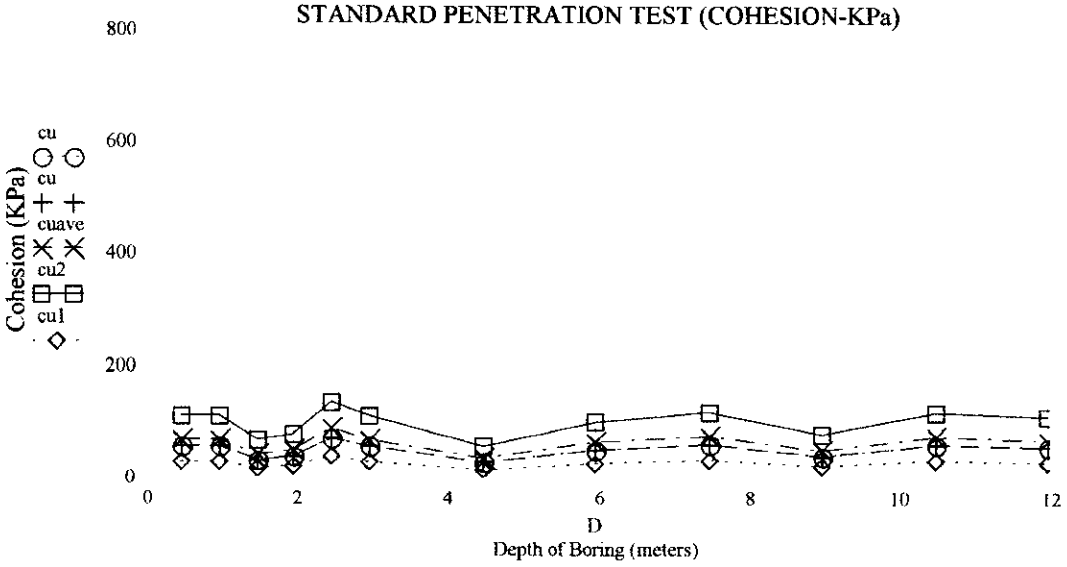
MEYERHOF BEARING CAPACITY



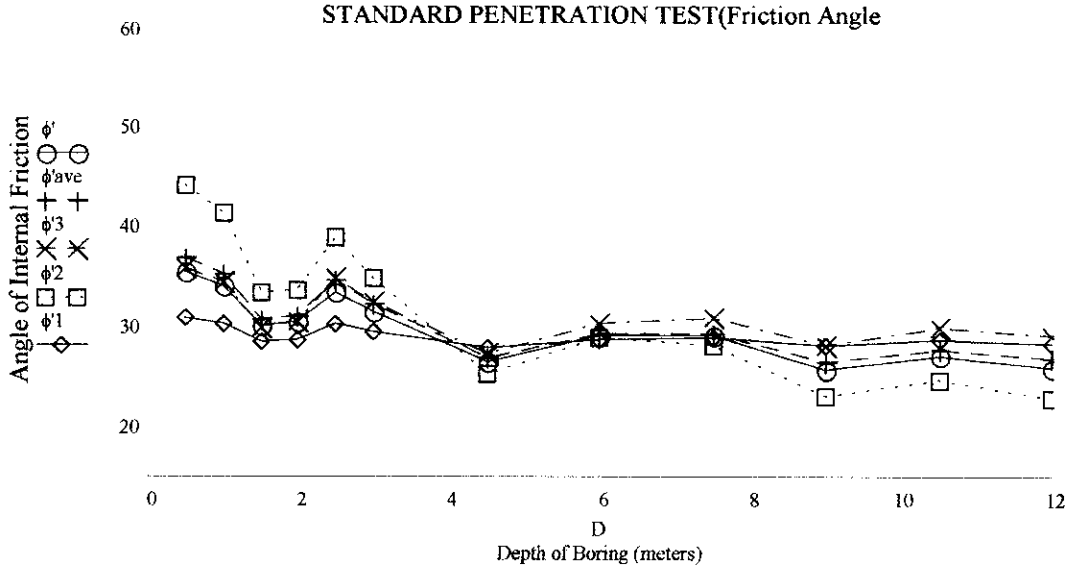
STANDARD PENETRATION TEST (N-VALUES)



STANDARD PENETRATION TEST (COHESION-KPa)



STANDARD PENETRATION TEST(Friction Angle



SKEMPTON'S BEARING CAPACITY (1951) FROM MUNI BUDHU 'Soil Mechanics and Foundations page 327"

Width of Footing:

$B^T =$ 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

Lenght of Footing: L := B

$L^T =$ 1 1.3 1.5 1.8 2 2.3 2.5 2.8 3 3.3 3.5 3.8

Undrained Shear Strength: su := cu

$cu^T =$ 52.7 52.7 30.1 36 68.4 52.7 23.9 47.3 58 36 58

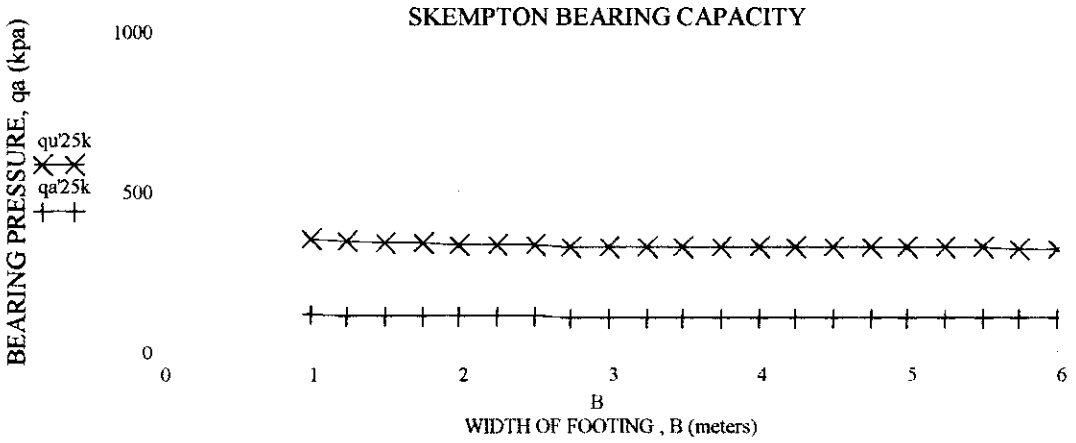
$su^T =$ 52.7 52.7 30.1 36 68.4 52.7 23.9 47.3 58 36 58

$ni := 1$ $D_{ni} = 0.5$ $su_{ni} = 52.7$ $FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot \text{if}\left[\left(\frac{D_{ni}}{B_n}\right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5\right]\right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n}\right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 347.9 341.6 337.4 334.4 332.1 330.4 329 327.8 326.9

$qa'25k^T =$ 116 113.9 112.5 111.5 110.7 110.1 109.7 109.3 109

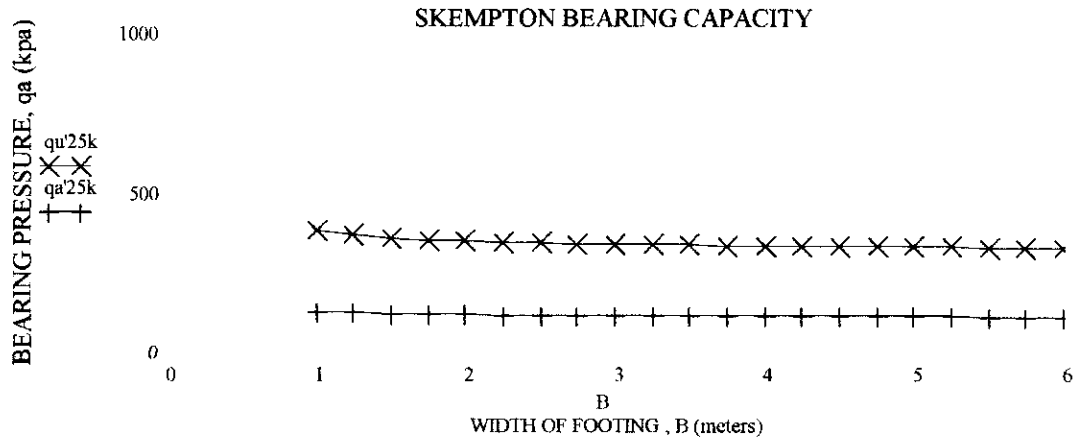


$ni := 2 \qquad D_{ni} = 1 \qquad su_{ni} = 52.7 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot if\left[\left(\frac{D_{ni}}{B_n} \right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5 \right] \right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n} \right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 379.6 366.9 358.5 352.5 347.9 344.4 341.6 339.3

