



**Smart Development
Engineering (SDE) Limited**

**SOIL INVESTIGATION
SERVICES**

We offer:

Standard Penetration Test (SPT)
Geotechnical Laboratory Tests
Seismic Downhole Test (SDHT)
Cone Penetration Test (CPT) &
Seismic Cone Penetration Test (SCPT)
Soil Characterization Analysis
Geohazard Analysis



Message

In Bangladesh's infrastructure development industry sub-soil investigation is often disregarded process despite having the paramount importance from geotechnical design to selecting structural system for seismic analysis. Results from geotechnical investigation defines the sustainability of the structure and viability of the project. In Bangladesh it has become a practice to use low-cost geotechnical equipment and laboratory facilities that are far below national and international standards leads to costly foundation, earth retaining structures and other structures due to unreliable test results. Smart Development Engineering (SDE) Limited has started its journey in 2015 with a commitment to contributing towards reliable and sustainable development through a multidisciplinary approach. SDE worked to produce the most accurate geotechnical information with its standardized geotechnical laboratory, state-of-the-art field test equipment, and well-trained and experienced professionals. Along with regular soil properties, SDE can produce dynamic properties of Soil, which is imperative for designing foundation resilient to an earthquake. SDE has the experience of national priority projects for developing microzonation city maps, analyzing liquefaction, amplification, and designing the foundation for tall structures.

Sincerely,

Ahmadul Hassan, PhD
Executive Director

STANDARD PENETRATION TEST (SPT)

The standard penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on geotechnical engineering properties of soil. We use high efficient Rotary Drilling Rig and follow ASTM D1586 – 18 test procedure.

Experiences:

1. CDA Flyover (50+ Boreholes),
2. Rajuk Urban Resilience Project (378 boreholes),
3. WFP lake dam protection project,
4. Jhilmil Residential Park Project (200 boreholes).
5. Rohingya Camp, RMG Factories, housing projects, Paper industries etc.



GEOTECHNICAL LABORATORY TESTS

Geotechnical laboratory has always been a concern for foundation engineers in Bangladesh, as most of the geotechnical laboratory lacks in Quality and standards in testing. Eventually these tests produce unreliable geotechnical information. As an engineering consultancy firm, Environment and Infrastructure Management Solution (EIMS) took it as a challenge and it introduced its sister concern Smart Development Engineering (SDE) Limited with highly professional team of geotechnical engineers

and technician and efficient laboratory facilities. Smart Development Engineering (SDE) Limited, a sister concern of EIMS Limited, has been involved in Geotechnical Investigation and Laboratory Testing since 2015. From then SDE develops its capacity and strength its resource with training from international experts. The laboratory test has been praised by national and international scientists from filed of geotechnical investigation and foundation design.



**Unconfined Compression
Testing Machine**



Consolidation Machine



**Liquid Limit
(Casagrande Device)**



Direct Shear Machine



Sieve Set and Oven



LIST OF LABORATORY TESTS IN SDE LAB, CAPACITY AND RELEVANT TEST STANDARDS

Moisture Content



- ◆ **Standard:** ASTM D2216 – 98
- ◆ **Number of Equipment:**
Weight machine – 10 Nos.
Oven – 6 Nos.
- ◆ **Temperature:** $110^{\circ}\pm 5^{\circ}\text{C}$

Moisture or Water Content (of a material) the ratio expressed as a percent of the mass of "pore" or "free" water in a given mass of material to the mass of the solid material.

Sieve Analysis



- ◆ **Standard:** ASTM D 422 – 63, ASTM D 6913 – 04
- ◆ **Number of Equipment:**
Sieve Set- 6 Nos.
Sieve Shaker- 4 Nos.
- ◆ Generate gradation curve.

Sieve analysis is a determination of the proportions of particles lying within certain size ranges in a granular material by separation on sieves of different size openings.

