ဗုဒ္ဓံ ဓမ္မံ သံဃံ

GEOLAB (MYANMAR) CO., LTD.
Foundation Soil and Concrete Specialist

COMPANY PROFILE

(As of September 2025) (15th Year Anniversary)

(Your Trusted One-Stop Geotechnical Services Provider)

Company Registration No:153906386

(YCDC-Pile License-PL-36) | (YCDC-Soil Test License-STL-16)

Operation Office
413-414, Aung Thit Sar Street, 48 Ward, North Dagon Township, Yangon, Myanmar, 11421.
Tel.: 09-798476843, 09-5003281, 09-5077153.
E-Mail: csc1999@gmail.com; info@csc1999.com;
A member of CSC Group; Website: https://www.csc1999.com

COMPANY REGISTERATION & HPBC RECOMMENDATION

ကုမ္ပဏီမှတ်ပုံတင်လက်မှတ်

Certificate of Incorporation

ဂျီအိုလက်(ပ်)(မြန်မာ) ကုမ္ပဏီ လီမိတက်

GEOLAB (MYANMAR) COMPANY LIMITED

Company Registration No. 153906386

မြန်မာနိုင်ငံကုမ္ပဏီများအက်ဥပဒေ ၁၉၁၄ ခုနှစ် အရ

ဂျီအိုလက်(ပ်)(မြန်မာ) ကုမ္ပဏီ လီမိတက်

အား ၂၀၁၂ ခုနှစ် ဒီဇင်ဘာလ ၁၄ ရက်နေ့တွင်

အစုရှယ်ယာအားဖြင့် တာဝန်ကန့်သတ်ထား သည့် အများနှင့်မသက်ဆိုင်သောကုမ္ပဏီ

အဖြစ် ဖွဲ့စည်းမှတ်ပုံတင်ခွင့် ပြုလိုက်သည်။

This is to certify that

GEOLAB (MYANMAR) COMPANY LIMITED

was incorporated under the Myanmar Companies Act 1914 on 14 December 2012 as a Private Company Limited by Shares.

ကုမ္ပဏီမှတ်ပုံတင်အရာရှိ

Registrar of Companies

ရင်းနှီးမြှုပ်နှံမှုနှင့်ကုမ္ပဏီများညွှန်ကြားမှုဦးစီးဌာန

Directorate of Investment and Company Administration

Former Registration No. 271/2012-2013

HIGH-RISE AND PUBLIC BUILDING PROJECTS COMMITTEE

HPBC

This is to certify that the following organization/ company is duely recognized as "Geotechnical Working Team" assigned to do the Piling Work/ Pile Load Test/ Soil Investigation of the specified Projects in Myanmar

GEOLAB (MYANMAR) COMPANY LIMITED

(PILE LOAD TEST)

Note: The certificate is valid up to ---------- *2027 AUGUST*

Prof. Dr. Aung Kyaw Myat
Chairman
HPBC

18/8/2022

YANGON, MYANMAR

YCDC PILE TEST LICENSE SOIL LICENSE

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
ရန်ကုန်တိုင်းဒေသကြီးအစိုးရအဖွဲ့
ရန်ကုန်မြို့တော်စည်ပင်သာယာရေးကော်မတီ
အင်ဂျင်နီယာဌာန (အဆောက်အအုံ)

Pileလုပ်ငန်းလုပ်ကိုင်ခွင့်လိုင်စင်

စာအမှတ်၊ PEL1-0111-PLE2-0100/ လိုင်စင် / ယာ (အုံ)
ရက်စွဲ၊ ၂၀၂၅ခုနှစ် ဧပြီလ ၇ရက်

မြောက်ဒဂုံမြို့နယ်၊ ၄၈ ရပ်ကွက်၊ အောင်သစ္စာလမ်း၊အမှတ်(၄၁၃) ရှိ GeoLab Myanmar Co., Ltd. ကုမ္ပဏီသည် ၂၀၂၅-၂၀၂၆ ဘဏ္ဍာရေးနှစ်အတွက် သတ်မှတ်ထားသော နှစ်စဉ်ကြေးကို ပေးသွင်းပြီးဖြစ်သဖြင့် ကော်မတီအသိအမှတ်ပြုPileလုပ်ငန်းလုပ်ကိုင်ခွင့်လိုင်စင်အား သက်တမ်းတိုးခွင့်ပြုလိုက်သည်။

သက်တမ်းကုန်ဆုံးရက်၊ ၃၁.၃.၂၀၂၆

လိုင်စင်အမှတ် - PL-36

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
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အင်ဂျင်နီယာဌာန (အဆောက်အအုံ)

မြေသားစစ်းသပ်မှုလုပ်ကိုင်ခွင့်လိုင်စင်

စာအမှတ်၊ SIEL1-0044-SILE2-0039/ လိုင်စင် / ယာ (အုံ)
ရက်စွဲ၊ ၂၀၂၅ခုနှစ် ဧပြီလ ၇ရက်

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သက်တမ်းကုန်ဆုံးရက်၊ ၃၁.၃.၂၀၂၆

လိုင်စင်အမှတ် - STL-16

DOCUMENT HISTORY

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Sep-2025	Sep-2025 Release	09.09.2025	AUNG HTET	-

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Geolab Myanmar Co., Ltd.

(Technical Company Profile)

1. Our Firm

Geolab (Myanmar) Co., Ltd. (GEOLAB) is established in 2012 at Yangon, Union of Myanmar. Founding members of Myanmar civil engineers having in depth understanding for local situation with extensive regional and international perspectives, i.e. engineering experiences in design, testing and monitoring + construction supervision fields.

GEOLAB has recruited young, energetic and technically sound group of local engineers and technicians as main assets of the firm. In line with core dynamic work force, GEOLAB main office is well equipped with modern office equipment, professional software, surveying and monitoring instrument, international quality standard references and laboratory equipment and apparatus.

Area of Interest: GEOLAB is a Testing Firm for Pile Load Test such as Static Load Test, Instrumented Static Load Test, Pile Dynamic Analysis (High Strain PDA), Low Strain Pile Integrity Test (SIT/PIT), Pile Sonic Logging, Lateral Load Test and Site Investigation (Soil Boring and Testing); Vibration & Noise Monitoring, Instrumentation such as Inclinometer, Temperature & Strain Monitoring, Building Settlement Markers, Tilt Meter, Crack Meter and Deflection Measurement, Piezometer Monitoring. Apart from compact and strong founder team, GEOLAB has extensive professional network through CSC Group of Companies.

Operation Office: is opened from Monday to Friday (9:00 AM to 5:00 PM) & located at 413-414, Aung Thit Sar Street, 48 Ward, North Dagon Township, Yangon, Myanmar, 11421, to serve customers with ease.

Current key contact person is Mr. Aung Htet (Director, Geotechnical Engineer) +95-9-798476843, aung.htet@csc1999.com, csc1999@gmail.com and Geolab's web page can be reached easily for more information at: https://www.csc1999.com.

2. GeoLab Myanmar Organization

GEOLAB TESTING STANDARD, PROFESSIONAL SOFTWARE OFFICE AUTOMATION, MONITORING and INSTRUMENTATION QUALITY ARE FULLYCOMPATIBLE and COMPARABLE WITH INTERNATIONAL CODES & STANDARDS.

HOWEVER,

GEOLAB SERVICE FEE, CONSULTATION FEE AND OPERATION COST ARE

VERY REASONABLE AS WE AIM TO MEET CUSTOMER NEEDS WITH SATISFACTION

2.1 The Codes and Standards

GEOLAB is applying following local and international codes and standards

- ACI : American Concrete Institute
- ASTM : American Standard for Testing Materials
- AASHTO : American Association of State Highway & Transportation Officials
- BS : British Standards
- JIS : Japanese Industrial Standards
- UBC : Uniform Building Code
- EN1997 : Eurocode 7 for Geotechnical & Civil Design
- MNBC2025 : Myanmar National Building Code 2025
- HPBC : High Rise and Public Building Committee
- YCDC : Yangon City Development Committee

2.2 Software, Surveying, Office Equipment

1) Geotechnical and infrastructure Software
   a. CSC's survey coordinate conversion program
   b. Plaxis 2D-3D, GeoStudio, GEO-5 (Trial Versions)
   c. Pile-AXL, Shaft, LPile, SteinPro, (Trial Versions)

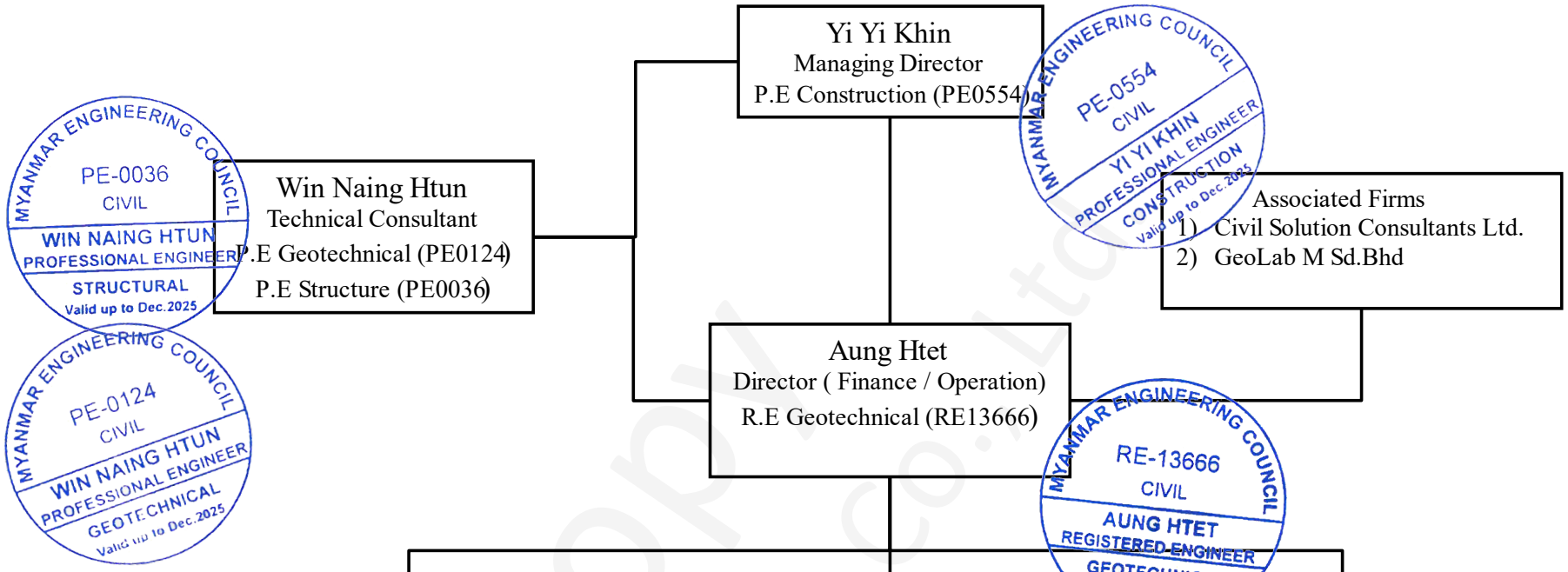
d. LiqSVs (for liquefaction analysis) (Trial Versions)
e. Autodesk Auto CADD 2019, Civil 3D 2019 (Trial Versions)
f. Pix4d (for GIS, aerial mapping) (Trial Versions)
g. Strater (for geotechnical bore logs) (Trial Versions)
h. Campbell Scientific Logger-net software for instrumentation
i. Allnamic software package for dynamic pile testing
j. GeoLab in house spread sheets for laboratory testing

2) Office Automation Equipment
   a. Intel, ARM, Personal Office Computers
   b. Rugged Tablets and PC for field testing
   c. Toshiba, Konica, Epson, brand copier, printers, scanners,
   d. Hi-Speed Fiber internet and networking

3) Instrumentations (Civil/Geotechnical) Equipment
   a. Campbell Scientific Data Loggers,
   b. Sierra RV50 Modems, for remote monitoring,
   c. Geokon Sensors, (Load Cells, Piezometers, Strain Gauge,etc,.),
   d. CEP RWLC Load Cells,
   e. KYOWA & TML's (LVDT, Displacement, Pressure Sensors),
   f. (Topcon, Kalida, Sokkia) brand Total Stations, Levels, RTKs,

4) Laboratory Equipment
   a. Humboldt, ELE soil test apparatus,
   b. Malaysia Made Drilling Rigs & Accessories
   c. China Brand Soil test equipment
   d. Civil Lab Compression Machine (NL Scientific)

2.3 GeoLab Myanmar Organization Chart



2.4 Our Management System

2.5 The Associations

GEOLAB has obtained mutual understanding for technical co-operation and international business development with following firms:

Affiliated Firms

1) Civil Solution Consultants Ltd.
   Full-scale Consulting Engineering Firm, Myanmar Based

Firms to be Associated

2) GEOLAB (M) Sd. Bhd.
   Full-scale Soil and Engineering Testing Firm, Malaysia Based
3) Pyae Sone Engineering Group
   Drilling, Water Well Development and Mini Bore Piles Firm, Myanmar Based

2.6 The Resource Persons

1) ***U Win Naing Htun***, CSC Group MD and Technical Consultant
   B.E. (Civil), M. Eng. AIT, M.MES, PE-M.ASCE, M.SEI, Licensed Structural Engineer SEC-YCDC, ASEAN Engineer Registered, PE-0036 Structure, PE-0124 Geotechnical, ACPE (ASEAN Chartered Professional Engineer), AER
   - More than 25 years of regional and international professional experiences in engineering design, construction projects and project management.
   - He has involved more than 45 oversea design projects for infrastructure development such as highways, expressways, power sub-stations, industrial plants, drainage systems, reservoir operations, industrial estates, real estates, country clubs, stadiums, airports and ship docks.
   - He was also involved in 3 major-oversea-construction-projects for expressways & airport development.
   - He has successfully managed to complete several projects as mentioned in Appendicies, The Experiences.

2) ***Daw Yi Yi Khin***, Managing Director
   B.E. (Civil), CERT (Computer Application), Senior Licensed Engineer YCDC, PE-0554 Construction (Myanmar Engineering Council)
   - More than 25 years of regional and international professional experiences in engineering design, technical works, management and cost control.
   - She has involved more than 40 design projects (Oversea) for land grading, roads, drainage systems, reservoirs, factories, industrial estates, real estates, communication centers, golf courses, stadiums, airports and dockyards.
   - She was also involved in 5 major projects (Oversea) for cost control and technical works.
   - She has participated the projects as mentioned in item 10.

3) ***Ko Aung Htet***, Director Finance / Operation
   B.E. (Civil), M. Eng AIT (Geotechnical)
   RE-13666 Geotechnical (Myanmar Engineering Council)
   - More than 6+ years' experience in pile load tests, geotechnical instrumentation and testing. He re-shaped GeoLab's today appearances and all activities starting 2021.
   - He is also responsible and in charge of GeoLab current affairs and all activities.

4) ***Mr. Kyaw Htut Aung***, Drilling Water / Sanitation
   BSc. (Geology), DAG (Hydro-Geology)
   Team Leader of Pyae Soan Engineering Group
   - More than 26 years of Government Staff in Mines, Professional experience in mineral exploration, Water exploration, water well drilling.
   - He has completed more than 200 water wells development and maintenance projects in Myanmar.