$qa'25k^T =$ 126.5 122.3 119.5 117.5 116 114.8 113.9 113.1 112.5

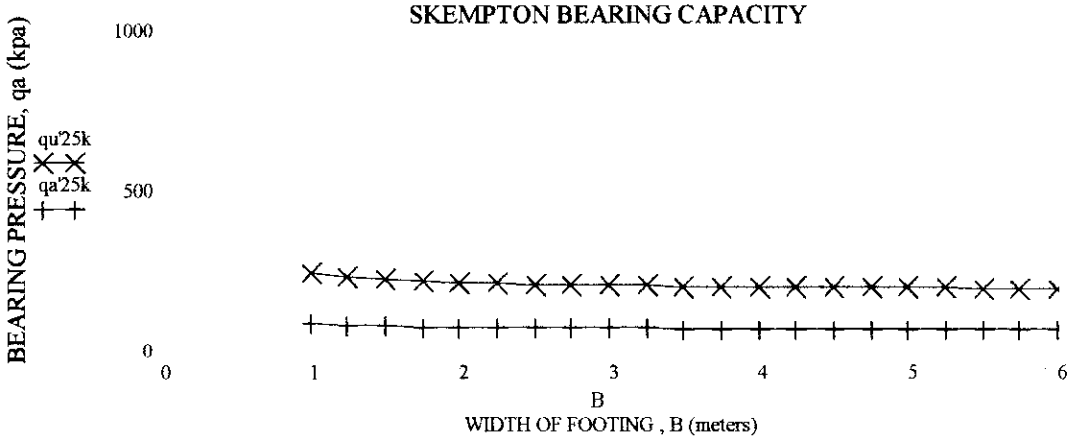


$ni := 3 \qquad D_{ni} = 1.5 \qquad su_{ni} = 30.1 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot if\left[\left(\frac{D_{ni}}{B_n} \right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5 \right] \right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n} \right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 234.9 224.1 216.9 211.7 207.8 204.8 202.4 200.4

$qa'25k^T =$ 78.3 74.7 72.3 70.6 69.3 68.3 67.5 66.8 66.3 65.8

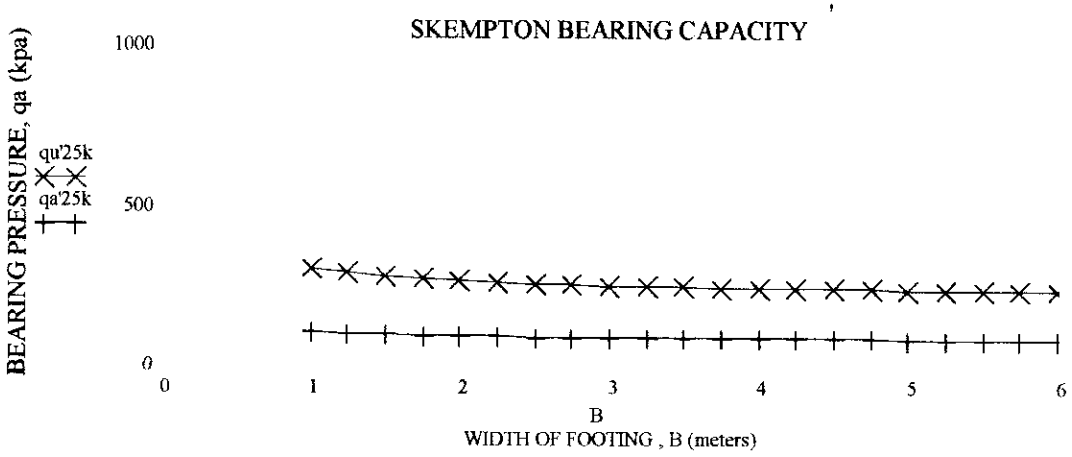


$ni := 4 \qquad D_{ni} = 2 \qquad su_{ni} = 36 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot \text{if}\left[\left(\frac{D_{ni}}{B_n}\right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5\right]\right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n}\right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 302.7 285.4 273.9 265.6 259.5 254.7 250.8 247.7

$qa'25k^T =$ 100.9 95.1 91.3 88.5 86.5 84.9 83.6 82.6 81.7 80.9

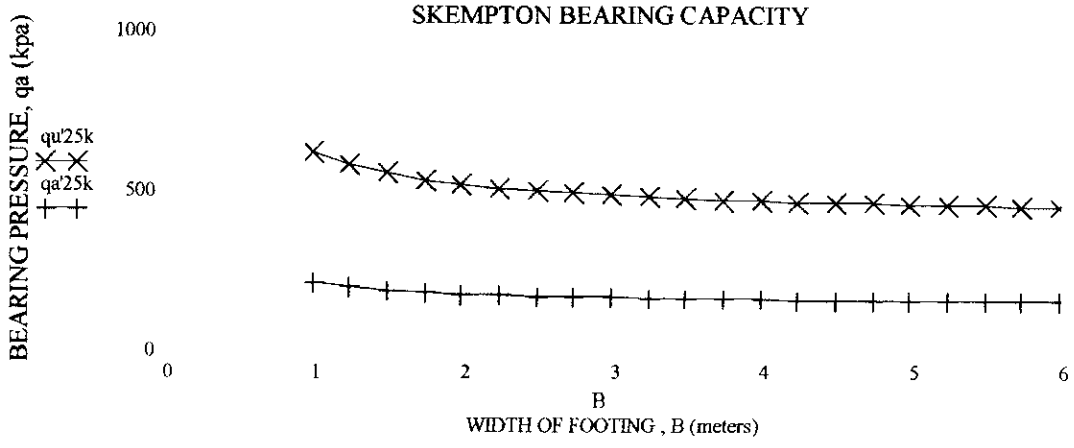


$ni := 5 \qquad D_{ni} = 2.5 \qquad su_{ni} = 68.4 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot \text{if}\left[\left(\frac{D_{ni}}{B_n}\right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5\right]\right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n}\right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 615.3 574.3 547 527.4 512.8 501.4 492.3 484.8 478.6

$qa'25k^T =$ 205.1 191.4 182.3 175.8 170.9 167.1 164.1 161.6

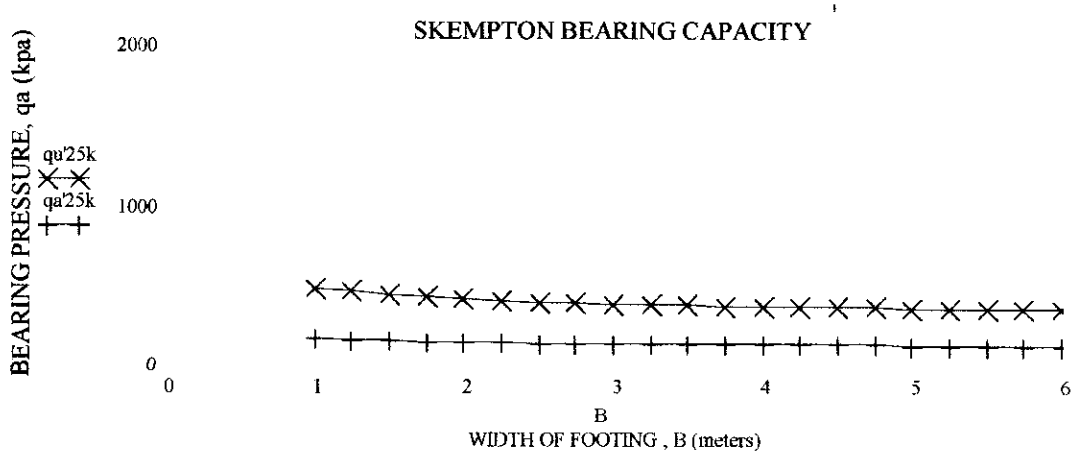


$ni := 6 \qquad D_{ni} = 3 \qquad su_{ni} = 52.7 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot \text{if}\left[\left(\frac{D_{ni}}{B_n}\right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5\right]\right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n}\right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 474.5 468.1 442.8 424.8 411.2 400.7 392.2 385.3