Wet Sieve Analysis



- ◆ **Standard:** ASTM D 1140 – 00
- ◆ **Number of Equipment:**
Sieve Set- 6 Nos.
Sieve Shaker- 4 Nos.

Wet sieving is a method to separate the coarse material with water or another type of liquid before drying, identifying and analyzing. In this process, the sample is washed through the sieve stack.

Shrinkage Limit



- ◆ **Standard:** ASTM D 4943 – 08
- ◆ **Number of Equipment:**
Shrinkage Dish- 52 Nos.

Evaluates the water content of a soil where further loss of moisture will not result in an additional volume reduction.



Liquid Limit & Plastic Limit



- ◆ **Standard:** ASTM D4318 – 05
- ◆ **Number of Equipment:** Casagrande apparatus – 9 Nos.

To distinguish between silt and clay, and to distinguish between different types of silts and clays.

Hydrometer Analysis



- ◆ **Standard:** ASTM D 422 – 63, ASTM D7928 – 17
- ◆ **Number of Equipment:** 6 Nos.

The sedimentation or hydrometer method is used to determine the particle-size distribution (gradation) of the material that is finer than the No. 200 (75- μ m) sieve and larger than about 0.2- μ m.

Direct Shear Test



- ◆ **Standard:** ASTM D3080/D3080M –11
- ◆ **Number of Equipment:** DST apparatus – 2 Nos.

This test method covers the determination of the consolidated drained shear strength of one specimen of a soil material under direct shear boundary conditions.

Specific Gravity



- ◆ **Standard:** ASTM D 854 – 02
- ◆ **Number of Equipment:** Pycnometer – 6 Nos.

Specific gravity of soil solids, G_s , n - the ratio of the mass of a unit volume of a soil solids to the mass of the same volume of gas-free distilled water at 20°C. From this test, we understand how porous the soil is and how saturated the soil is with water.



Unconfined Compression Test



- ◆ **Standard:** ASTM D2166/D2166M – 13
- ◆ **Number of Equipment:** UCT machine- 1 Nos.

The primary purpose of Unconfined Compression Test is to determine the unconfined compressive strength, which is then used to calculate the unconsolidated undrained shear strength of the clay under unconfined conditions.

One Dimensional Consolidation Test



- ◆ **Standard:** ASTM D2435/ D2435M – 11
- ◆ **Number of Equipment:** Consolidation machine – 15 Nos.

The gradual reduction in volume of a soil mass resulting from an increase in compressive stress to determine the rate and magnitude of soil consolidation when the soil is restrained laterally and loaded axially.

Lab technicians after continuous capacity development trainings.



SEISMIC DOWNHOLE TEST (SDHT)

Downhole seismic test is an in-situ test and determine the velocity of primary (P) and secondary (S) seismic waves to provide the elastic soil parameters. The P and S waves Velocities are used in geotechnical foundation analysis, static and dynamic soil analysis, liquefaction assessment and etc. We follow ASTM D7400 test procedure.



Experiences:

Rajuk Urban Resilience Project (400 Tests),



CONE PENETRATION TEST (CPT) & SEISMIC CONE PENETRATION TEST (SCPT)

The cone penetration test (CPT) is used to determine the geotechnical engineering properties of soils. Seismic CPT or SCPT is used to calculate the small strain shear modulus of the soil by measuring shear wave velocity through the soil. The machine that we use is Gouda Geo-Equipment-B.V. The capacity of this machine is 350 kN. It generates vertical & horizontal wave (P-waves & S-waves). We follow ASTM D5778 – 20 & ASTM D7400 test procedure for CPT & SCPT respectively.