3. Main Services

GEOLAB is engaging with these main tasks as follows:

1. Pile Testing Services (Pile Load Test, Integrity Tests, etc.)
2. Geotechnical/Structural Instrumentation & Monitoring Services
3. Soil Investigation (Field Testing & Laboratory Testing) Services
4. Geotechnical Design Services

Figure 1: GEOLAB's Pile Test Services

Pile Static Load Test

Inverted Beam System,Kentledge System

Pile Dynamic Load Test

Using Allnamic System

Pile Integrity Test

Using Pile Test's Pile Echo Tester

3.1 Pile Testing Services (For structures with deep foundation)

Piles are important elements in foundation designs, and they are expensive to construct or install, especially for larger diameter and longer in-depth. Therefore, since errors can be encountered in piles without being seen while the construction process, piles should be tested in possible manners to make sure they have maximum capacities. The testing methods should not do any damage to the test pile. The common non-destructive methods available based on integrity and load-bearing capacity are as follows

4) Integrity Testing
   (1) Low Strain Integrity Test
   (2) Cross Hole Sonic Logging
5) Pile Load Capacity Testing
   (1) Dynamic Loading Test
   (2) Static Loading Test

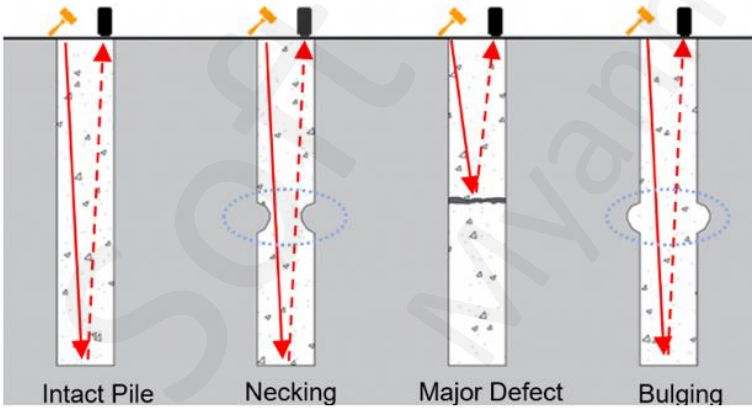
3.1.1 Low Strain Pile Integrity Testing (PIT/SIT)

Low Strain Integrity Test (ASTM D5882) is the easiest and most performed cost-effective test in the piling industry. It is only required to clean the top of the pile or pile cap for a small area, then the low strain sensor made of an accelerometer is put on the top of the pile. Sonic wave impacted by plastic or wooden hammer near the placed sensor.

The low strain sonic wave travels along with the piles and then is reflected to the sensor. Multiple blows are given to achieve a better result. If there are any anomalies, they are reflected in the reflectogram, and they can be easily located. Also, the pile toe location can be estimated.

GEOLAB utilizes industry leading Pile Test's Pile Echo Tester for conducting low strain tests.

Figure 2: Basic Concept of PIT Testing, Reflectogram, PET Equipment



Pile	Depth (m)	Reflectogram	Details	Remarks
S*/9	16.8 m	0m 5 10 15 20	Amp:75 Planned:16.0m Avg:5	
S*/13	15.0 m	0m 5 10 15	Amp:55 Planned:15.0m Avg:9	

Figure 3: PIT Testing on Bored Pile (Cast in-situ Piles), Pre-casted Piles

3.1.2 Pile Integrity Testing by Cross Hole Sonic Logging (Sonic Logging)

This test (ASTM D 6760) is mainly performed to check whether the pile material (usually concrete) has constant homogeneity along with the pile or not. If there are any changes in the homogeneity of concrete, it can affect the load transfer capacity of piles, and repairment should be done in case of major defects. These anomalies are usually caused by the intrusion of drilling slurry while concreting.

At least two or more <50 mm diameter steel or PVC pipes are preinstalled at the rebar age of the piles and usually diagonally. Then the pile is constructed. After the concrete sets, these tubes are filled with water, and the ultrasonic sensors are lowered down to the bottom for testing. Pile's Concrete can also be core-drilled at later point.

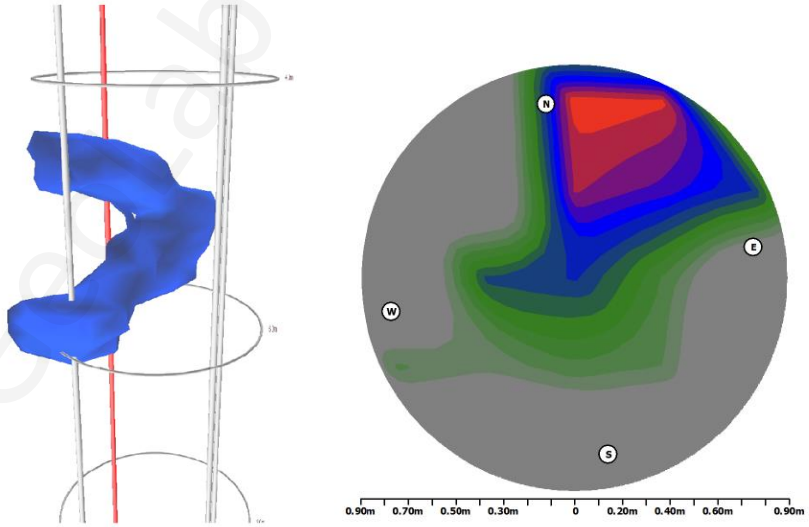
They are then pulled back at the constant speed, and the sonic waves transmitted from one sensor to another are through preinstalled tubes and recorded along with the pile during pulling time. The result is then illustrated with the waterfall reflectogram. If there are any anomalies, the sonic velocity may have changed and reflected in the waterfall reflectogram. In more advanced optional analysis, a 3D profile of piles integrity can be generated from 2D results. The holes are to be grouted after testing.

GEOLAB utilizes industry leading Pile Test's Cross Hole Ultrasonic Monitor (CHUM) Equipment for Sonic Logging Test services.

Figure 4: CHUM Sonic Logging Equipment

Figure 5: Waterfall Reflectogram; Sonic Logging Testing on Bored Pile

Figure 6: CHUM 3DT Result



3.1.3 Pile Dynamic Load Testing (Utilizing Allnamic PDR system)

Due to the time requirement and expensive costs of the traditional static load testing methods, it is not economical for smaller bored and driven piles. Therefore, a new technique is adopted as the dynamic load test. This test (ASTM D 4945) includes dropping a dead load equal to 1% - 2% of the test load to the top of the pile from a certain distance.

This test provides the strains and accelerations present within a pile during driving operation. Strain and acceleration data from the test can describe the pile driving stresses and compression, transferred energy and the contribution of shaft friction and toe resistance to the load bearing capacity. Driving records are immediately available to assist in optimizing foundation installation through accurate selection of final driving depth. This method can be used for prefabricated piles, cast-in-place piles, steel piles, timber piles and even composite piles.

Figure 7: Basic Concept of Dynamic Load Test (Middendorp, 2013)

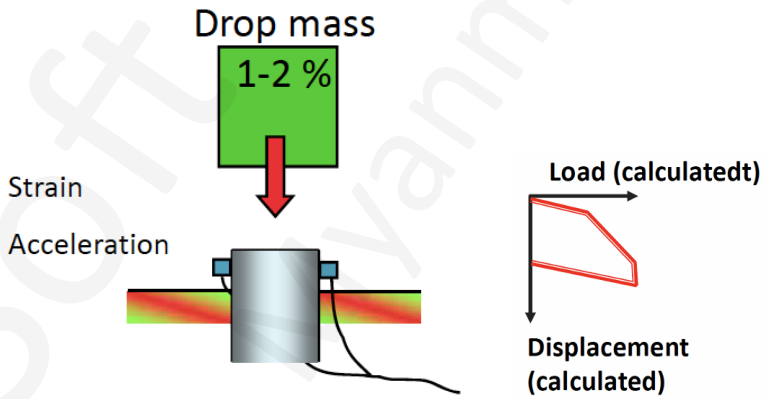


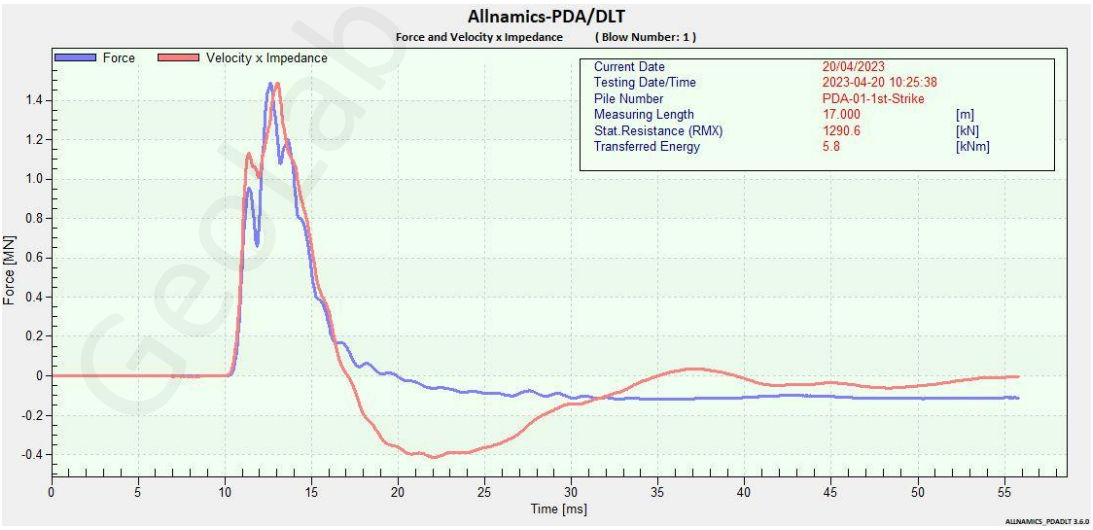
Figure 8: Allnamic Pile Dynamic Recorder (PDR Set) & Sensor Set

Combined sensors to be used on both steel and concrete piles, easy to mount with two bolts

High Strain Dynamic Testing (or Dynamic Load Testing): can be a fast and cost-effective alternative to Static Load Testing of both concrete and steel piles. During the test a load is applied to the pile by either an impact hammer or a suitable drop weight and the generated stress wave travels down to the pile toe and back up again to the top of the pile. The measured signals are then processed and analyzed to assess the pile capacity.

During pile driving these same signals can be recorded to monitor and analyze the performance of the hammer, the condition of the pile cushion and pile driving process in general. This so-called Pile Driving Analysis (or PDA) reduces the risk of damage to both the pile and the hammer and allows the contractor to drive the pile to the optimum depth.

Figure 9: PDA Testing on Pre-Casted Pile & Cast In-situ (Bored Piles)

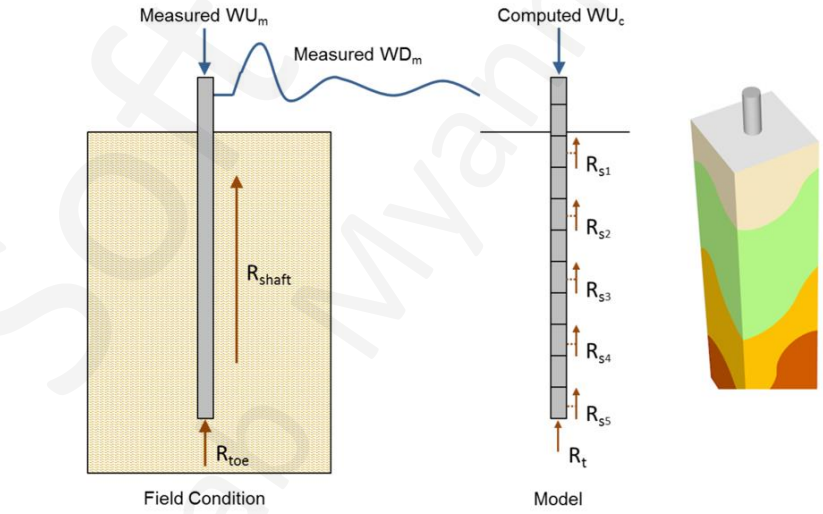


AllWave Stress Wave Program: AllWave-DLT is one of the options of the wave equation package AllWave. This application is used to determine the pile capacity and static load displacement behavior (SLT) of a pile. The blow from a dynamic load test (DLT), measured with an Allnamics-PDADLT system, is introduced on top of the wave equation pile model and signals are calculated on the pile top.

A comparison is made between calculated signals and real measured dynamic load test signals. The soil model parameters are updated until a good match is obtained between calculated and measured signals. The load displacement behavior is calculated from the computer soil model. The Dynamic Load Testing method is most suited for precast piles.

GEOLAB utilizes industry standard Allnamic's PDR system and Allwave software package for full dynamic load testing services for its clients.