$qa'25k^T =$ 158.2 156 147.6 141.6 137.1 133.6 130.7 128.4 126.5

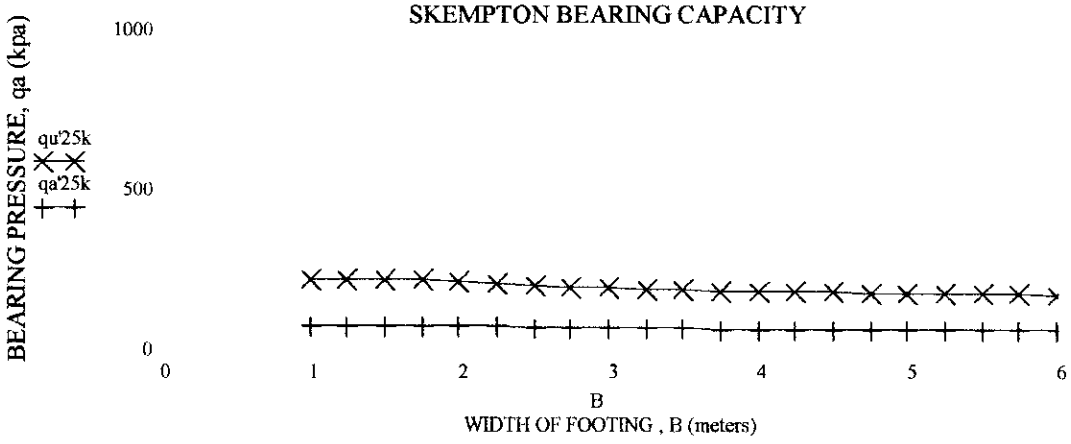


$ni := 7 \qquad D_{ni} = 4.5 \qquad su_{ni} = 23.9 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot \text{if}\left[\left(\frac{D_{ni}}{B_n}\right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5\right]\right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n}\right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 215.4 215.4 215.4 215.4 208.2 201 195.3 190.6 186.7

$qa'25k^T =$ 71.8 71.8 71.8 71.8 69.4 67 65.1 63.5 62.2 61.1

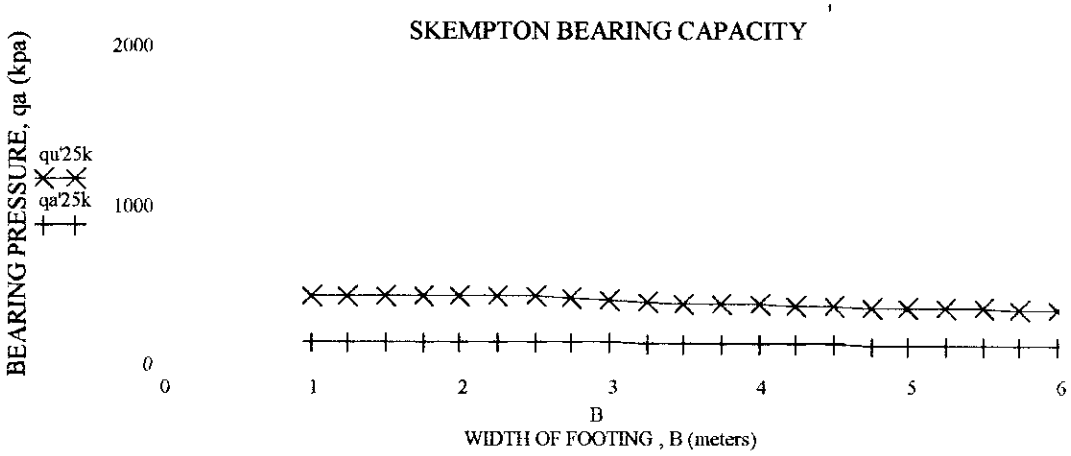


$ni := 8 \qquad D_{ni} = 6 \qquad su_{ni} = 47.3 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot \text{if}\left[\left(\frac{D_{ni}}{B_n}\right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5\right]\right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n}\right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 425.7 425.7 425.7 425.7 425.7 425.7 420 407.6 397.3

$qa'25k^T =$ 141.9 141.9 141.9 141.9 141.9 141.9 140 135.9 132.4

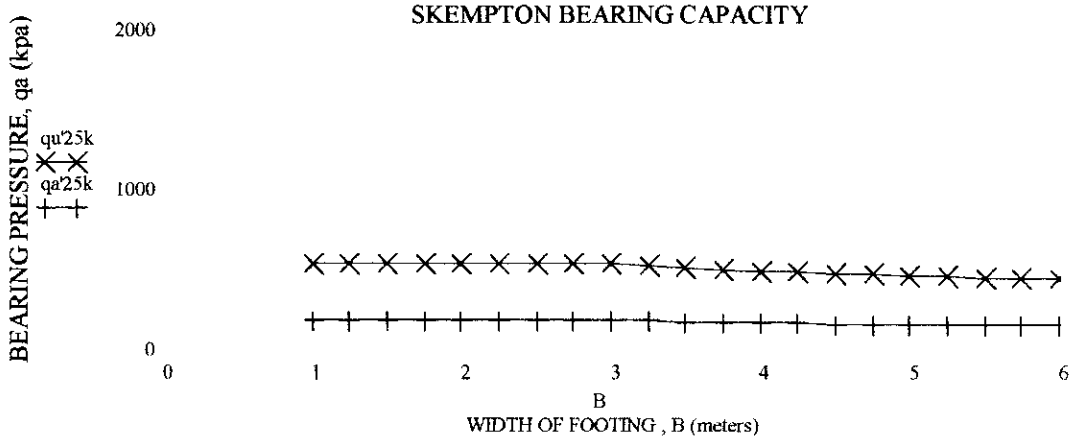


$ni := 9 \qquad D_{ni} = 7.5 \qquad su_{ni} = 58 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot \text{if}\left[\left(\frac{D_{ni}}{B_n}\right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5\right]\right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n}\right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 522.2 522.2 522.2 522.2 522.2 522.2 522.2 522.2

$qa'25k^T =$ 174.1 174.1 174.1 174.1 174.1 174.1 174.1 174.1

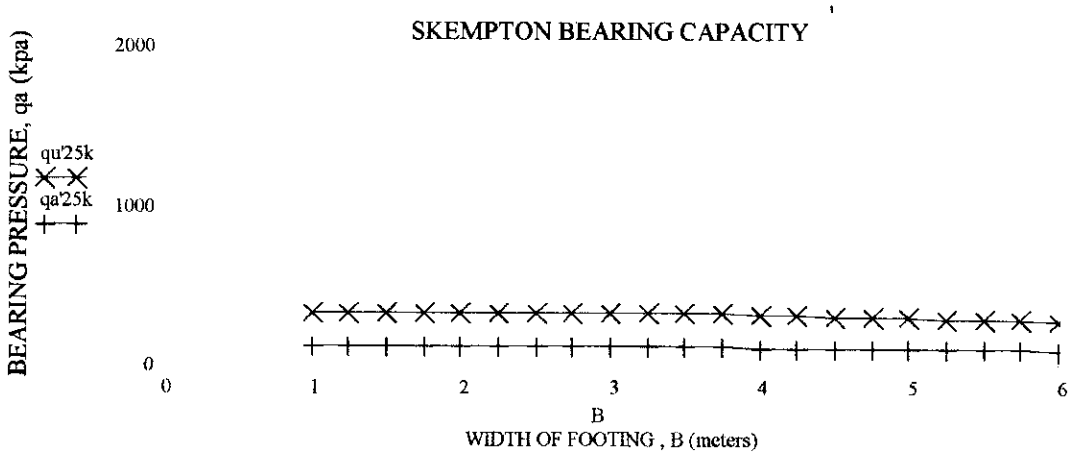


$ni := 10 \qquad D_{ni} = 9 \qquad su_{ni} = 36 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot if\left[\left(\frac{D_{ni}}{B_n} \right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5 \right] \right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n} \right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 324.3 324.3 324.3 324.3 324.3 324.3 324.3 324.3