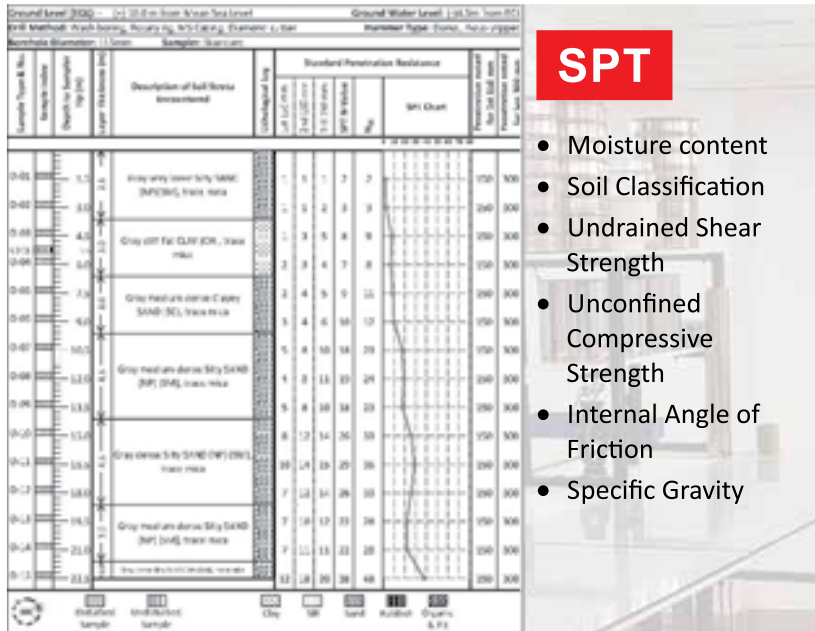


Experiences:

1. Rajuk Urban Resilience Project.

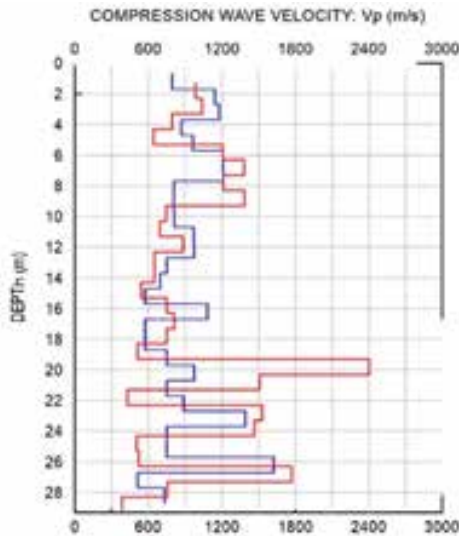
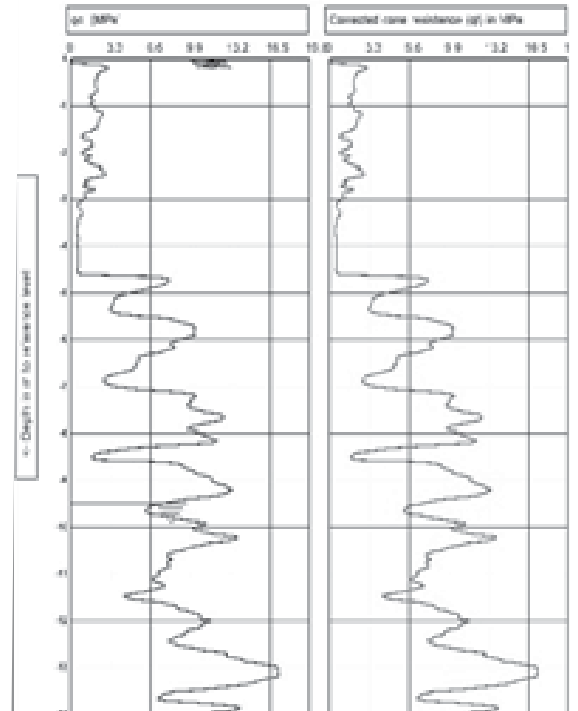


SOIL CHARACTERIZATION ANALYSIS



SPT

- Moisture content
- Soil Classification
- Undrained Shear Strength
- Unconfined Compressive Strength
- Internal Angle of Friction
- Specific Gravity