Figure 10: Wave Equation Analysis Concept, Allwave DLT Program



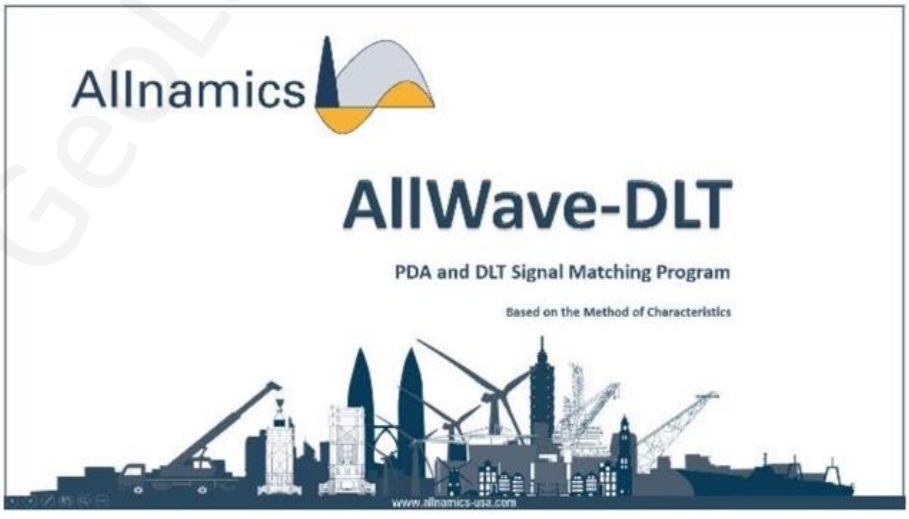


Figure 11: Allwave DLT Program Soil Model

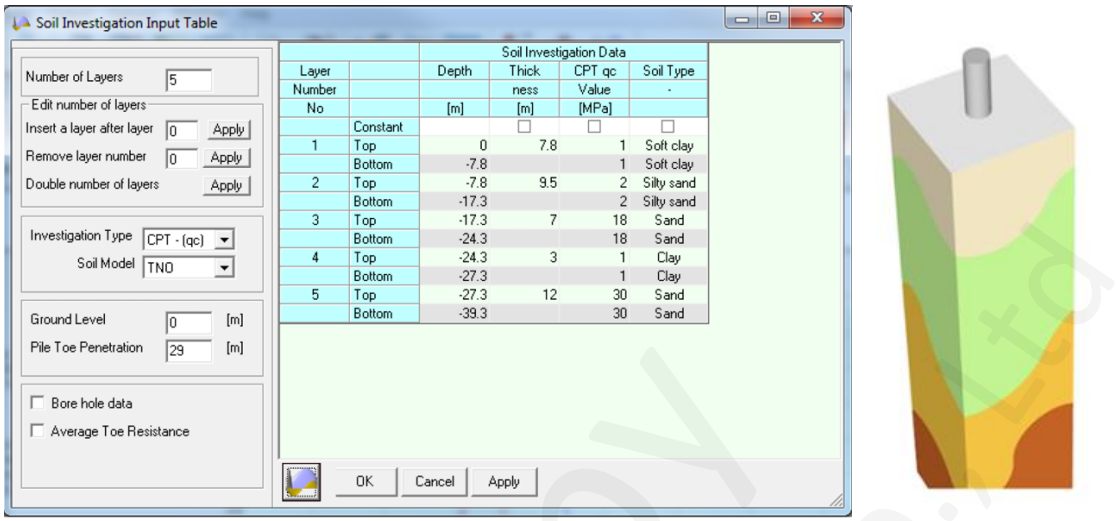


Figure 12: Allwave DLT Signal Matching

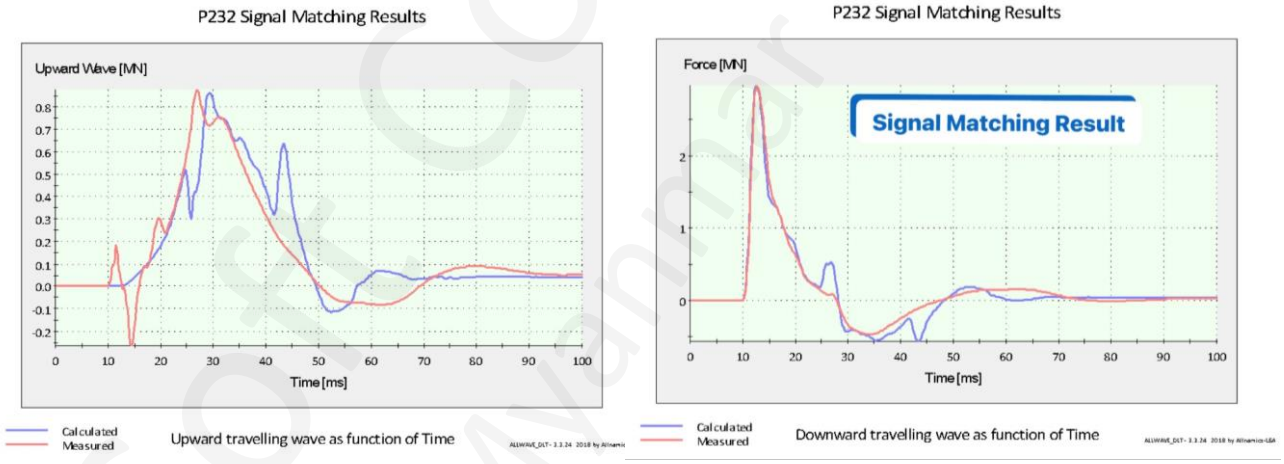
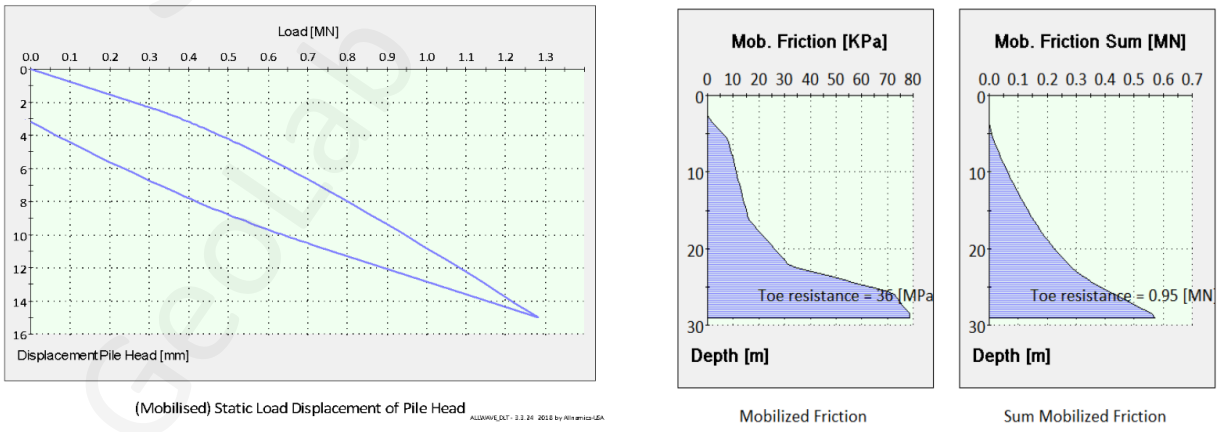


Figure 13: Estimated Load Settlement Result



3.1.4 Pile Static Load Test Services

For traditional pile static load tests, GEOLAB's has compiled industry leading state of the art high accuracy transducers, equipment and real time monitoring systems to conduct pile tests ever since company's establishment.

GEOLAB is only firm in Myanmar which utilizes full digital equipment such as dataloggers, load cells, strain, displacement & pressure transducers, as well as skillful testing engineers in pile testing services with corresponding HPBC regulations.

Figure 14: GEOLAB's Static Pile Testing Instrumentation

Dataloggers

Campbell Scientific dataloggers are at the center of our rugged, reliable data acquisition systems.

Displacemnet Transducers

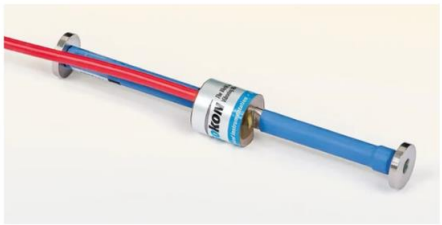
TML SDP-C displacement transducer is a general-purpose, strain gauge type transducer. Designed with a strain-generating cantilever, it is able to make stable measurement while maintaining the high sensitivity to minuscule displacements.

VW Load Cells

Geokon Model 4900 Vibrating Wire Load Cell consists of a cylinder of high-strength steel with 3, 4 or 6 vibrating wire strain gages located around the circumference of the cell. Loads applied to the cell are measured by the vibrating wire strain gages. The effects of uneven and eccentric loading are minimized by averaging the output of all 3, 4 or 6 individual readings.

RW Load Cells

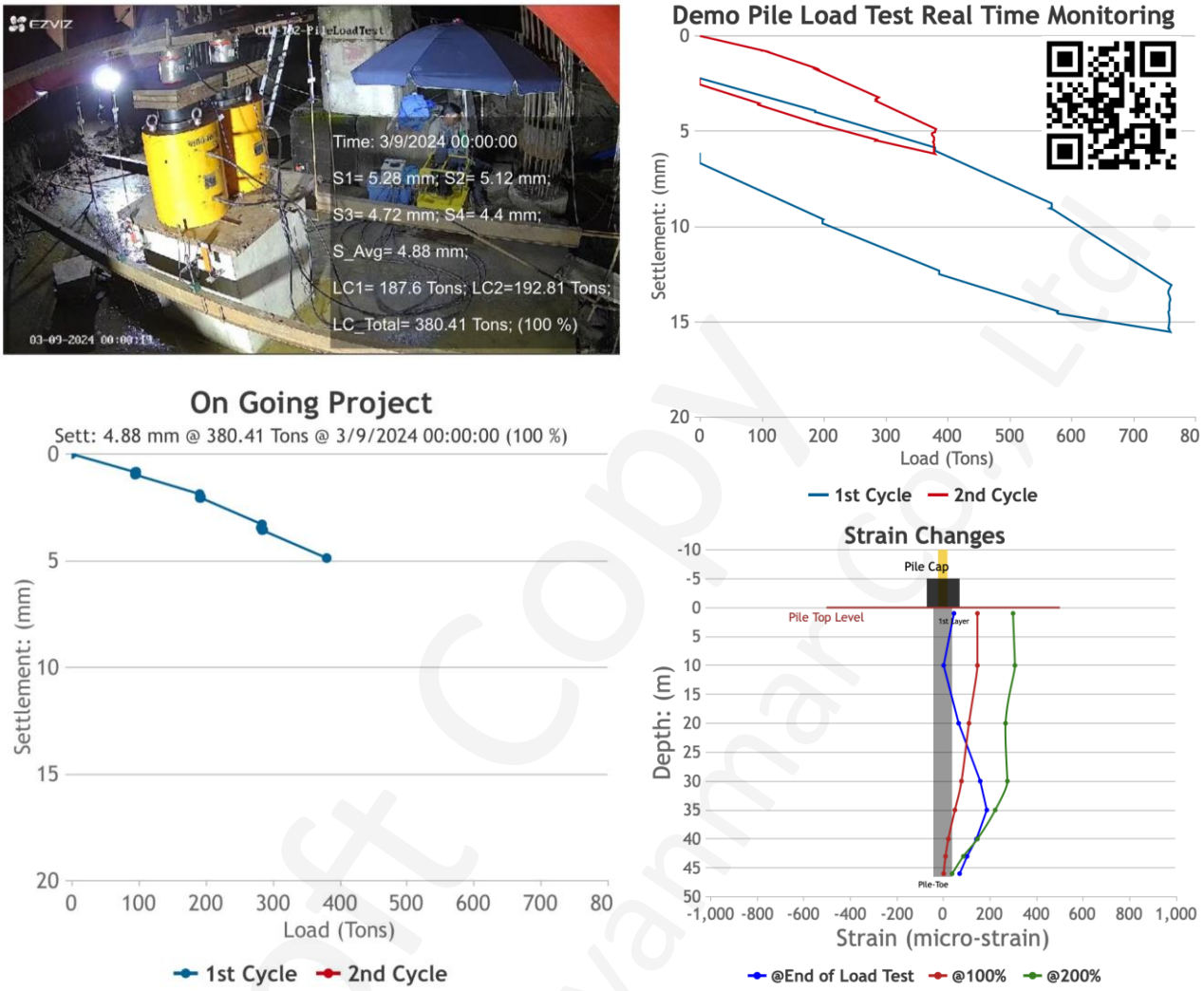
CEP resistance strain gauge load cells (RSGLC) are compact sensors for measuring loads in tie backs, foundation anchors, struts, rock bolts, tunnel supports and loading pile tests.



Embedded VW Strain Gauges

Geokon vibrating wire embedment strain gages are designed for direct embedment in concrete. This can be accomplished by attaching the gage to rebar or tensioning cables and then casting the gage into a concrete briquette which is subsequently cast into the structure, or grouting the gage into boreholes in the concrete.

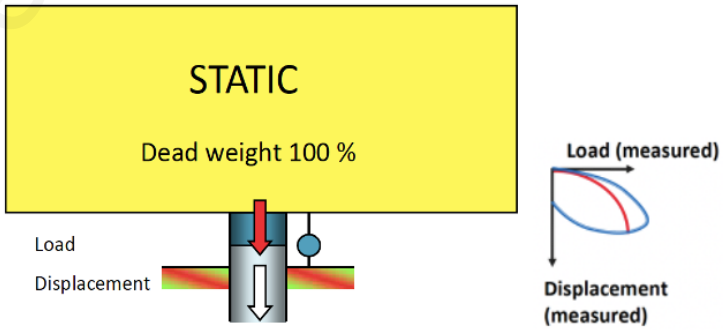
Figure 15: GEOLAB's Real Time Test Data Monitoring web app System



3.1.4.1 Pile Static Axial Compression Load Test (ASTM D1443)

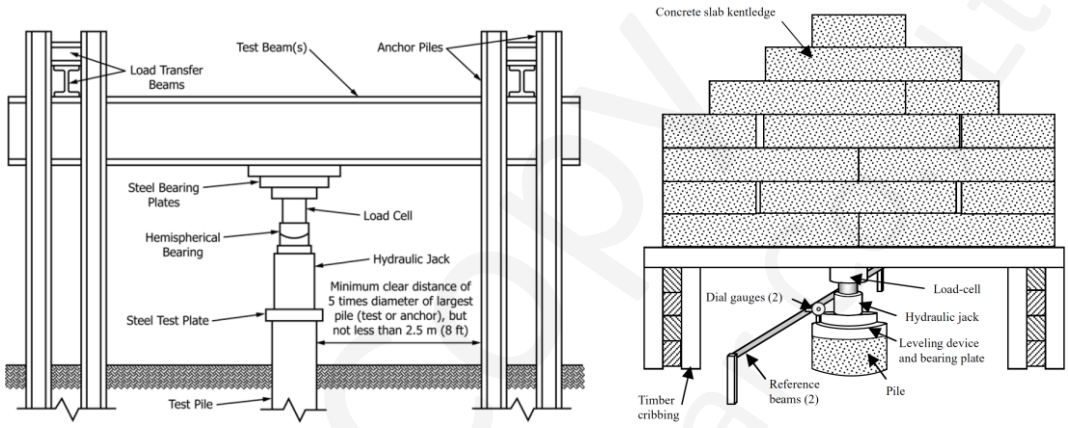
Static load tests are traditional ways to simulate the loading of the proposed building to piles. Simply apply the dead loads equal to the proposed building to the top of the building. The loadings are increased step by step until it reaches the maximum specified loads. The corresponding load and settlement data are recorded. When strain gauges are used, a Load transfer mechanism can also be achieved.

Figure 16: Static Axial Compression Load Test Concept



Reaction Pile Method (Inverted Beam System). In an inverted beam system, the pile is loaded by pushing the reaction beams connected to two or four reaction piles, while test pile is being axially loaded. It is the most done method, and test load up to 3 times the service load can be achieved easily. However, it requires the construction of two to four reaction piles which should be designed to resist tension.

Figure 17: Inverted Beam System & Kentledge System (ASTM)



Kentledge Method (Dead Weight Method). In the dead load method, usually known as the Kentledge method, an even surface platform area is needed to be prepared first to arrange the loading platform. Kentledge System is also well suited for pre-casted piles, (PHC-Spun Piles, R.C Squared Piles) when tested using a piling machine as a counterweight

Figure 18: GEOLAB's Inverted Beam System & Kentledge System

Figure 19: Piling Machine as a Kentledge Counterweight

3.1.4.2 Pile Static Axial Tension Load Test (ASTM-D 3689)

When piles are designed for tension purpose, it's tension load carrying capacity can be tested as follows:

Figure 20: Pile Static Axial Tension Load test

3.1.4.3 Pile Static Lateral Load Testing (ASTM D3966)

When piles are designed for lateral usage purpose, it lateral load carrying capacity can be tested as follows:

Figure 21: Pile Static Lateral Load test

3.2 Geotechnical/Structural Instrumentation & Monitoring Services

GEOLAB is engaging with these main tasks in geotechnical/structural instrumentation & monitoring services such as:

i) Geotechnical Instrumentation Services
   (1) Soil Plate Load Tests; Soil EDG Tests
   (2) ERSS, TERS, Open Excavation's Slope inclination. Tilt, water level, settlement, stress – strain monitoring services
   (3) Soil Settlement Marker, Surveying, etc.
   (4) Geotechnical/Structural Pullout Tests

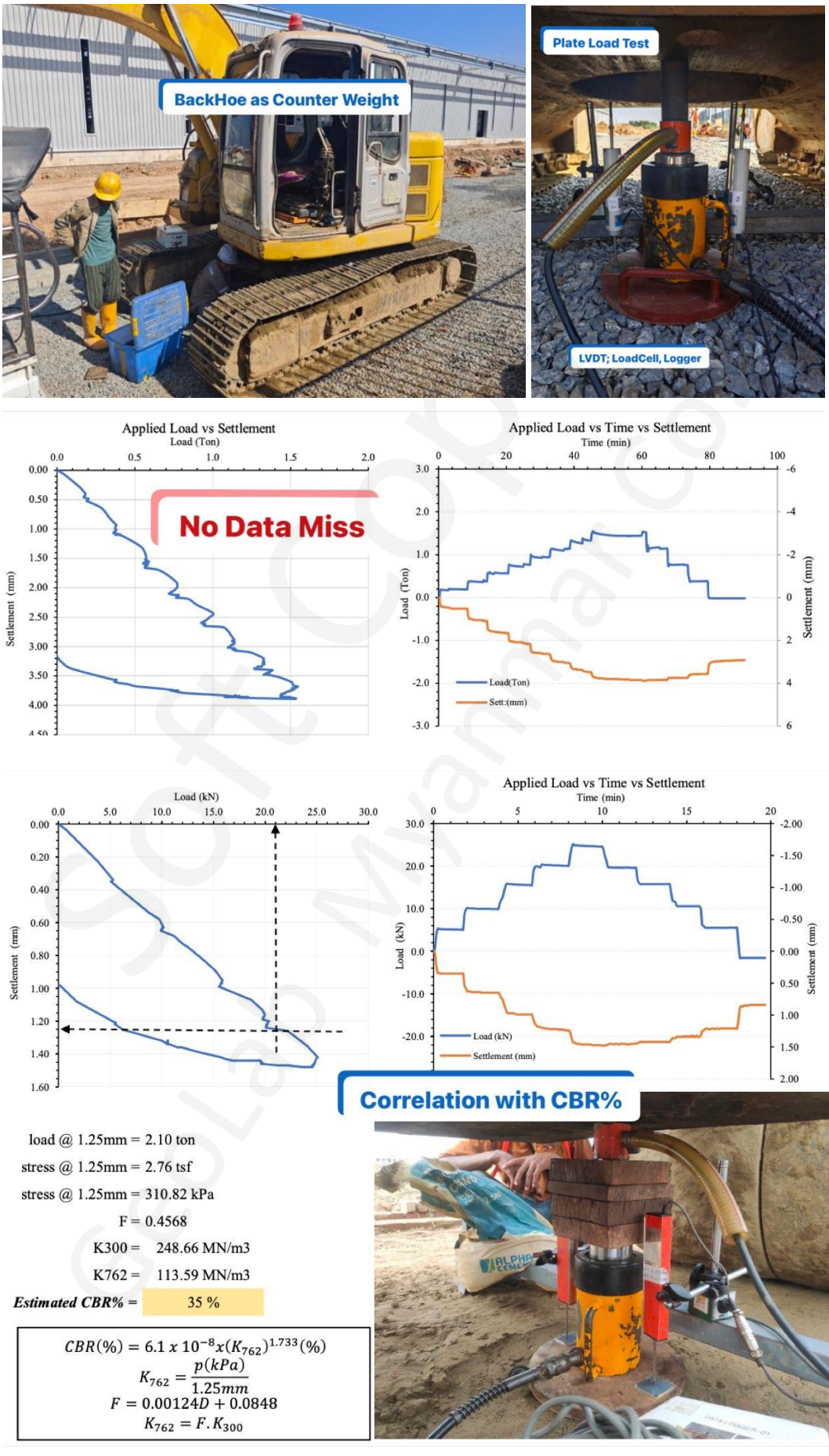
ii) Structural Instrumentation Services
   (1) Temperature monitoring in mass concreting
   (2) Building, Floor/ Slab load tests,
   (3) Structural health monitoring (Stress-Strain)
   (4) Vibration / Noise Monitoring, etc.