$qa'25k^T =$ 108.1 108.1 108.1 108.1 108.1 108.1 108.1 108.1

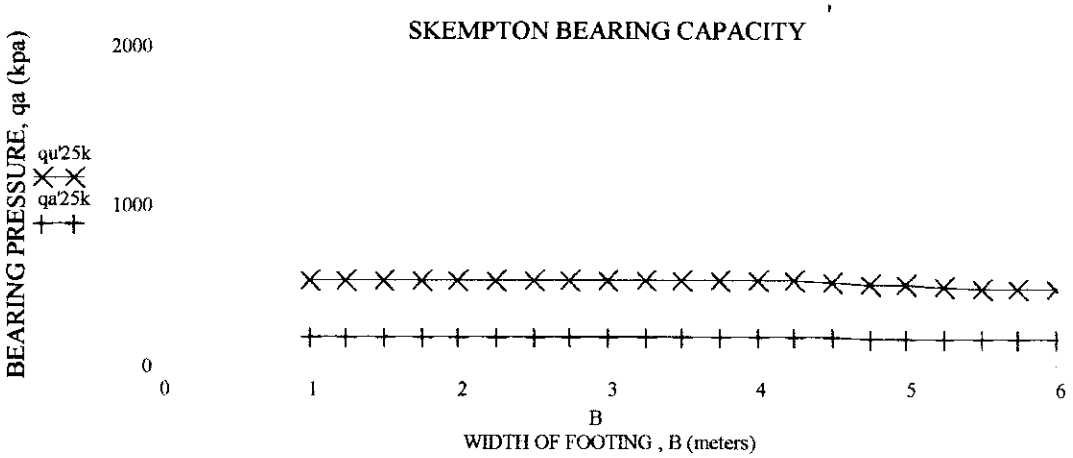


$ni := 11 \qquad D_{ni} = 10.5 \qquad su_{ni} = 58 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot if\left[\left(\frac{D_{ni}}{B_n} \right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5 \right] \right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n} \right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ 522.2 522.2 522.2 522.2 522.2 522.2 522.2 522.2

$qa'25k^T =$ 174.1 174.1 174.1 174.1 174.1 174.1 174.1 174.1

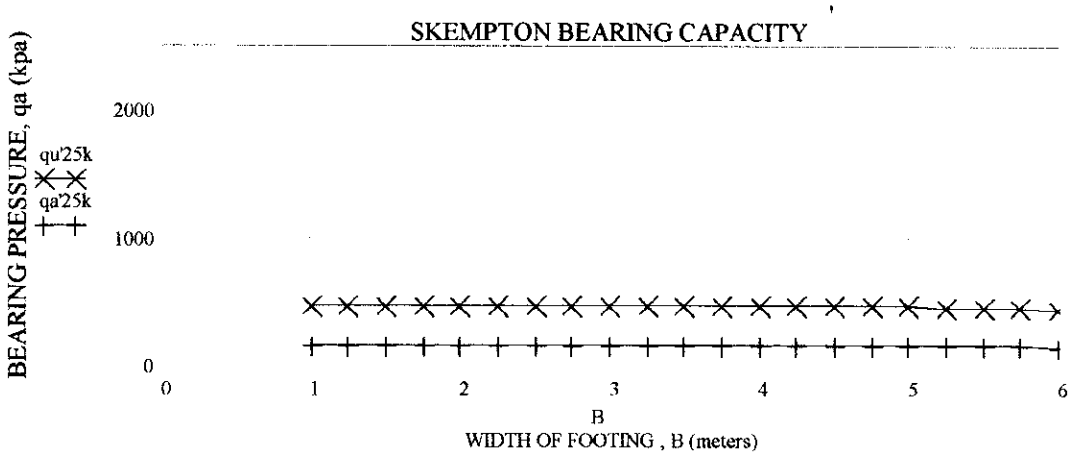


$ni := 12 \qquad D_{ni} = 12 \qquad su_{ni} = 52.7 \qquad FS := 3$

$$qu'25k_n := 5 \cdot su_{ni} \cdot \left[1 + .2 \cdot \text{if}\left[\left(\frac{D_{ni}}{B_n}\right) \le 2.5, \frac{D_{ni}}{B_n}, 2.5\right]\right] \cdot \left(1 + .2 \cdot \frac{B_n}{L_n}\right) \qquad qa'25k := \frac{qu'25k}{FS}$$

$qu'25k^T =$ [redacted] 474.5 474.5 474.5 474.5 474.5 474.5 474.5 474.5

$qa'25k^T =$ [redacted] 158.2 158.2 158.2 158.2 158.2 158.2 158.2 158.2



TERZAGHI ULTIMATE BEARING CAPACITY (LOCAL SHEAR FAILURE MODE IN SOILS)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
EXPLORED BY: LPRA GEO-SOLUTIONS
BOREHOLE NO. 1
SQUARE FOOTING:

Local Shear Failure:

$$q_u = 0.867\ c'\ N_c + q\ N'_q + 0.40\ \gamma\ B_\gamma\ N'_\gamma \qquad Fs = 1 \qquad FS = 4$$

$$N'_c = \cot \phi' \left[\frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(\pi/4 + \pi/2)} - 1 \right]$$

$$N'_q = \frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(45 + \phi/2)}$$

$$N'_\gamma = \frac{1}{2}\left(\frac{K_{p\gamma}}{\cot^2\phi} - 1\right)\tan\phi$$

N' γ = From Table 3.2 page 130 (Principles of Foundation Engineering By BRAJA M. DAS)

Fs = 2 to 3 Shear Failure

c' = 26.56 KPa

tan ϕ' = 2/3 tan ϕ

ϕ' = 21.29 degrees

γ =	***15.61***	KN/m³
ϕ =	***30.30***	degrees
c =	***26.56***	Kpa
D_{WT} =	***0.00***	m
Depth of Excav=	***1.50***	m

Square Footing Size m	Depth of Excav- m	Effective Stress q KPa	Wet Unit Weight of Soil γ KN/cu.m.	Cohesion c KPa	Angle of Internal Friction ϕ degrees	Angle of Internal Friction ϕ radians	Bearing Factors N'c	Bearing Factors N'q	Bearing Factors N'γ	Ultimate Bearing Pressure qu gross KPa	Allowable Bearing Pressure qa gross KPa	Allowable Bearing Pressure qa net KPa
1.00	**1.50**	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	478	120	111
1.50	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	483	121	112
2.00	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	487	122	113
2.50	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	492	123	114
3.00	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	496	124	115
3.50	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	500	125	116
4.00	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	505	126	117
4.50	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	509	127	119
5.00	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	514	128	120
5.50	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	518	129	121
6.00	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	522	131	122
6.50	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	527	132	123
7.00	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	531	133	124
7.50	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	536	134	125
8.00	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	540	135	126
8.50	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	544	136	127
9.00	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	549	137	128
9.50	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	553	138	130
10.00	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	558	139	131
10.50	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	562	140	132
11.00	1.50	8.71	15.6	26.56	21.29	0.37	12.53	4.26	1.41	566	142	133

qa net = qa - q

TERZAGHI ULTIMATE BEARING CAPACITY (LOCAL SHEAR FAILURE MODE IN SOILS)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020

EXPLORED BY: LPRA GEO-SOLUTIONS
BOREHOLE NO. 1
SQUARE FOOTING:

Local Shear Failure:

Fs = 2 to 3 Shear Failure

c' = 24.80 KPa

tan ϕ' = 2/3 tan ϕ

ϕ' = 20.84 degrees

Fs = 1 FS = 4

$$q_u = 0.867\ c'\ N_c + q\ N'_q + 0.40\ \gamma\ B_\gamma\ N'_\gamma$$

$$N'_c = \cot\phi' \left[\frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(\pi/4 + \pi/2)} - 1 \right]$$

$$N'_q = \frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(45 + \phi/2)}$$

$$N'_\gamma = \frac{1}{2}\left(\frac{K_{p\gamma}}{\cot^2\phi} - 1\right)\tan\phi$$