SCPT

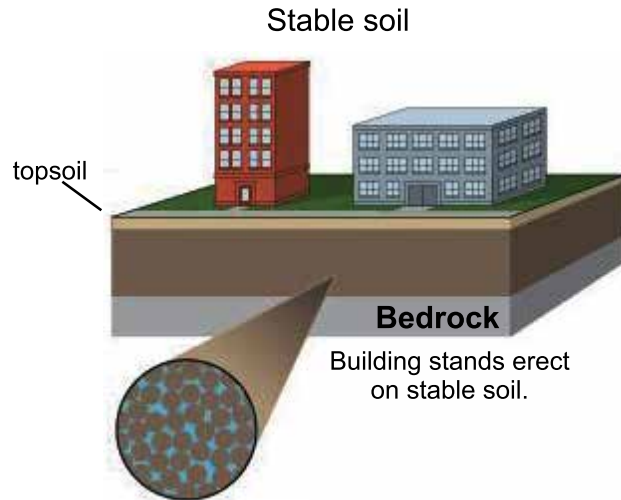
- Compression wave velocity, (V_p)
- Shear wave velocity, (V_s)
- Shear modulus, (G_0)

CPT

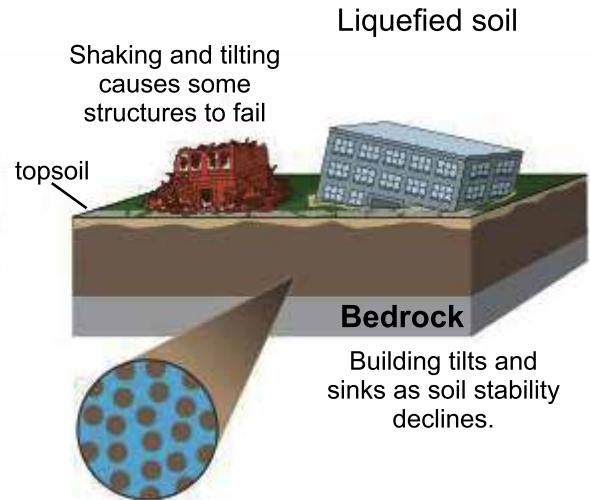
- Cone resistance (q_c)
- Sleeve friction (f_s)
- Pore water pressure (u_2)
- Relative density
- Undrained shear strength
- Soil behavior type index



GEOHAZARD ANALYSIS



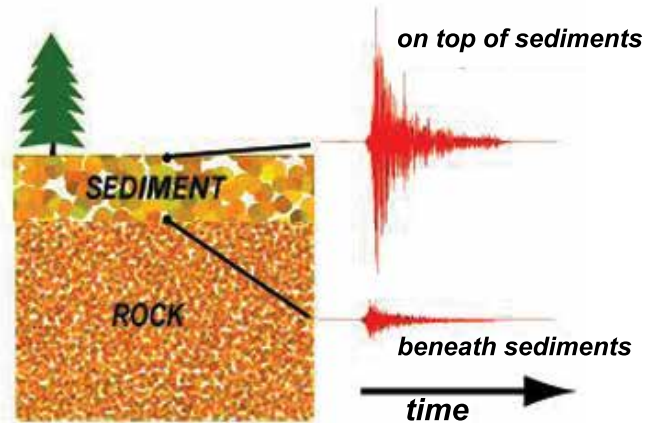
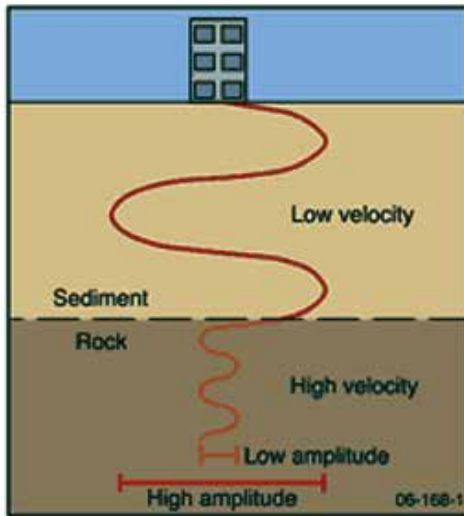
Loosely packed grains of soil are held together by friction. Pore spaces are filled with water.