3.2.1 Soil Plate Load Tests

Plate Loading test are sometimes performed at locations where shallow foundation of proposed building will sit to observe actual soil structure interaction; also, to observe bearing capacity of proposed location. It is sometimes performed at sub-base of roads pavement, floor slabs. Plate load test result can also be correlated into Califorenia Beraing Ratio value.

GeoLab is providing plate load test services utilizing Displacement Sensors, Load Cell and datalogging at 10 second interval. There is no way manual recording can achieve that. Advantages over traditional dial gauges are that not operator workforce intensive; reducing potential human reading calculations errors and more efficiency.

Figure 22: Soil Plate Load Test Photos & Results



3.2.2 Soil Electrical Density Gauge (EDG) Tests

Soil electrical gauge tests are done at location where filled, cut or borrow soil's degree of compaction is necessary for compaction control. It is usually done at road or pavement's subbase, base and underlying soil beneath concretings. GeoLab performs Soil EDG tests utiizing Humboldt's Electrical Density Gague.

The soil model has to be bulilt using several Sand Cone Tests & Laboratoty Standard Compactions Tests prior to initial usage. Once the proper soil model is built, the degree of compaction of compacted soil can be know instantly. However soil model should be limited to same compacting soil type. It is most suitable option for time crtitcal situations.

Figure 23: Performing Soil EDG Tests

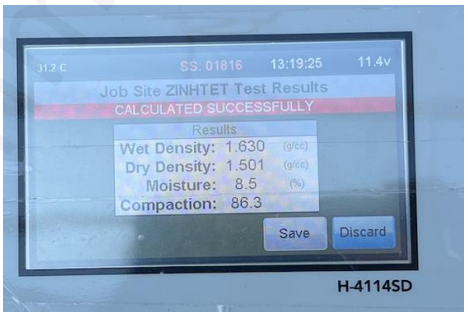
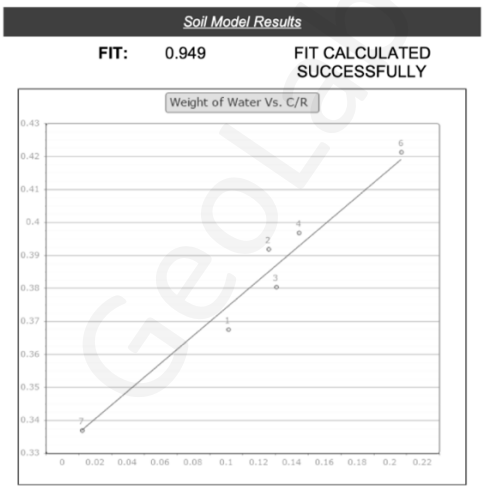


Figure 24: EDG Tests Soil Model Building with Sand Cone Test



3.2.3 Inclinometer, Tiltmeter, Water Level, Strain Monitoring

In projects where deep excavation tasks are to be executed for basement construction, deep foundation construction, tunneling, bridge pier construction or etc,. Earth Retaining Stability Structures (ERSS) & Temporary Earth Retaining Structures (TERS) are built temporarily or permanently to provide necessary support.

In such scenarios, the stability of ERSS & TERS as are crucial for construction safety. Thereafter, observation wells are drilled, and inclinometer casing are inserted to monitor the lateral, horizontal movements and the tilt of the project's adjacent structures (if any) of the respective, ERSS, TERS periodically as the underground project works are undergoing. The ground water level of the respective BH is also monitored utilizing Casagrande piezometer or VW piezometers for pore water pressure changes. In full parameter ERSS, in downtown location where there are surrounding buildings, located, the ERSS, TERS's struct forces are also monitored utilizing VW Strain Gauges welded to the main or auxiliary king post, or I-beams of strut.

Geolab has been providing such critical monitoring services utilizing state of the art products such as Geokon's instruments for over a decade.

Figure 25: ERSS, TERS, Inclinometer Casing, Monitoring

Figure 26: Geokon's Inclinometer & Casing

Figure 27: ERSS, TERS Inclinometer Monitoring Result Sample

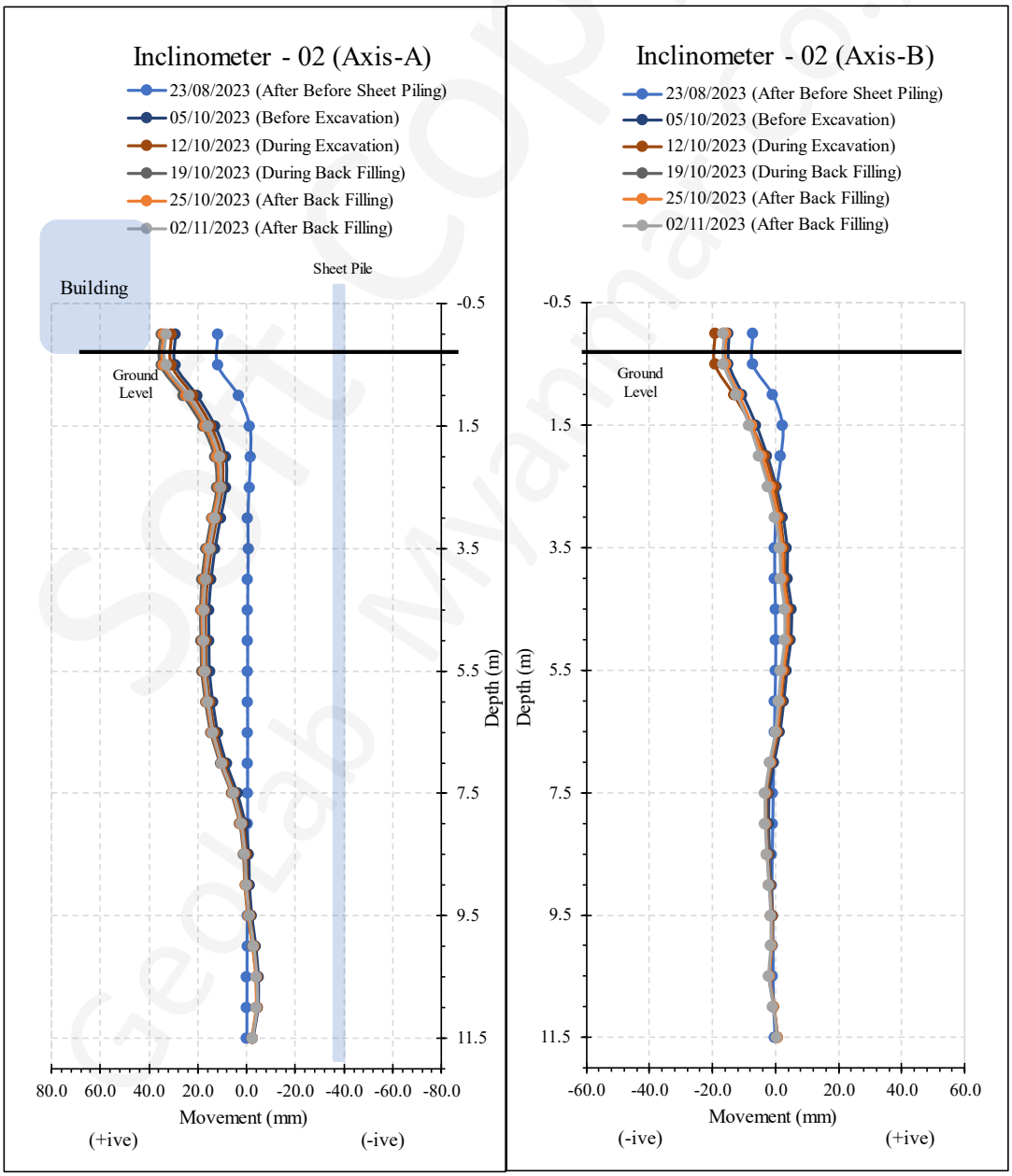


Figure 28: Geokon MEMS Tiltmeter & Tilt Plate

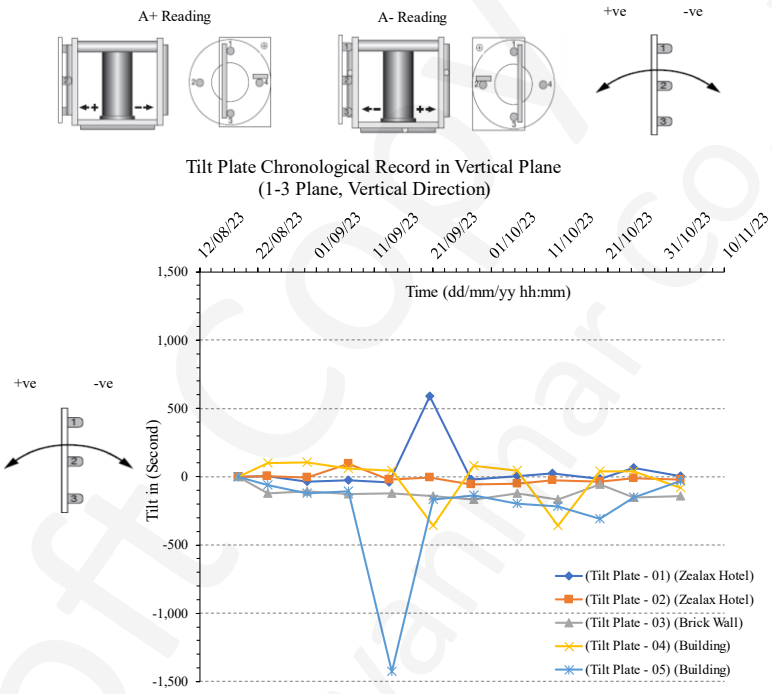


Figure 29: Adjacent Structures Tilt Monitoring

Figure 30: Water level meter and BH water level Measurement

Figure 31: Casagrande Piezometer & VW Piezometers

Figure 32: VW Arc Weldable Strain Gauge and Sample Welded to I-Beam

Figure 33: Struct Force Monitoring Station @ Deep Excavation Site

3.2.4 Geotechnical/Structural Pull-Out/ Lateral Load Tests

In solar farm's solar post foundations, unlike the traditional foundations, they are primarilaly intended to withstand tension & lateral forces. Thereafter, they are load tested in upward and lateral direction to ensure their geotechnical / structural capacities. Soil Nails in slope protection projects are aslo pull-out tested to ensure their geoitechnical tesnion capacities.

In attaching or fixing anchor bolt or rebar to exisitng strcutrue in construction, epoxy or anchor bolts are used. They are also pull-out tested to ensure theire bond strength between rebar and concrete. GeoLab is providing such services utilizing modern equipments as follows.

Figure 34: Solar Foundation Pull Out & Lateral Test

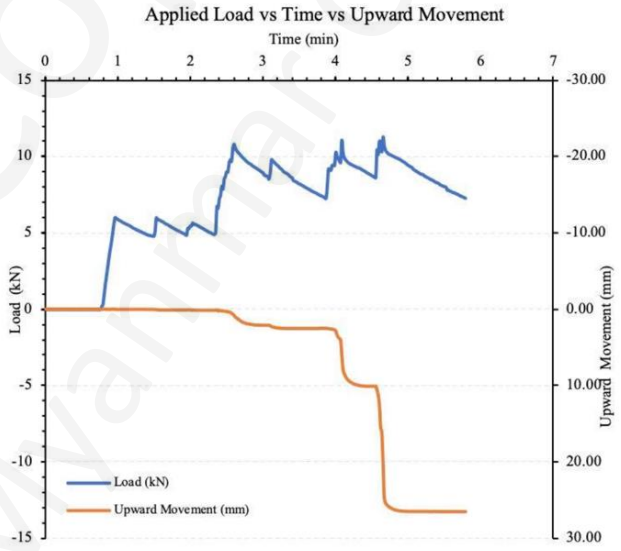


Figure 35: Rebar Pull-out Test

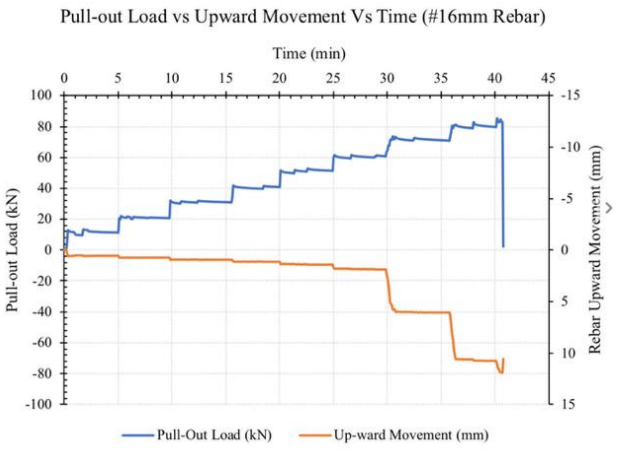
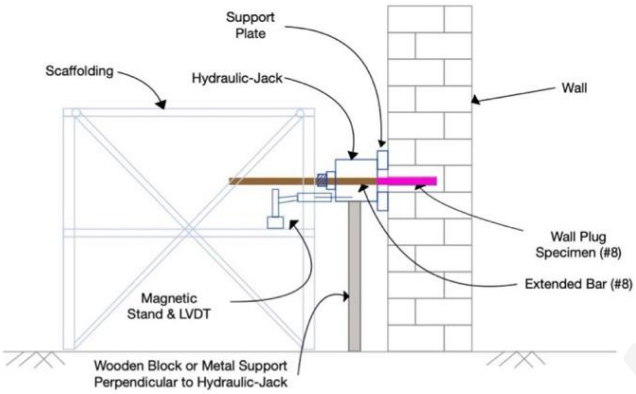


Figure 36: Anchor Bolt Pull-out Test



Schematic of Pull Out Test on Wall (Side X-Section View)