N' γ = From Table 3.2 page 130 (Principles of Foundation Engineering By BRAJA M. DAS)

γ =	***16.84***	KN/m^3
ϕ =	***29.73***	degrees
c =	***24.80***	Kpa
D_{WT} =	***0***	m
Depth of Excav=	***3.00***	m

Square Footing Size m	Depth of Excav- m	Effective Stress q KPa	Wet Unit Weight of Soil γ KN/cu.m.	Cohesion c KPa	Angle of Internal Friction ϕ degrees	Angle of Internal Friction ϕ radians	Bearing Factors N'c	Bearing Factors N'q	Bearing Factors N'γ	Ultimate Bearing Pressure qu gross KPa	Allowable Bearing Pressure qa gross KPa	Allowable Bearing Pressure qa net KPa
1.00	**3.00**	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	492	123	102
1.50	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	496	124	103
2.00	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	501	125	104
2.50	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	505	126	105
3.00	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	510	127	106
3.50	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	514	129	107
4.00	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	519	130	109
4.50	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	523	131	110
5.00	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	527	132	111
5.50	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	532	133	112
6.00	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	536	134	113
6.50	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	541	135	114
7.00	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	545	136	115
7.50	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	550	137	116
8.00	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	554	138	117
8.50	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	558	140	118
9.00	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	563	141	120
9.50	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	567	142	121
10.00	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	572	143	122
10.50	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	576	144	123
11.00	3.00	21.10	16.8	24.80	20.84	0.36	12.29	4.12	1.31	580	145	124

$q_{a\ net} = q_a - q$

TERZAGHI ULTIMATE BEARING CAPACITY (LOCAL SHEAR FAILURE MODE IN SOILS)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
EXPLORED BY: LPRA GEO-SOLUTIONS
BOREHOLE NO. 1
SQUARE FOOTING:

Fs = *1* FS = 4

Local Shear Failure: $q_u = 0.867\ c'\ N_c + q\ N'_q + 0.40\ \gamma\ B_\gamma\ N'_\gamma$

$$N'_c = \cot \phi' \left[e^{\frac{2(3\pi/4 - \phi/2)\tan\phi}{2\cos^2(\pi/4 + \pi/2)}} - 1 \right]$$

Fs = 2 to 3 Shear Failure

c' = 21.80 KPa

$\tan \phi' = 2/3 \tan \phi$

ϕ' = 18.74 degrees

$$N'_q = \frac{2(3\pi/4 - \phi/2)\tan\phi}{2\cos^2(45 + \phi/2)}$$

$$N'_\gamma = \frac{1}{2}\left(\frac{K_{p\gamma}}{\cot^2 \phi} - 1\right)\tan\phi$$

N' γ = From Table 3.2 page 130 (Principles of Foundation Engineering By BRAJA M. DAS)

γ =	***26.97***	KN/m³
ϕ =	***26.97***	degrees
c =	***21.80***	Kpa
D_{WT} =	***0***	m
Depth of Excav=	***4.50***	m

Square Footing Size m	Depth of Excav- m	Effective Stress q KPa	Wet Unit Weight of Soil γ KN/cu.m.	Cohesion c KPa	Angle of Internal Friction ϕ degrees	Angle of Internal Friction ϕ radians	Bearing Factors N'c	Bearing Factors N'q	Bearing Factors N'γ	Ultimate Bearing Pressure qu gross KPa	Allowable Bearing Pressure qa gross KPa	Allowable Bearing Pressure qa net KPa
1.00	**4.50**	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	603	151	74
1.50	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	609	152	75
2.00	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	614	153	76
2.50	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	619	155	78
3.00	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	625	156	79
3.50	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	630	157	80
4.00	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	635	159	82
4.50	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	641	160	83
5.00	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	646	161	84
5.50	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	651	163	86
6.00	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	657	164	87
6.50	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	662	166	88
7.00	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	667	167	90
7.50	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	673	168	91
8.00	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	678	170	92
8.50	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	683	171	94
9.00	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	689	172	95
9.50	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	694	174	96
10.00	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	699	175	98
10.50	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	705	176	99
11.00	4.50	77.26	27.0	21.80	18.74	0.33	11.24	3.55	0.99	710	178	100

$q_{a\ net} = q_a - q$

TERZAGHI ULTIMATE BEARING CAPACITY (LOCAL SHEAR FAILURE MODE IN SOILS)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020

EXPLORED BY: LPRA GEO-SOLUTIONS
BOREHOLE NO. 1
SQUARE FOOTING:

Local Shear Failure:

$$q_u = 0.867\ c'\ N_c + q\ N'_q + 0.40\ \gamma\ B_\gamma\ N'_\gamma \qquad Fs = 1 \qquad FS = 4$$

$$N'_c = \cot \phi' \left[\frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(\pi/4 + \pi/2)} - 1 \right]$$

$$N'_q = \frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(45 + \phi/2)}$$

$$N'_\gamma = \frac{1}{2}\left(\frac{K_{p\gamma}}{\cot^2 \phi} - 1\right)\tan\phi$$

N' γ = From Table 3.2 page 130 (Principles of Foundation Engineering By BRAJA M. DAS)

Fs = 2 to 3 Shear Failure

c' = 24.20 KPa

tan ϕ' = 2/3 tan ϕ

ϕ' = 20.00 degrees

γ = ***17.39*** KN/m³
ϕ = ***28.63*** degrees
c = ***24.20*** Kpa
D_{WT} = ***0*** m
Depth of Excav= ***6.00*** m

Square Footing Size m	Depth of Excav- m	Effective Stress q KPa	Wet Unit Weight of Soil γ KN/cu.m.	Cohesion c KPa	Angle of Internal Friction ϕ degrees	Angle of Internal Friction ϕ radians	Bearing Factors N'c	Bearing Factors N'q	Bearing Factors N'γ	Ultimate Bearing Pressure qu gross KPa	Allowable Bearing Pressure qa gross KPa	Allowable Bearing Pressure qa net KPa
1.00	**6.00**	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	557	139	94
1.50	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	561	140	95
2.00	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	565	141	96
2.50	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	569	142	97
3.00	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	573	143	98
3.50	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	577	144	99
4.00	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	581	145	100
4.50	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	584	146	101
5.00	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	588	147	102
5.50	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	592	148	103
6.00	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	596	149	103
6.50	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	600	150	104
7.00	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	604	151	105
7.50	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	608	152	106
8.00	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	612	153	107
8.50	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	616	154	108
9.00	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	619	155	109
9.50	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	623	156	110
10.00	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	627	157	111
10.50	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	631	158	112
11.00	6.00	45.53	17.4	24.20	20.00	0.35	11.85	3.88	1.12	635	159	113

qa net = qa - q

TERZAGHI ULTIMATE BEARING CAPACITY (LOCAL SHEAR FAILURE MODE IN SOILS)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
EXPLORED BY: LPRA GEO-SOLUTIONS
BOREHOLE NO. 1
SQUARE FOOTING:

Local Shear Failure:

Fs = 1 FS = 4

$$q_u = 0.867\ c'\ N_c + q\ N'_q + 0.40\ \gamma\ B_\gamma\ N'_\gamma$$

$$N'_c = \cot \phi' \left[\frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(\pi/4 + \pi/2)} - 1 \right]$$

$$N'_q = \frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(45 + \phi/2)}$$

$$N'_\gamma = \frac{1}{2}\left(\frac{K_{p\gamma}}{\cot^2\phi} - 1\right)\tan\phi$$

N'_γ = From Table 3.2 page 130 (Principles of Foundation Engineering By BRAJA M. DAS)

Fs = 2 to 3 Shear Failure

c' = 25.40 KPa

tan ϕ' = 2/3 tan ϕ

ϕ' = 20.25 degrees

γ = **17.77** KN/m^3
ϕ = **28.95** degrees
c = **25.40** Kpa
D_{WT} = **0** m
Depth of Excav= **7.50** m