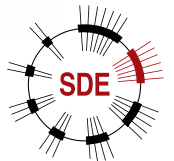
Shaking destabilizes the soil by increasing the space between grains. With its structure lost,

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Effect of Soil Liquefaction



Site Amplification



EXPERIENCES

SDE have worked in several high priority projects. An overview of SDE's projects is given below:

City wide (DMDP area)

Geotechnical Investigation for

Completed tasks

- SPT Field and Lab test:15000m
- Seismic downhole test: 400 Nos
- Cone Penetration Test (CPT): 5000m
- Seismic Cone Penetration Test (SCPT): 400 Nos

Geotechnical Investigation of CDA Fly-over, Chottogram

Completed tasks

- SPT Field and Lab test:200 Nos

Geotechnical Investigation and Seismic Vulnerability Assessment for Jhilmil Residential Project

Completed tasks

- SPT Field and Lab test:200 Nos
- Liquefaction and Amplification analysis for the project area

Geotechnical Investigation for 2 existing Bridges in Cox's Bazar and for 3 new walking bridges in Rohingya Camp under WFP

Completed tasks

- SPT Field and Lab test:20 Nos

Geotechnical Investigation, Slope Stability Analysis and Dam Protection in Rohingya Camp 20 and 20 extension

Completed tasks

- SPT Field and Lab test
- Existing Sheet Pile Analysis for adequacy
- Slope Stability Assessment of existing Hill Slope

Geotechnical Investigation and Foundation Assessment for UNICEF office Building in 7 districts in Bangladesh

Completed tasks

- SPT Field and Lab test
- Foundation Analysis for existing structure

Geotechnical Investigation and Seismic Vulnerability Assessment for Several RMG factories (Green Textile Limited, Young One etc.

Completed tasks

- SPT Field and Lab test:200 Nos
- Liquefaction and Amplification analysis for the project area



OUR REPORTS

THE WORLD BANK

Development of Risk Sensitive Land Use Planning Practice in Greater Dhaka

Comprehensive Study on a Citywide (DMDP) Geotechnical and Geological Investigation

Seismic Downhole Test (SDHT) Test Report of 80 SDHTs GD-04.1 (Volume 5)

June 21, 2021

NKY ARCHITECT & DESIGN

SHELTECH

SDE

REPORT
Subsoil Investigation

Project
Geotechnical Assessment for Foundation Design of Three Bailey Bridges
Kubawing Moga Canal, Cox's Bazar, Bangladesh

Client
World Food Programme
Via Centre Gato, Villa, 4870
30148 Roma, Italy

Consultant
Smart Development Engineering (SDE) Limited

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February, 2021

Project Title
Soil Investigation for Campus Buildings of Sheikh Hasina University

Project Location
Maimansingha District, Mymensingh, Bangladesh

Report of Soil Investigation
Date: Wednesday, June 3, 2020

Client
Tanvirul Haque & Associates Limited

Consultant
Smart Development Engineering (SDE) Limited

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REPORT
Sub Soil Investigation

Client
BNG Global Holding SDN BHD
50-6, Wiluna (JSA 1, Damansara Jazir Dungan, Damansara Heights, 50490 Kuala Lumpur, Malaysia)

Project
Sub Soil Investigation for Jhirmir Residential Park
Keranang, Dhaka

Consultant
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March, 2019





Client consultation at field and office, Technology transfer, Filed investigation, Project progress presentation, Team meeting before field work.

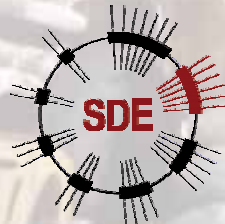


OUR CLIENTS



AND
Architects, Engineers and Developers





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