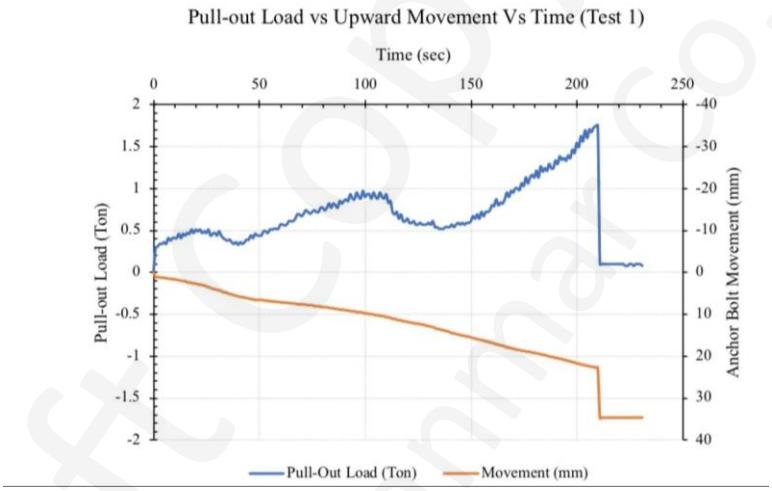
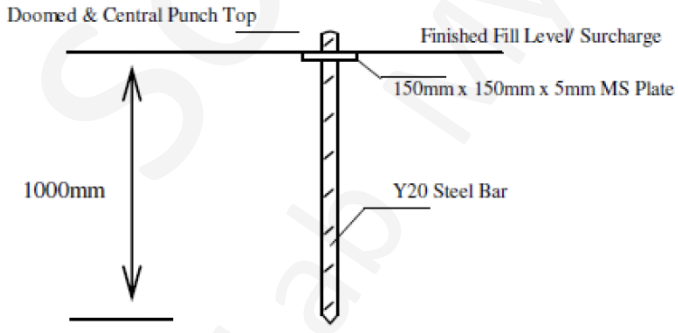
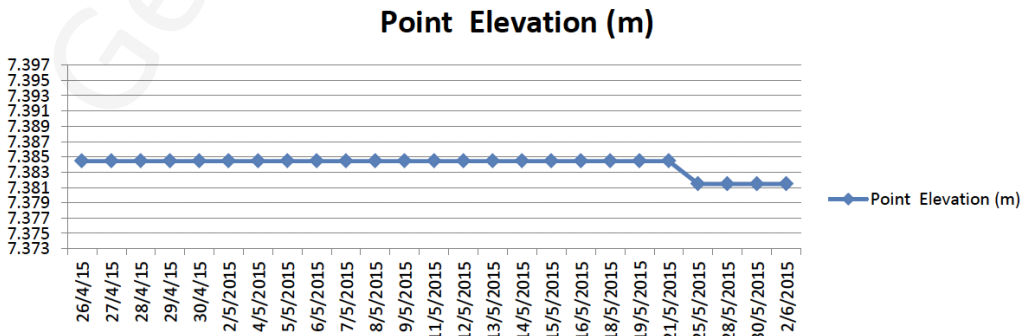


Figure 37: Ground Settlement Marker & Auto Level



Sketch of Settlement Marker/Displacement Marker



3.2.5 Temperature Monitoring in Mass Concreting

Mass concreting refers to large-volume concrete pours — typically in dams, raft foundations, large piers, thick retaining walls, and other structures where the cross-sectional dimension exceeds about 1 m. Because of the large volume, heat generation and dissipation become critical issues.

Temperature monitoring in mass concreting is essential to prevent cracking and ensure durability. As cement hydrates, the core of large concrete pours can reach high temperatures while the surface cools faster, creating harmful temperature differences. By using embedded sensors to track core and surface temperatures, engineers can keep the core below about 65–70 °C and limit temperature differences to around 20 °C, applying cooling or insulation measures when needed to ensure the concrete cures evenly and remains strong for decades.

Geolab has been providing real time temperature monitoring servies during masss concreting utilizing industry standard thermocouple sensors and data logging units for long term measure.

Figure 38: Type-K Thermocouples

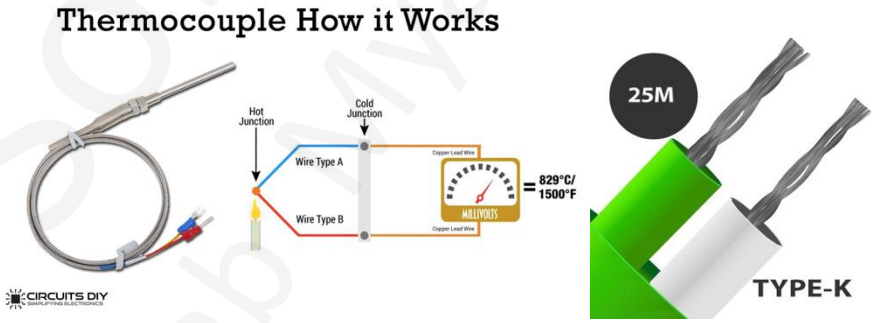


Figure 39: Mock-up Concrete & Mass Concreting

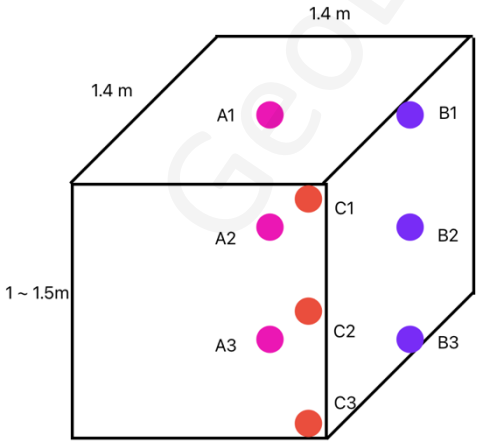
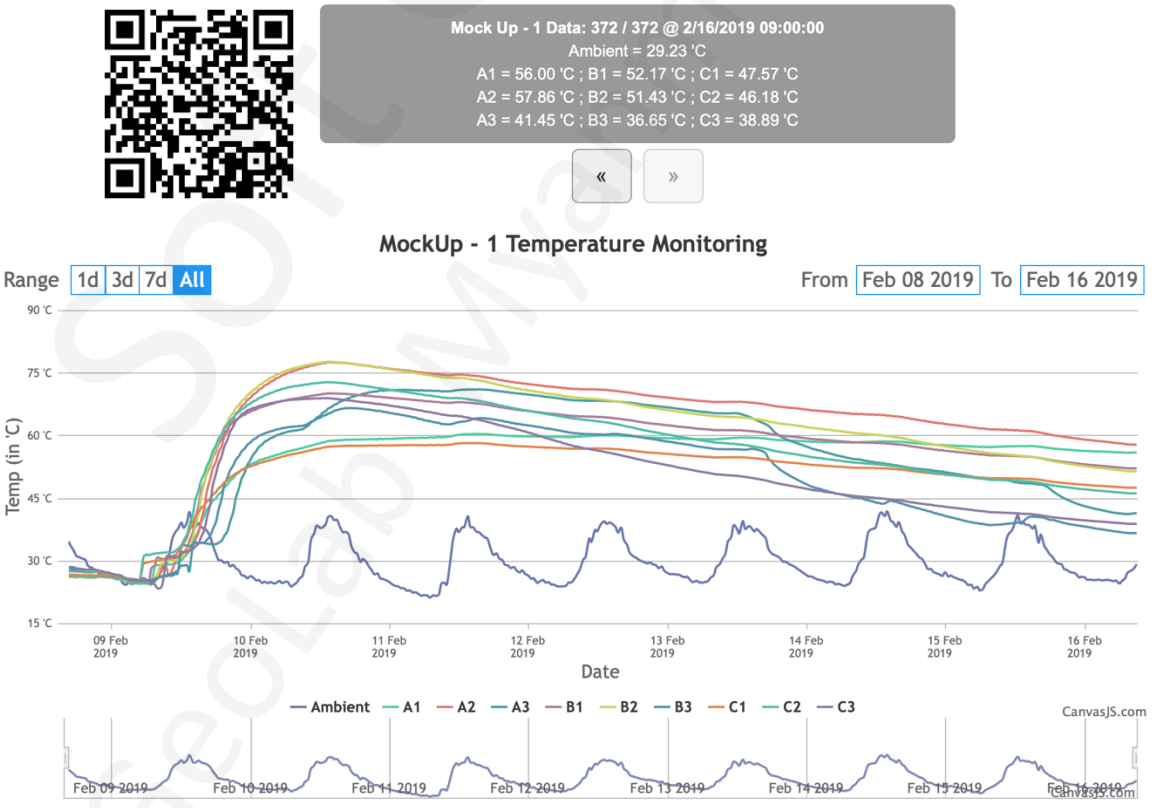


Figure 40: Monitoring Station, Sensor Installation

Figure 41: Sample Result & Real Time Test Data Monitoring Webapp



3.2.6 Building Floor/ Slab Load Tests

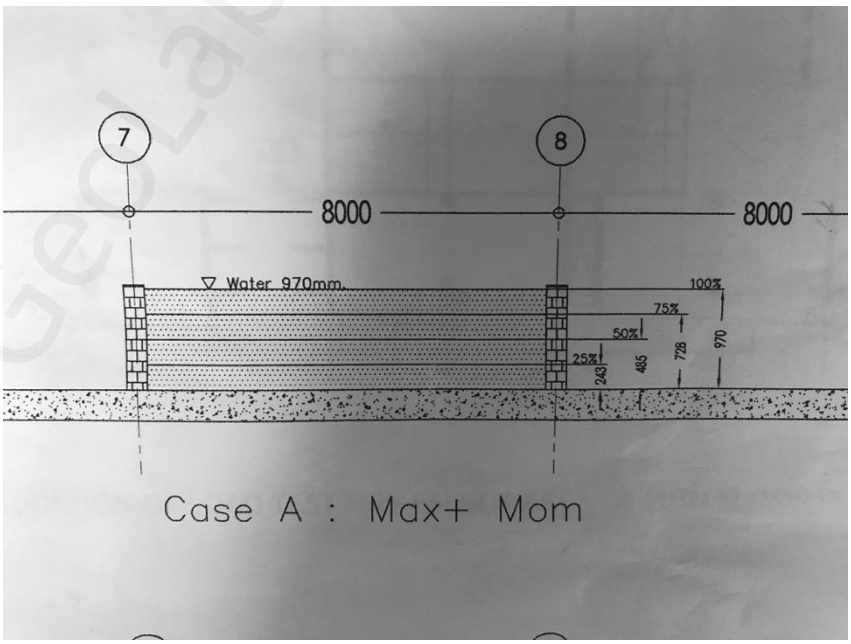
A building floor or slab load test is a structural check used to verify that a floor or slab can safely carry its designed loads. In this test, weights such as water tanks, sandbags, or concrete blocks are placed on the slab to simulate the intended live load (and sometimes a safety factor above it).

The slab's deflection (how much it bends under load) is measured using precise instruments, both during loading and after the load is removed, to see how much of the deflection recovers. If the deflections stay within allowable limits, and no cracks or signs of distress appear, the slab is considered to have passed. These tests are often required for new buildings before handover, for floors supporting unusually heavy equipment, or when assessing older structures for reuse, ensuring the slab performs as intended in real-world conditions.

Geolab has been providing real time monitoring servies during masss concreting utilizing industry leading LVDTs, dispalcement sensors & data logging units for precise measurement, monitoring & data recording.

Figure 42: Floor/ Slab Load Test

Figure 43: Floor/ Slab Load Test



3.2.7 Structural Health Monitoring (Stress – Strain)

Structural Health Monitoring is the continuous or periodic measurement of a structure's performance to detect damage, assess safety, and predict maintenance needs. For buildings and bridges, stress–strain monitoring is a key part focusing on how materials deform under load.

In practice, strain sensors (such as foil strain gauges, vibrating wire gauges, or fiber optic sensors) are fixed to critical elements like beams, columns, girders, and cables. These sensors measure strain — the change in length per unit length — which can be converted into stress using the material's modulus of elasticity. By monitoring these parameters over time:

- Engineers can detect overloading or unusual deformation patterns.
- Progressive increases in strain may indicate structural fatigue, settlement, or crack development.
- Sudden changes can signal damage from events like earthquakes, heavy impacts, or extreme weather.

Data is collected via data loggers and analyzed in real time or periodically. SHM allows early intervention before visible damage appears, optimizes maintenance schedules, and extends the service life of structures — ensuring that buildings and bridges remain safe, reliable, and resilient throughout their lifespan or loading under special circumstances.