Square Footing Size m	Depth of Excav- m	Effective Stress q KPa	Wet Unit Weight of Soil γ KN/cu.m.	Cohesion c KPa	Angle of Internal Friction ϕ degrees	Angle of Internal Friction ϕ radians	Bearing Factors N'c	Bearing Factors N'q	Bearing Factors N'γ	Ultimate Bearing Pressure qu gross KPa	Allowable Bearing Pressure qa gross KPa	Allowable Bearing Pressure qa net KPa
1.00	**7.50**	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	640	160	100
1.50	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	644	161	101
2.00	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	648	162	102
2.50	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	652	163	103
3.00	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	657	164	104
3.50	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	661	165	105
4.00	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	665	166	107
4.50	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	669	167	108
5.00	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	673	168	109
5.50	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	678	169	110
6.00	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	682	170	111
6.50	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	686	171	112
7.00	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	690	173	113
7.50	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	694	174	114
8.00	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	698	175	115
8.50	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	703	176	116
9.00	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	707	177	117
9.50	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	711	178	118
10.00	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	715	179	119
10.50	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	719	180	120
11.00	7.50	59.74	17.8	25.40	20.25	0.35	11.98	3.95	1.18	724	181	121

qa net = qa - q

TERZAGHI ULTIMATE BEARING CAPACITY (LOCAL SHEAR FAILURE MODE IN SOILS)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
EXPLORED BY: LPRA GEO-SOLUTIONS
BOREHOLE NO. 1
SQUARE FOOTING:

Local Shear Failure:

$$q_u = 0.867\ c'\ N_c + q\ N'_q + 0.40\ \gamma\ B_\gamma\ N'_\gamma \qquad Fs = 1 \qquad FS = 4$$

$$N'_c = \cot \phi' \left[\frac{e^{2(3\pi/4 - \phi'/2)\tan\phi}}{2\cos^2(\pi/4 + \pi/2)} - 1 \right]$$

$$N'_q = \frac{e^{2(3\pi/4 - \phi'/2)\tan\phi}}{2\cos^2(45 + \phi/2)}$$

$$N'_\gamma = \frac{1}{2}\left(\frac{K_{p\gamma}}{\cot^2\phi} - 1\right)\tan\phi$$

N' γ = From Table 3.2 page 130 (Principles of Foundation Engineering By BRAJA M. DAS)

Fs = 2 to 3 Shear Failure

c' = 23.00 KPa

tan ϕ' = 2/3 tan ϕ

ϕ' = 18.84 degrees

γ =	***16.90***	KN/m³
ϕ =	***27.10***	degrees
c =	***23.00***	Kpa
D_{WT} =	***0***	m
Depth of Excav=	***9.00***	m

Square Footing Size m	Depth of Excav- m	Effective Stress q KPa	Wet Unit Weight of Soil γ KN/cu.m.	Cohesion c KPa	Angle of Internal Friction ϕ degrees	Angle of Internal Friction ϕ radians	Bearing Factors N'c	Bearing Factors N'q	Bearing Factors N'γ	Ultimate Bearing Pressure qu gross KPa	Allowable Bearing Pressure qa gross KPa	Allowable Bearing Pressure qa net KPa
1.00	**9.00**	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	572	143	79
1.50	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	575	144	80
2.00	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	579	145	81
2.50	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	582	146	82
3.00	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	586	146	83
3.50	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	589	147	83
4.00	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	592	148	84
4.50	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	596	149	85
5.00	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	599	150	86
5.50	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	603	151	87
6.00	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	606	152	88
6.50	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	609	152	89
7.00	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	613	153	89
7.50	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	616	154	90
8.00	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	620	155	91
8.50	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	623	156	92
9.00	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	626	157	93
9.50	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	630	157	94
10.00	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	633	158	94
10.50	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	637	159	95
11.00	9.00	63.83	16.9	23.00	18.84	0.33	11.29	3.57	1.01	640	160	96

qa net = qa - q

TERZAGHI ULTIMATE BEARING CAPACITY (LOCAL SHEAR FAILURE MODE IN SOILS)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
EXPLORED BY: LPRA GEO-SOLUTIONS
BOREHOLE NO. 1
SQUARE FOOTING:
Local Shear Failure:

Fs = 2 to 3 Shear Failure

c' = 25.40 KPa

tan ϕ' = 2/3 tan ϕ

ϕ' = 19.72 degrees

Fs = 1 FS = 4

$$Qu = 0.867\ c'\ Nc + q\ N'q + 0.40\ \gamma\ B_\gamma\ N'_\gamma$$

$$N'c = \cot\phi' \left[\frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(\pi/4 + \pi/2)} - 1 \right]$$

$$N'q = \frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(45 + \phi/2)}$$

$$N'\gamma = \frac{1}{2}\left(\frac{K_{p\gamma}}{\cot^2\phi} - 1\right)\tan\phi$$

N' γ = From Table 3.2 page 130 (Principles of Foundation Engineering By BRAJA M. DAS)

γ =	***17.66***	KN/m^3
ϕ =	***28.26***	degrees
c =	***25.40***	Kpa
D_{WT} =	***0***	m
Depth of Excav=	***10.50***	m

Square Footing Size m	Depth of Excav- m	Effective Stress q KPa	Wet Unit Weight of Soil γ KN/cu.m.	Cohesion c KPa	Angle of Internal Friction ϕ degrees	Angle of Internal Friction ϕ radians	Bearing Factors N'c	Bearing Factors N'q	Bearing Factors N'γ	Ultimate Bearing Pressure Qu gross KPa	Allowable Bearing Pressure Qa gross KPa	Allowable Bearing Pressure Qa net KPa
1.00	**10.50**	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	708	177	95
1.50	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	712	178	96
2.00	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	716	179	96
2.50	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	720	180	97
3.00	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	724	181	98
3.50	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	727	182	99
4.00	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	731	183	100
4.50	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	735	184	101
5.00	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	739	185	102
5.50	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	743	186	103
6.00	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	747	187	104
6.50	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	751	188	105
7.00	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	754	189	106
7.50	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	758	190	107
8.00	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	762	191	108
8.50	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	766	192	109
9.00	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	770	192	110
9.50	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	774	193	111
10.00	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	778	194	112
10.50	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	781	195	113
11.00	10.50	82.46	17.7	25.40	19.72	0.34	11.71	3.80	1.09	785	196	114

Qa net = Qa - Q

TERZAGHI ULTIMATE BEARING CAPACITY (LOCAL SHEAR FAILURE MODE IN SOILS)

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020

EXPLORED BY: LPRA GEO-SOLUTIONS
BOREHOLE NO. 1
SQUARE FOOTING:

Local Shear Failure:

Fs = 2 to 3 Shear Failure

c' = 24.80 KPa

tan ϕ' = 2/3 tan ϕ

ϕ' = 19.61 degrees

Fs = 1 FS = 4

$$Qu = 0.867\ c'\ Nc + q\ N'q + 0.40\ \gamma\ B_\gamma\ N'_\gamma$$

$$N'c = \cot\phi' \left[\frac{e^{2(3\pi/4 - \phi/2)\tan\phi}}{2\cos^2(\pi/4 + \pi/2)} - 1 \right]$$

$$N'q = \frac{2(3\pi/4 - \phi/2)\tan\phi}{2\cos^2(45 + \phi/2)}$$

$$N'\gamma = \frac{1}{2}\left(\frac{K_{p\gamma}}{\cot^2\phi} - 1\right)\tan\phi$$

N' γ = From Table 3.2 page 130 (Principles of Foundation Engineering By BRAJA M. DAS)

γ =	***17.39***	KN/m^3
ϕ =	*28.12*	degrees
c =	***24.80***	Kpa
D_{WT} =	***0***	m
Depth of Excav=	***12.00***	m