Figure 44: Strain Gauges for Structure's stress – stress measurements

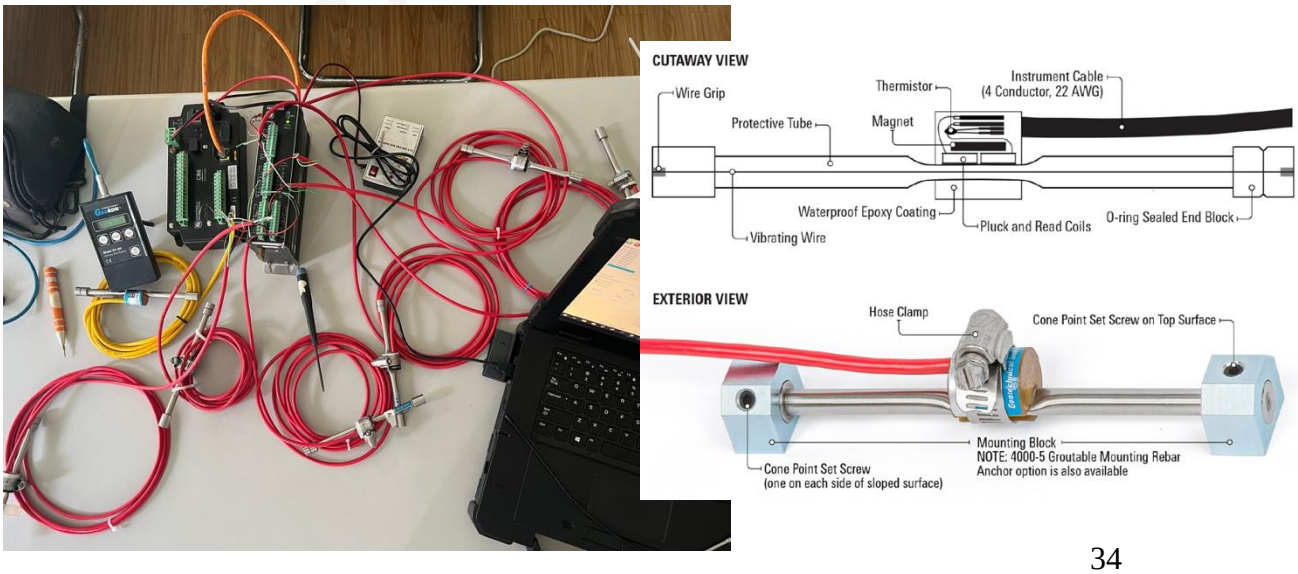


Figure 45: Stress Monitoring Location Plan for Vehicle Bridge

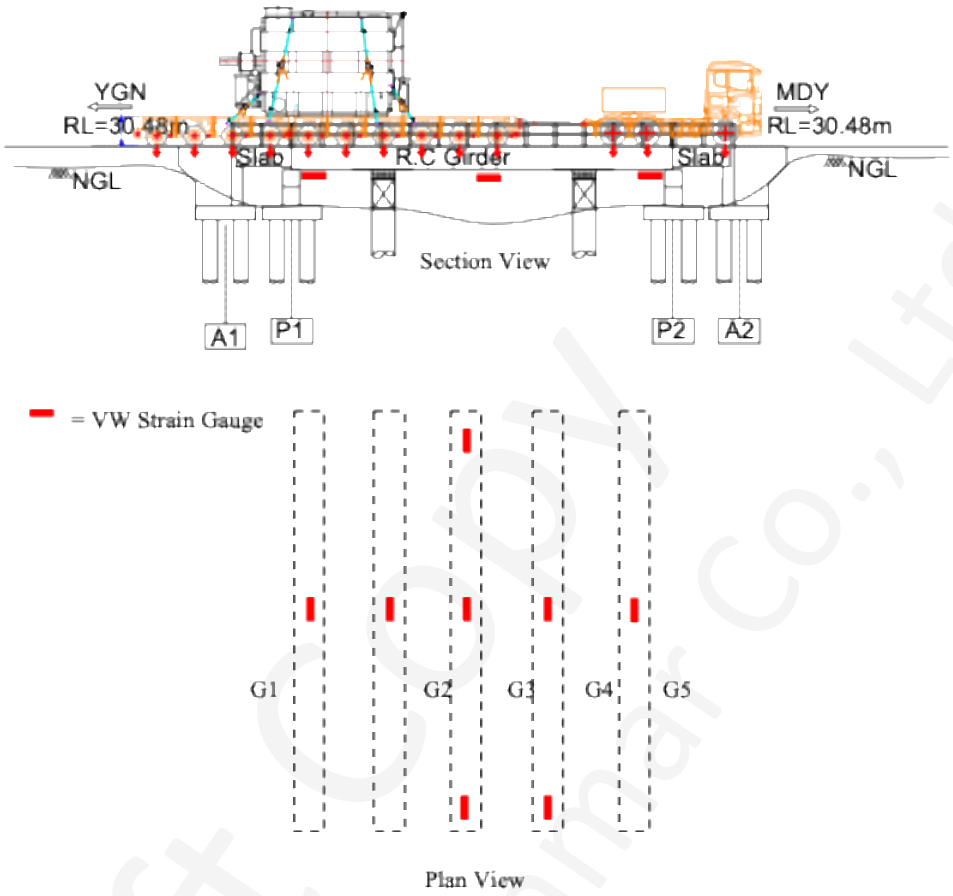


Figure 46: Stress Monitoring at Vehicle Bridge

Figure 47: Stress Monitoring Location Plan for Railway Bridge

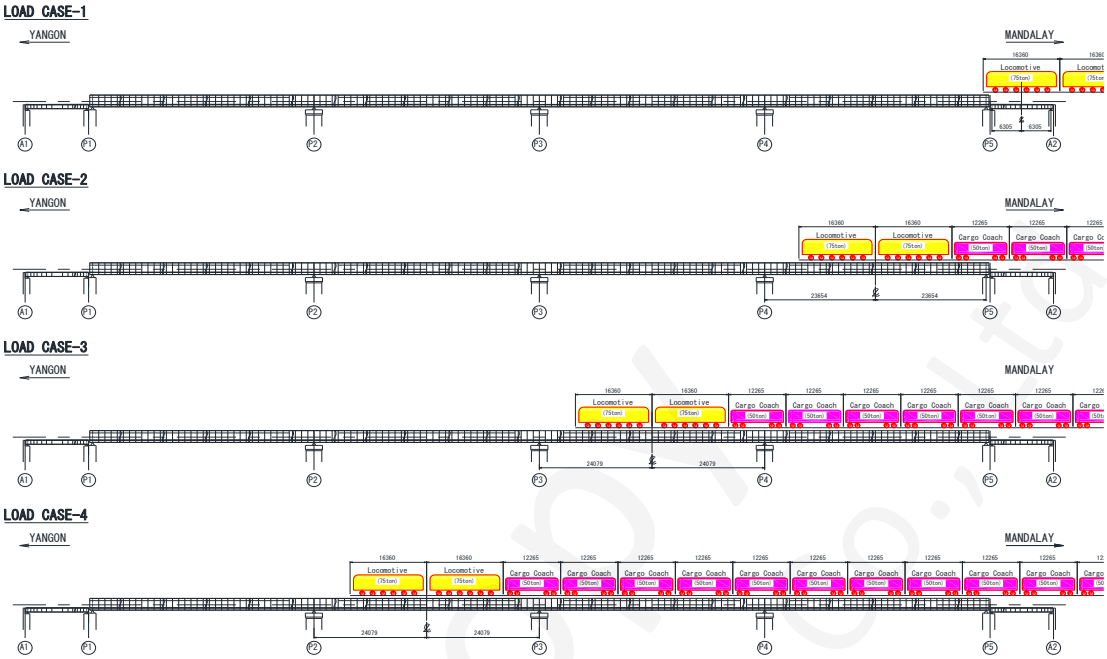


Figure 48: Load Test for Railway Bridge

Figure 49: Structural Health Monitoring Sample Result

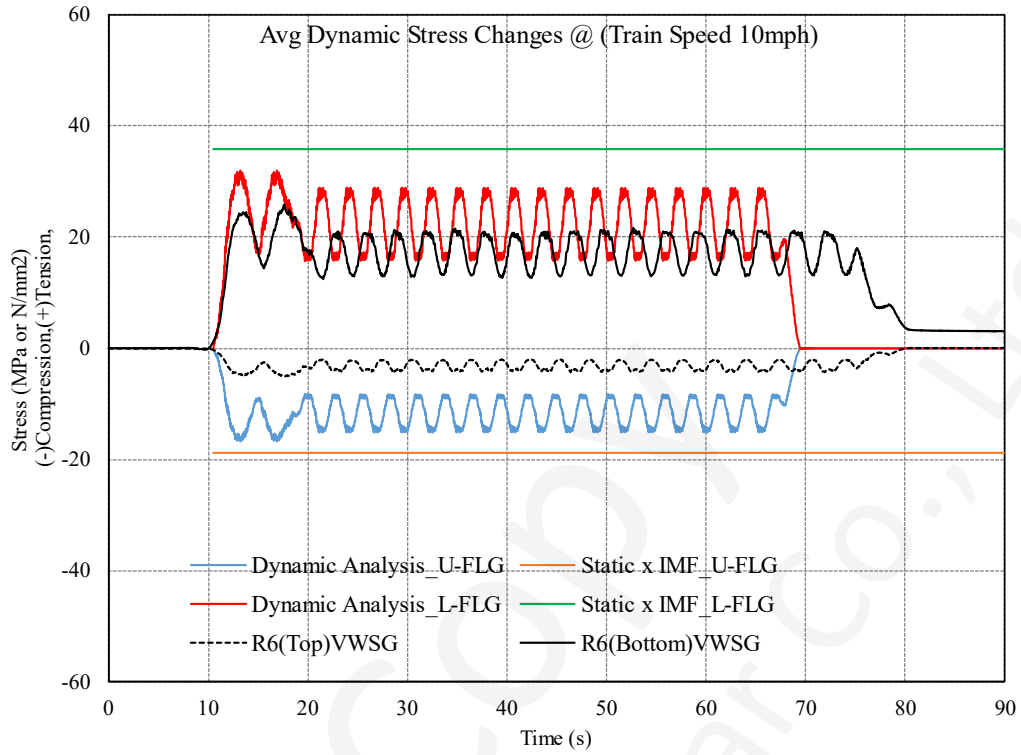
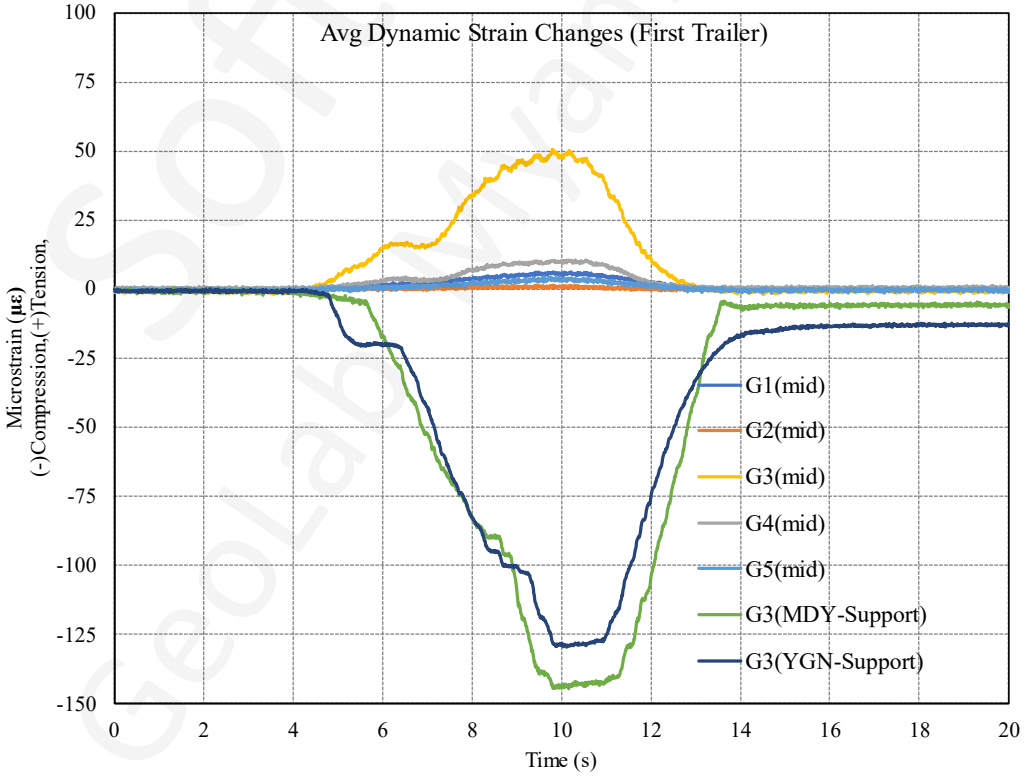


Figure 50: Structural Health Monitoring Sample Result



3.2.8 Various Instrumentations

Apart from traditional instrumentation services; Geolab is always participating in research and development sector such as university researches, custom instrumentations and testings, survey & aerial mapping,etc.

Figure 51: Phd Research's Test Assisting

Figure 52: Phd Research's Test Assisting

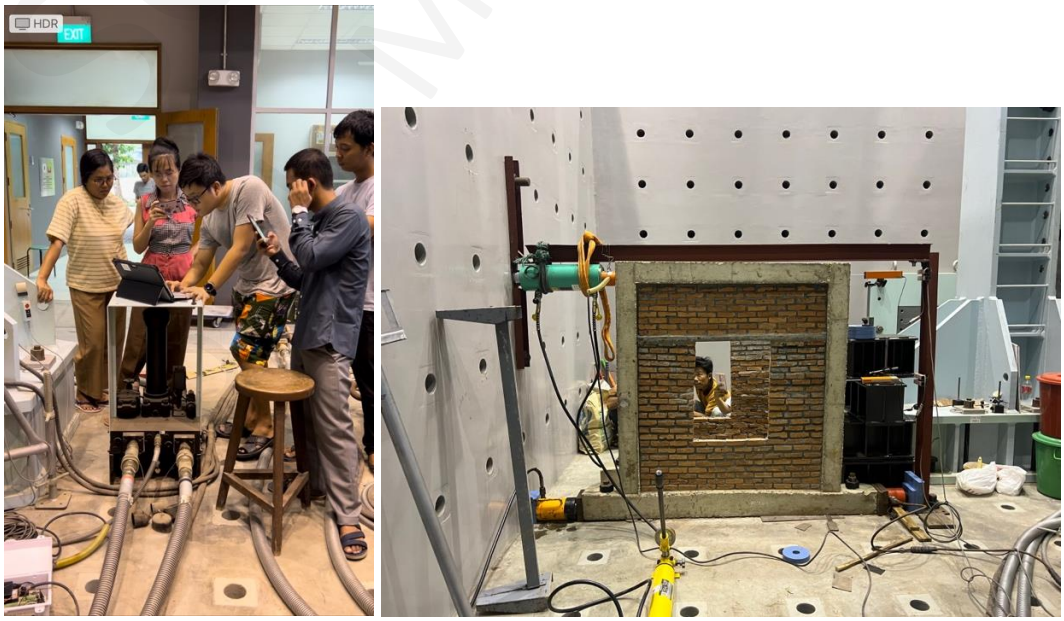


Figure 53: Phd Research's Test Assisting

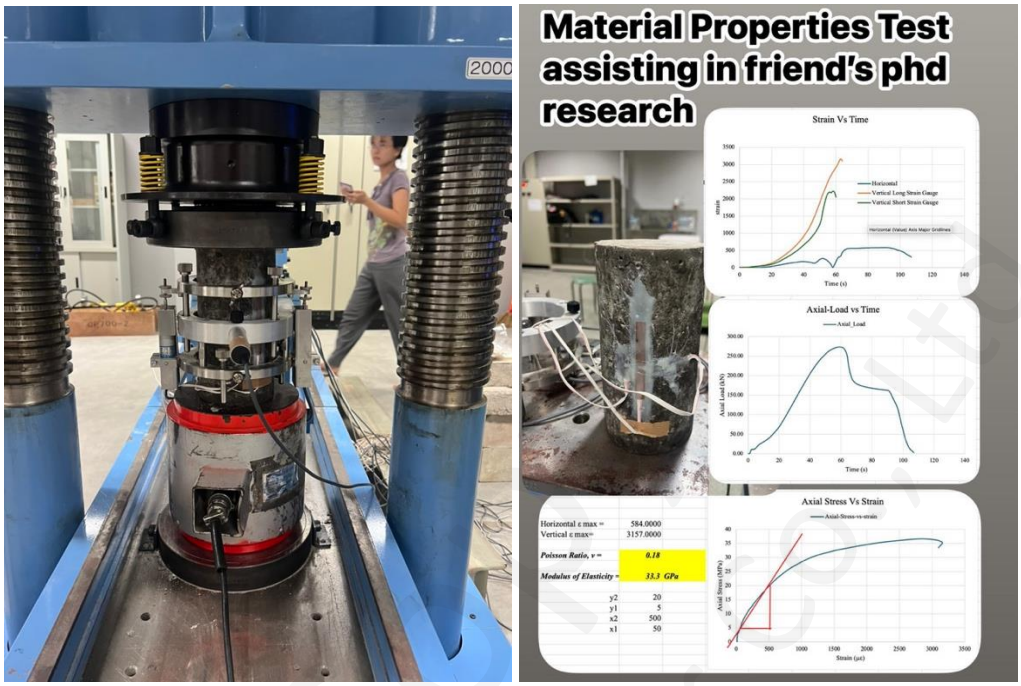


Figure 54: Phd Research's Test Assisting

Figure 55: Phd Research's Test Assisting

Figure 56: Custom Material Testing

Figure 57: Vibration & Noise Monitoring

Figure 58: Pumping Tests

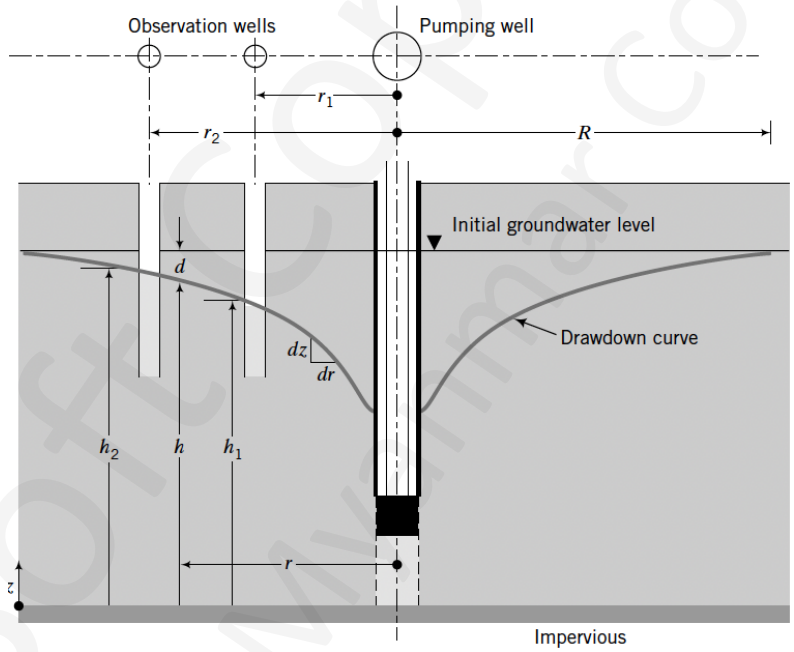
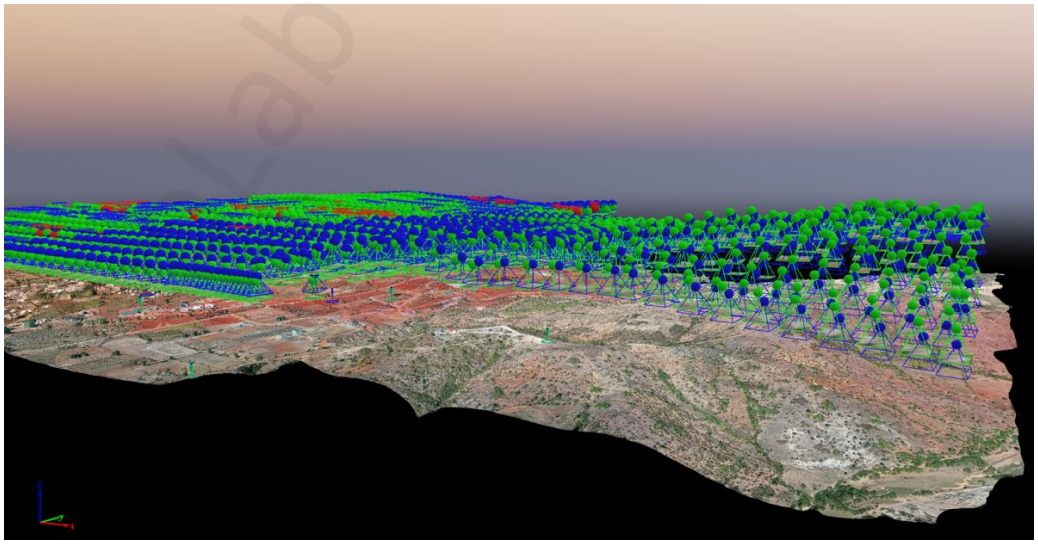


Figure 59: Topographic Surveying & Aerial Mapping



3.3 Soil Investigation Services

Soil investigation is the process of examining the properties and conditions of soil at a construction site to determine its suitability for supporting proposed structures. It involves field methods such as boreholes, trial pits, and penetration tests, along with laboratory tests like grain size analysis, compaction, and shear strength, to identify soil type, bearing capacity, and groundwater conditions.

The results help engineers understand soil behavior under load, assess risks like settlement or liquefaction, and provide recommendations for safe and economical foundation design.

GeoLab provides comprehensive soil investigation services in compliance with local and international standards, including YCDC, HPBC, and MNBC 2025 code requirements, ensuring reliable data and safe (shallow/deep foundation) design for building projects. Geolab also provides construction control tests for various projects requirement such as (infrastructures, earth works, structures, etc.)

1) Construction Control Testing
    a. Field Density Control Tests
        i. Sand cone Test / Soil Electrical Density Gauge (ASTM D1556)
        ii. Core Cutter (ASTM D2167)
    b. Field California Bearing Ratio Test (ASTM D1883)
    c. Soil Plate Load Tests (ASTM D1194)
    d. Dynamic Cone Penetrometer Test (ASTM D6951)
    e. Laboratory California Bearing Ratio Tests (ASTM D1883)
    f. Laboratory Standard Proctor Compaction (ASTM D698)
    g. Laboratory Modified Proctor Compaction (ASTM D1557)
    h. Laboratory Concrete Cube Strength Tests (ASTM C39)
    i. Field Rebound Hammer Test / Schmidt Hammer Test (ASTM C805)

2) Sub-Surface Soil Investigation (Shallow/Deep)
    a. Field Tests
        i. Standard Penetration Testing (ASTM D1586)
        ii. Vane Shear Test (ASTM 2573)

b. Physical Properties
   i. Moisture Content Test (ASTM D2216)
   ii. Specific Gravity Test (ASTM D854)
   iii. Particle Size Distribution Test (ASTM D421; ASTM D422)
   iv. Atterberg Limit (ASTM D4318)
   v. USCS Classification of Soil (ASTM D2487)

c. Shear Strength Properties
   i. Direct Shear Test (ASTM D3080/D3080M)
   ii. Triaxial Test (U-U Test) (ASTM D2850)

d. Soil Permeability & Compressibility Tests
   i. 1-D Consolidation Test (ASTM D2435)
   ii. Falling Head Permeability Test (ASTM D5084)
   iii. Constand Head Permeability Test (ASTM D-2434)

3) Geotechnical Report Preparation
   a. For Building with Shallow Foundations
      i. Bearing Capacity Analysis / Settlement Analysis
   b. For Structure with Deep Foundations
      i. Site Classifications / Liquefaction Potential Analysis
      ii. Bearing Capacity Analysis for pile foundations

Figure 60: Rotary Wash Boring Setup for Deep Boring

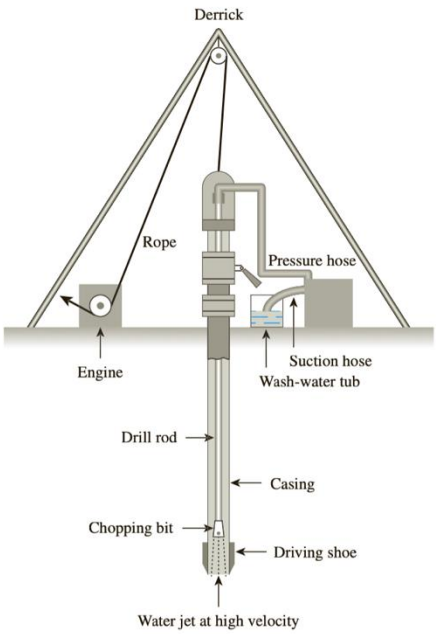
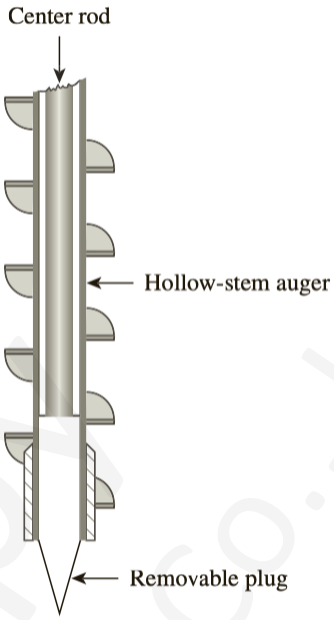


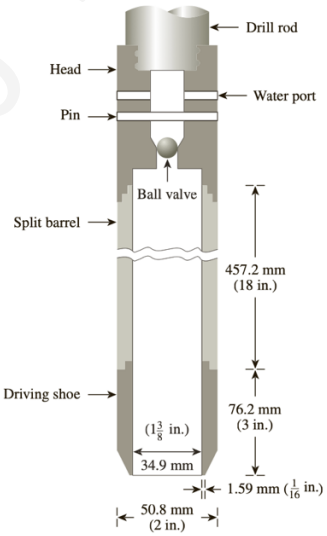
Figure 61: Hand Auger Setup for Shallow Soil Investigation



3.3.1 Standard Penetration Test (ASTM D 1586)

The standard penetration test (SPT) was created in 1927 and is the most widely used field test today. A traditional split spoon sampler is driven into the ground by blows from a drop hammer weighing 63.5 kg and dropping from 760 mm. The sampler is pushed 152 mm (6 inches.) into the soil at the borehole's bottom, and the number of blows (N) needed to drive it another 304 mm is counted. The standard penetration number (N) is the number of blows.

Figure 62: SPT Testing at Site



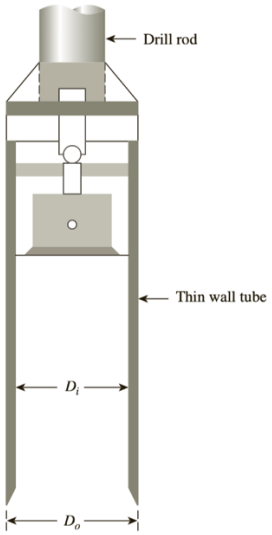
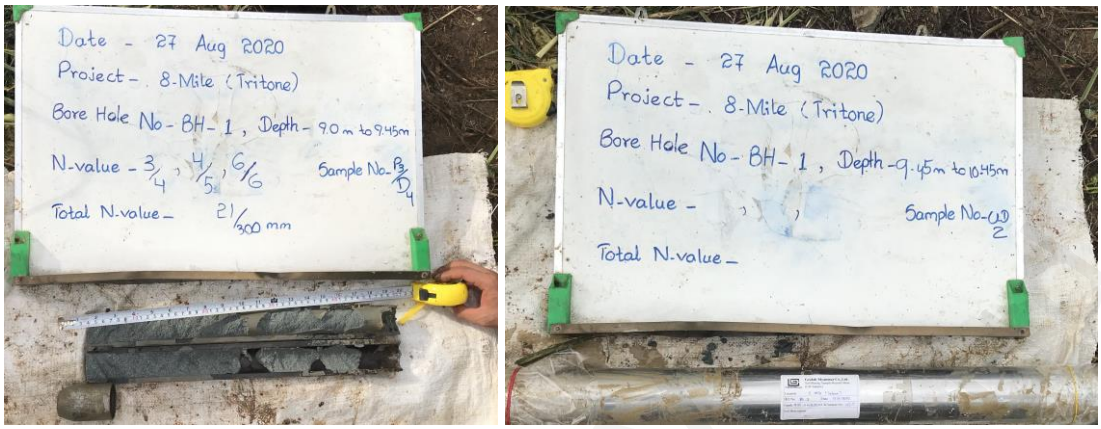


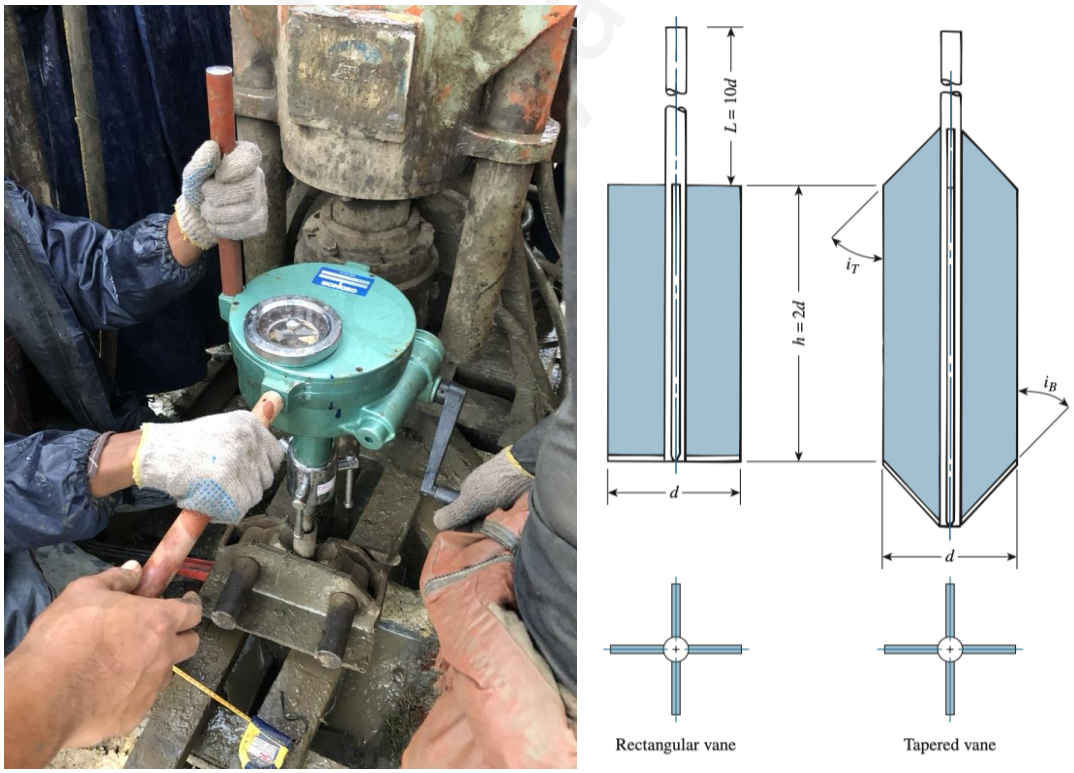
Figure 63: Sample Collection with Split Spoon Sampler and Thin Wall Tube



3.3.2 Vane Shear Test (ASTM D2573)

The Vane Shear Test is a field test used to determine the undrained shear strength of cohesive soils, especially soft clays. It involves inserting a four-bladed vane into the soil and rotating it at a constant rate while measuring the torque required to cause soil failure. The measured torque is then used to calculate the shear strength of the soil. This test is quick, simple, and does not disturb the soil structure significantly, making it ideal for in-situ assessment of soft, saturated soils.

Figure 64: Vane Shear Testing Photos



3.3.3 Moisture Content Test (ASTM D 2216)

Moisture content tests are done to determine the natural water content of the collected samples. The testing procedure is simple. First, dry container weight is determined. Then some wet soil from the collected sample is added, and wet soil + dry container weight is determined.

Figure 65: Moisture Testing of Samples

3.3.4 Specific Gravity Test (ASTM D854)

The weight of a given volume of material divided by the weight of an equivalent volume of distilled water is known as specific gravity "G_s". The specific gravity of soil solids is an important parameter for calculating the weight-volume relationship in soil mechanics.

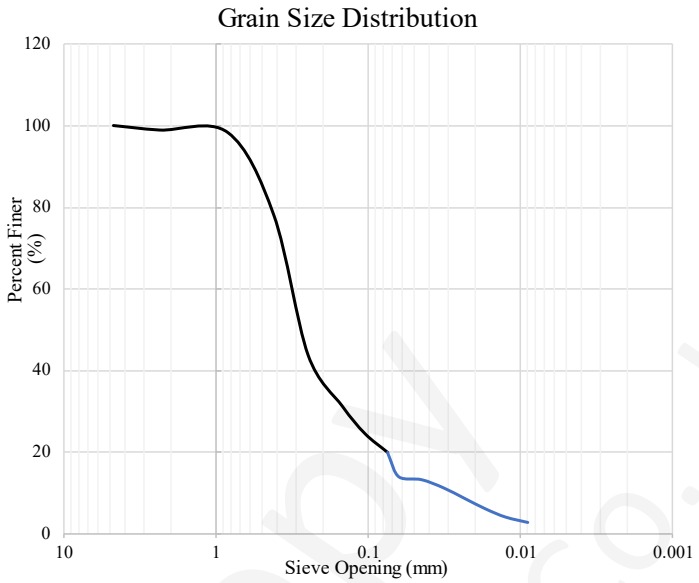
Figure 66: Specific Gravity Testing of Samples


3.3.5 Particle Size Distribution (ASTM D421-D422)

Grain-size distribution is known as what grain sizes are present within the soil in what percentage. The grain size distribution very much influences the geotechnical characteristics of coarse-grained soils. Since soil also includes both coarse and fine grains, the grain size distribution must be determined in order to distinguish them and better understand their engineering properties. The grain size distribution of coarse-grained soil is generally determined using sieve analysis. Hydrometer analysis can be used to determine the grain-size distribution in fine-grained soils.

Figure 67: Sieve Analysis and Hydrometer Analysis

Figure 68: Grain Size Distribution Curve of a Sample



3.3.6 Atterberg's Limit Test (ASTM D4318)

When a large volume of water is added to clayey soil, it may become semiliquid. Depending on the moisture content of the soil, it will act like plastic, semisolid, or solid material if it is eventually dried. The liquid limit is the moisture content in percent at which the soil transitions from a semiliquid to a plastic state (LL). The plastic limit (PL) and shrinkage limit (SL), respectively, are the moisture content in percent at which the soil transitions from a plastic to a semisolid state and from a semisolid to a solid state.

Figure 69: Grain Size Distribution Curve of a Sample

3.3.7 USCS Soil Classification (ASTM D 2487)

Once the percent of different soil types are obtained from Atterberg's Limit Tests, Grain Size Distribution Tests, these soils are then classified into their belonging

group with the USCS Soil Classification system in ASTM D 2487. Soil classification of plastic soils that was done in sample Project is shown as here . For the non-plastic soils, the soils are classified according to charts provided in ASTM D 2487.