Square Footing Size m	Depth of Excav- m	Effective Stress q KPa	Wet Unit Weight of Soil γ KN/cu.m.	Cohesion c KPa	Angle of Internal Friction ϕ degrees	Angle of Internal Friction ϕ radians	Bearing Factors N'c	Bearing Factors N'q	Bearing Factors N'γ	Ultimate Bearing Pressure Qu gross KPa	Allowable Bearing Pressure Qa gross KPa	Allowable Bearing Pressure Qa net KPa
1.00	**12.00**	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	727	182	91
1.50	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	731	183	92
2.00	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	735	184	93
2.50	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	738	185	94
3.00	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	742	186	94
3.50	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	746	186	95
4.00	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	750	187	96
4.50	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	753	188	97
5.00	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	757	189	98
5.50	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	761	190	99
6.00	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	765	191	100
6.50	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	768	192	101
7.00	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	772	193	102
7.50	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	776	194	103
8.00	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	780	195	104
8.50	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	784	196	105
9.00	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	787	197	106
9.50	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	791	198	107
10.00	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	795	199	108
10.50	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	799	200	109
11.00	12.00	91.02	17.4	24.80	19.61	0.34	11.66	3.77	1.08	802	201	110

Qa net = Qa - Q

LIQUEFACTION ASSESSMENT BY SEED & IDRISS

PROJECT : Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center
LOCATION: Davao del Norte Government Center, Mankilam, Tagum City
DATE: 9/20/2020
EXPLORED BY: LPRA GEO-SOLUTIONS

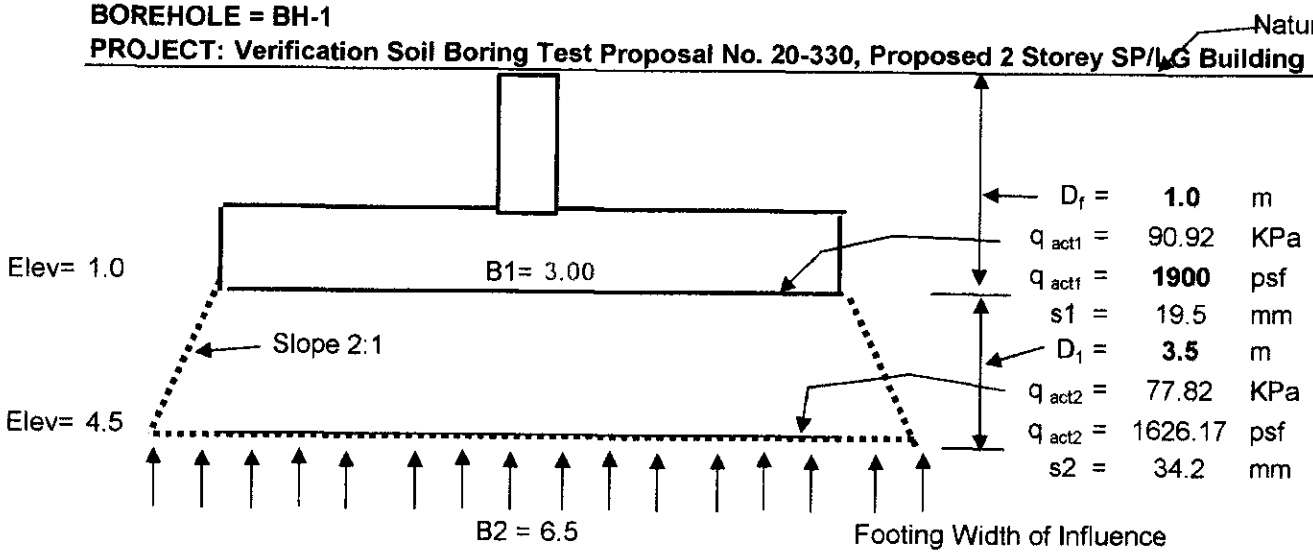
BOREHOLE NO. 1

DEPTH (m)	DEPTH (m)	% Fines	Specific Gravity of Soil Solids Gs	Field Measured N-Values	Water Content = w %	Wet Unit Weight KN/m^3	Saturated Unit Weight KN/m^3 = $(G_s + e)\gamma_w / (1+e)$	Dry Unit Weight KN/m^3 = γ / (1+w)	Vertical Effective Stress	Liao & Whitman-1982-Correction Factor = C_N	SPT Corrected $N_{cor} = N_f \times C_N$	Seed & Idriss -1982-Figure 10.34 page 441 Lower Bound of (τ_h / σ_v) field for which is likely	Horizontal Shear Stress $\tau_h = \sigma_v \times M(i)$	Total Vertical Stress	a_{max} / g	Seed & Idriss 1971-C_D= Stress Reduction Factor Figure 10.30b page 434	Maximum Shear Stress-time history $\tau_{av} = .65 \times C_D \times$ Total Vert. Stress $\times a_{max} / g \quad \sigma_v \times M(i)$	Liquefaction Resistance Factor (FL) = τ_h / τ_{av}	SYMBOL	Plasticity Index, PI	SOIL & ROCK DESCRIPTION
0.0 -0.5	0.50	34.6%	2.7	8	12.31%	16.44	19.03	14.64	7.32	3.62	28.9	0.40	2.93	12.22	0.40	1.000	3.178	0.921	SC-SM	3.25%	Silty, Clayey Sand Slightly plastic
0.5 -1.0	1.00	34.6%	2.7	8	10.78%	15.67	18.72	14.15	14.39	2.58	20.6	0.40	5.76	19.30	0.40	0.996	4.998	1.152	SC-SM	3.25%	Silty, Clayey Sand Slightly plastic
1.0 -1.5	1.50	25.3%	2.7	4	20.04%	14.73	17.54	12.27	18.26	2.29	9.2	0.17	3.10	23.16	0.40	0.992	5.975	0.519	SM	0.00%	Silty Sand Non plastic
1.5 -2.0	2.00	25.3%	2.7	5	31.62%	14.92	16.95	11.33	21.82	2.09	10.5	0.19	4.15	26.73	0.40	0.988	6.868	0.604	SM	0.00%	Silty Sand Non plastic
2.0 - 2.5	2.50	25.3%	2.7	11	18.72%	17.46	19.07	14.70	26.45	1.90	20.9	0.40	10.58	31.36	0.40	0.984	8.026	1.318	SM	0.00%	Silty Sand Non plastic
2.5 -3.0	3.00	25.3%	2.7	8	28.85%	18.14	18.67	14.07	30.88	1.76	14.1	0.25	7.72	35.79	0.40	0.980	9.123	0.846	SM	0.00%	Silty Sand Non plastic
3.0 - 4.5	4.50	25.3%	2.7	3	23.50%	16.09	18.01	13.03	43.19	1.49	4.5	0.13	5.61	57.90	0.40	0.969	14.584	0.385	SM	0.00%	Silty Sand Non plastic
4.5 -6.0	6.00	25.3%	2.7	7	26.88%	17.39	18.44	13.71	56.14	1.31	9.1	0.17	9.54	70.85	0.40	0.957	17.629	0.541	SM	0.00%	Silty Sand Non plastic
6.0 - 7.5	7.50	25.3%	2.7	9	14.30%	17.77	19.60	15.55	70.82	1.16	10.5	0.19	13.46	85.54	0.40	0.928	20.648	0.652	SM	0.00%	Silty Sand Non plastic
7.5 - 9.0	9.00	25.3%	2.7	5	29.17%	16.90	18.05	13.08	83.18	1.07	5.4	0.13	10.81	97.89	0.40	0.900	22.904	0.472	SM	0.00%	Silty Sand Non plastic
9.0 - 10.5	10.50	25.3%	2.7	9	23.36%	17.66	18.82	14.31	96.69	0.99	9.0	0.17	16.44	111.41	0.40	0.871	25.240	0.651	SM	0.00%	Silty Sand Non plastic
10.5 - 12.0	12.00	25.3%	2.7	8	21.64%	17.39	18.81	14.30	110.20	0.93	7.5	0.15	16.53	124.91	0.40	0.843	27.372	0.604	SM	0.00%	Silty Sand Non plastic
12.0 - 13.5	13.50	0.0%	2.7	0	0.00%	0.00	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	0.40	#DIV/0!	#DIV/0!	0.40	0.800	#DIV/0!	#DIV/0!	0	0.00%	0.00
13.5 - 15.0	15.00	0.0%	2.7	0	0.00%	0.00	#DIV/0!	0.00	#DIV/0!	#DIV/0!	#DIV/0!	0.40	#DIV/0!	#DIV/0!	0.40	0.756	#DIV/0!	#DIV/0!	0	0.00%	0.00

SOIL BEARING PRESSURE ANALYSIS BY 2:1 METHOD:

BOREHOLE = BH-1

PROJECT: Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center



γ =	**16.7**	KN/cu.m.	
D_f =	1.0	m	Depth from natural ground
q_{act1} =	90.92	KPa	Bearing pressure (use) at footing level

Computed Bearing Pressure at specified soil layer (q_{act2}):

D_1 =	3.5	m	Depth from bottom of footing

$q_{act2} = (B1)^2 / (B2)^2 \; q_{act} + \gamma \; D_1$

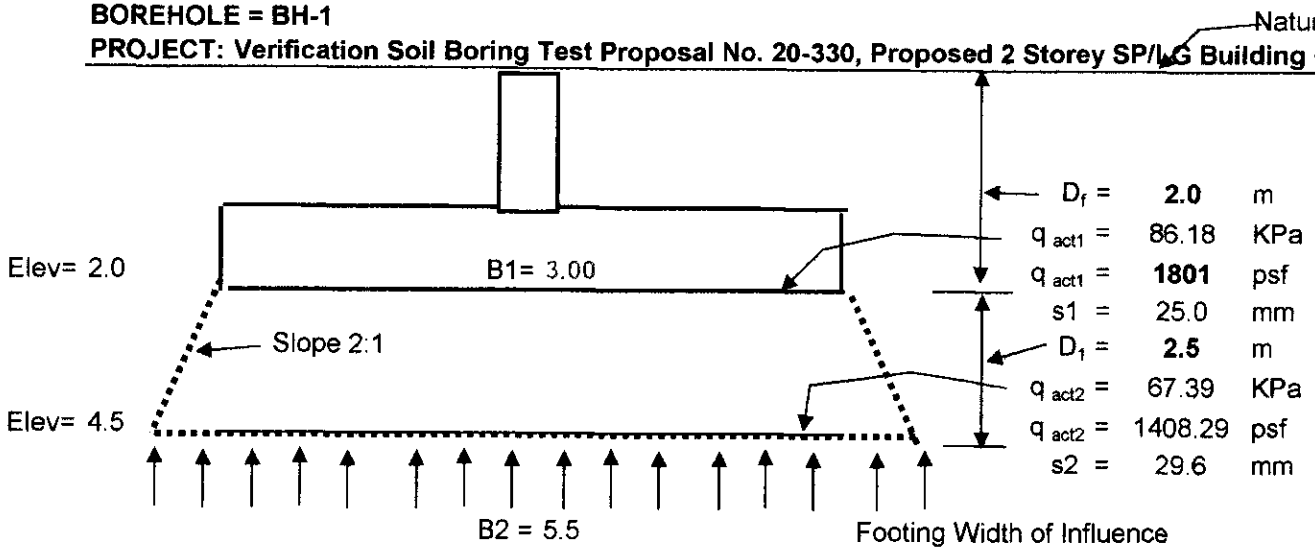
q_{act2} =	77.82	KPa	Computed Bearing pressure at specified level
s =	34.2	mm	(Approximate Settlement)

Allowable Bearing Pressure at depth from Natural Ground (q_a):

q_a = from Table generated above using Meyerhof Equations

	Level 1	Level 2		
q_a =	116.67	56.95	KPa	
q_a =	**2438**	**1190**	psf	
D_f =	1.0	4.5	m	Depth from natural ground
B =	3.00	3.00	m	Size of Footing
s =	25.0	25.0	mm	(Approximate Settlement)

SOIL BEARING PRESSURE ANALYSIS BY 2:1 METHOD:
BOREHOLE = BH-1
PROJECT: Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center



γ =	**16.7**	KN/cu.m.	
D_f =	2.0	m	Depth from natural ground
q_{act1} =	86.18	KPa	Bearing pressure (use) at footing level

Computed Bearing Pressure at specified soil layer (q_{act2}):

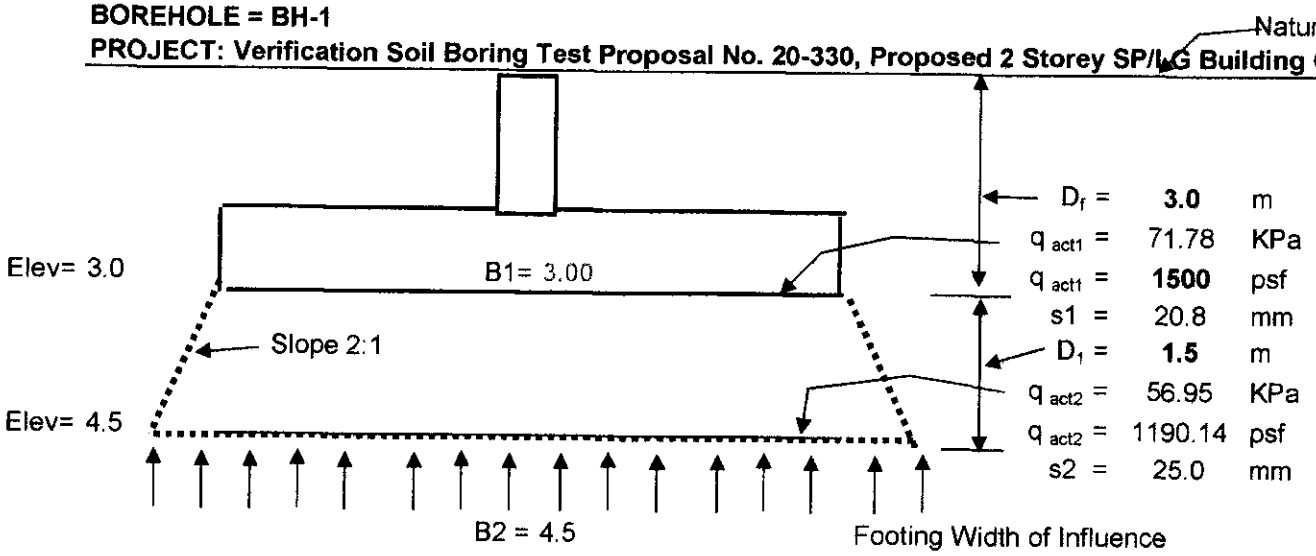
D_1 =	2.5	m	Depth from bottom of footing
$q_{act2} = (B1)^2 / (B2)^2$	q_{act} +	γ D_1	
q_{act2} =	67.39	KPa	Computed Bearing pressure at specified level
s =	29.6	mm	(Approximate Settlement)

Allowable Bearing Pressure at depth from Natural Ground (q_a):

q_a = from Table generated above using Meyerhof Equations

	Level 1	Level 2		
q_a =	86.18	56.95	KPa	
q_a =	**1801**	**1190**	psf	
D_f =	2.0	4.5	m	Depth from natural ground
B =	3.00	3.00	m	Size of Footing
s =	25.0	25.0	mm	(Approximate Settlement)

SOIL BEARING PRESSURE ANALYSIS BY 2:1 METHOD:
BOREHOLE = BH-1
PROJECT: Verification Soil Boring Test Proposal No. 20-330, Proposed 2 Storey SP/LG Building Gov't Center



γ =	**16.7**	KN/cu.m.	
D_f =	3.0	m	Depth from natural ground
q_{act1} =	71.78	KPa	Bearing pressure (use) at footing level

Computed Bearing Pressure at specified soil layer (q_{act2}):

D_1 =	1.5	m	Depth from bottom of footing

$q_{act2} = (B1)^2 / (B2)^2 \; q_{act} + \gamma D_1$

q_{act2} =	56.95	KPa	Computed Bearing pressure at specified level
s =	25.0	mm	(Approximate Settlement)

Allowable Bearing Pressure at depth from Natural Ground (q_a):

q_a = from Table generated above using Meyerhof Equations

	Level 1	Level 2		
q_a =	86.18	56.95	KPa	
q_a =	**1801**	**1190**	psf	
D_f =	3.0	4.5	m	Depth from natural ground
B =	3.00	3.00	m	Size of Footing
s =	25.0	25.0	mm	(Approximate Settlement)