Figure 70: USCS Classification Procedure Chart

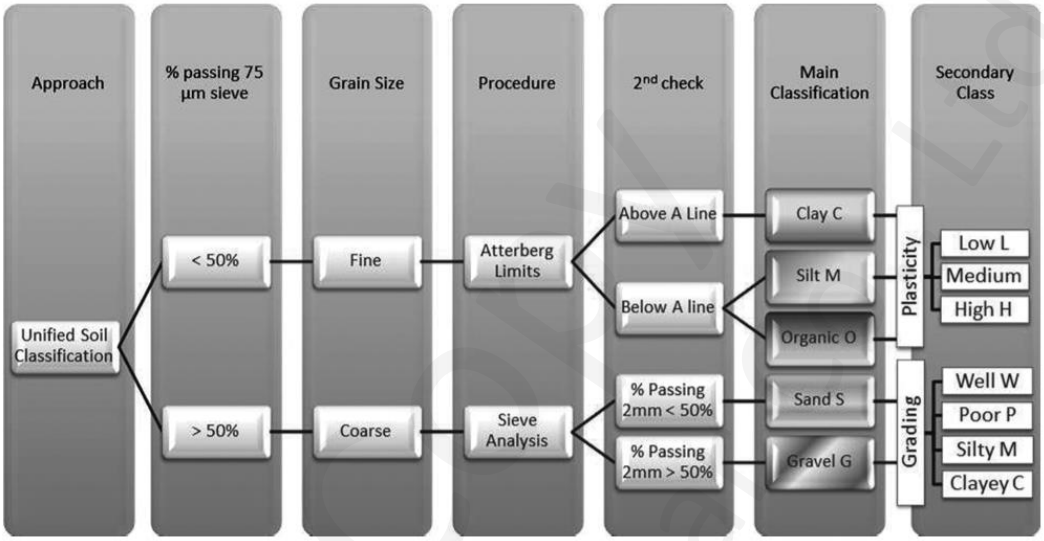
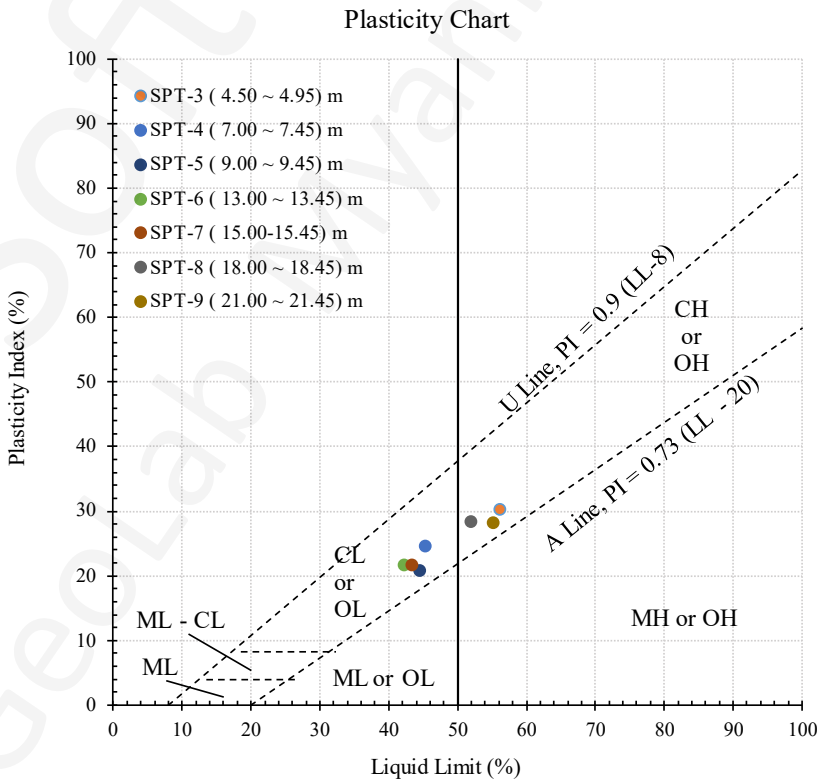


Figure 71: USCS Classification of Plastic Soils



3.3.8 Shear Strength Properties Tests

In shallow or deep soil investigation, it is important to know the shear strength properties such as apparent cohesion (c'), friction angle ($\emptyset'$), undrained shear strength (S_u) to determine the geotechnical properties of foundations designs. The list of tests to be carried out are as follows:

i. Direct Shear Test (ASTM D 3080)
ii. Triaxial Test (U-U Test) (ASTM D 2850)

Figure 72: Mohr's Cycles and Shear Stress vs Shear Displacement Graphs

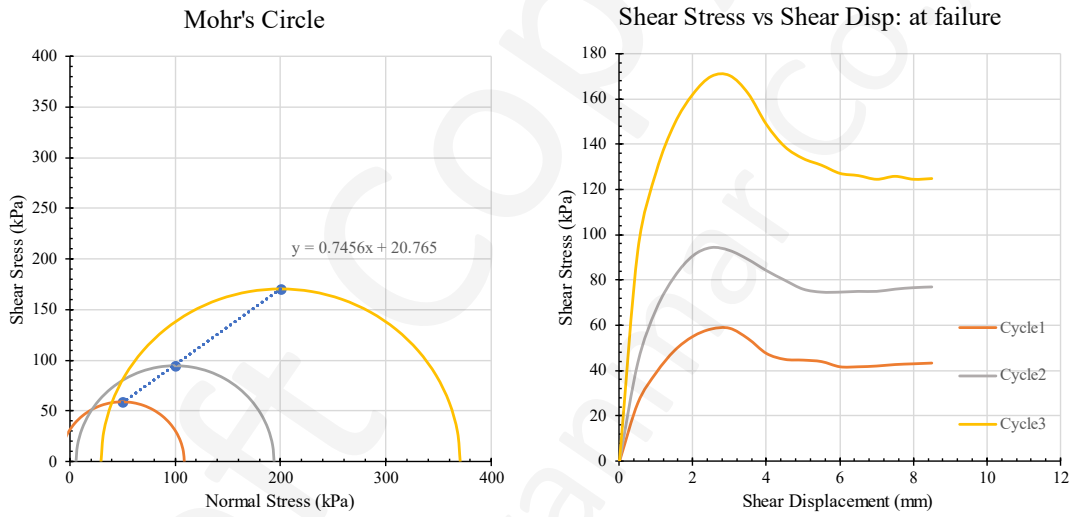


Figure 73: DS Tested Sample, Sample Preparation and Shearing Apparatus

Figure 74: UU Triaxial Test Set-Up and Sample after Test

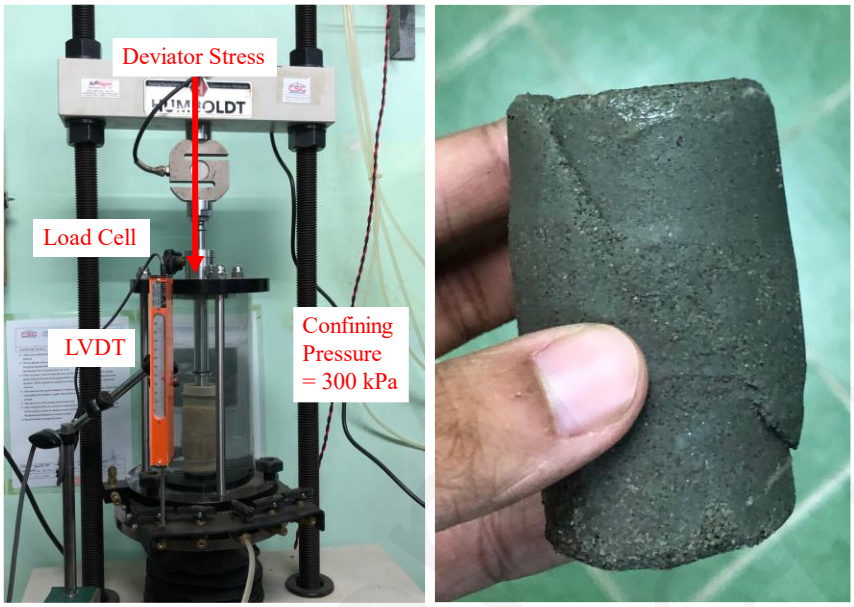


Figure 75: Deviator Stress vs Axial Strain and Shear Stress vs Normal Stress

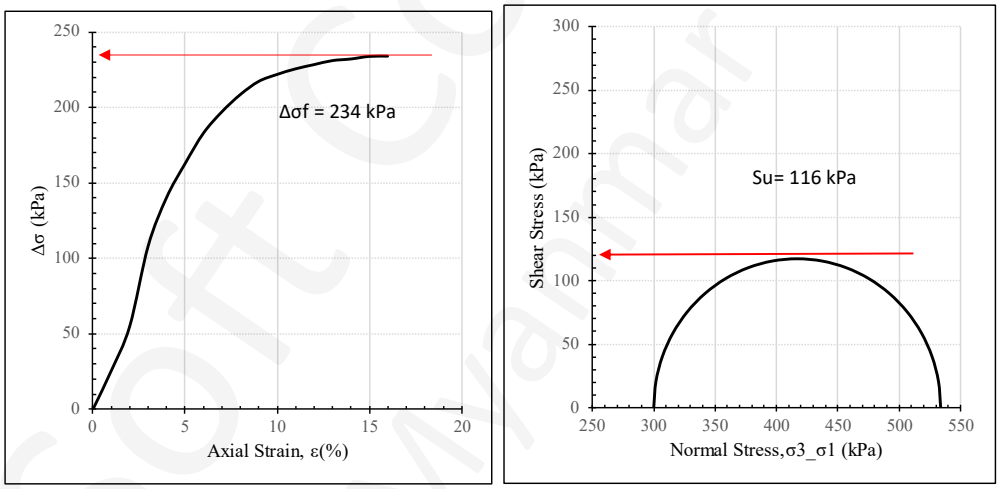


Figure 76: GeoLab's Geotechnical Laboratory

Figure 77: Example Bore Log

PROJECT :
CLIENT :
PROJECT NO :
LOCATION :
DRILLING STARTED : 20/8/2023
DRILLING ENED : 21/8/2023
LOGGED BY : Wai Yan
CHECKED BY : Aung Htet

DRILLING RIG : HYG-200
BH DIA : 76.2 mm
CORE DIA : -
DRILL METHOD : RWB
DRILLED BY : Aung Zaw Myint
SATRING DEPTH : 0.00 m
ENDING DEPTH : 21.45 m
ELEVATION : - m above MSL

Boring Log
BH-01
Page 1 of 2

NORTHING : -
EASTING : -
RE: LEVEL : -
GWL : 1.5 m
Dated : 20/8/2023

DEPTH(m)	REDUCED LEVEL(m)	GRAPHIC LOG	LEGEND	SAMPLE NO.	SOIL DESCRIPTION	SPT (N) VALUE 75/150/225/ /300/375/450mm	Grain Size(%) G/SA/S&C	PL (%)	LL (%)	Field Water Content ω (%)	USCS NAME	Shear Strength / Unit Wt: c or S_u (kPa)	ϕ (°)	γ_{sat} (kN/m^3)
0				Top Soil	*Top Soil, compacted sand with gravels.*	N=0								
1	GWL 1.50 m													
				SPT-1	*Filled sand with gravels.*	3/ 3/ 2/ 1/ 2/ 2 / N=7	40.6/51.4 7/7.93	Non	Plast ic	26.33	SW		21.2°	19.47
2														
3				SPT-2		2/ 3/ 3/ 2/ 2/ 2 / N=9	40.67/56. 11/3.22	Non	Plast ic	29.25	SW	1.48	20.0°	19.05
	3.45 m				*Bluish CLAY with trace of silt.*									
4														
				SPT-3		1/ 1/ 0/ 1/ 0/ 1 / N=2	0/3.04/96 .96	25.93	56.22	52.75	CH	Su = 7.05 / c = 2.49	15.3°	16.61
5														
6	6.00 m			UD-1	*Bluish CLAY*									
				SPT-4		0/ 0/ 0/ 1/ 0/ 1 / N=2	0/2.72/97 .28	20.76	45.41	44.36	CL			17.31
7														
8														
9	9.00 m			SPT-5	*Bluish CLAY*	2/ 0/ 1/ 0/ 0/ 1 / N=2	0/3.5/96. 5	23.65	44.54	42.81	CL	Su = 9.59		17.45
10														
11														
12	12.00 m			UD-2	*Bluish CLAY*									
13				SPT-6		1/ 1/ 0/ 1/ 1/ 1 / N=3	0.0/3.5/9 6.5	20.51	42.23	50.47	CL			16.79
14														
15	15.00 m													

=SPT N(Blows/300mm)
⊕=VaneShear (kPa)
0 10 20 30 40 50

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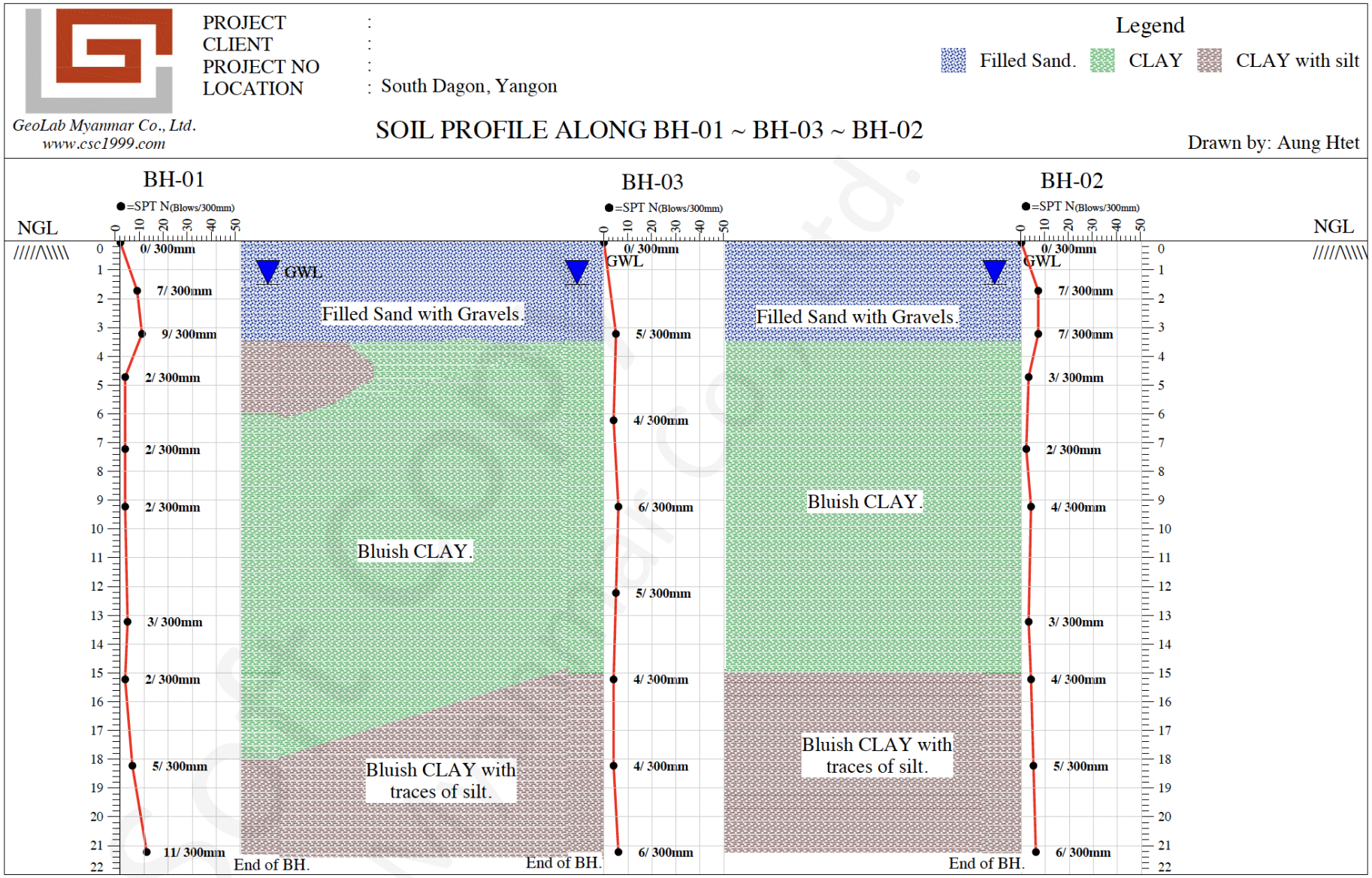
www.csc1999.com

= SAMPLE
= Undisturbed Sample

● = SPT Test
▼ = Ground Water Level
⊕ = Vane Shear Test(kPa)
PL = Plastic Limit (%)
LL = Liquid Limit (%)
γ_{sat} = wet unit weight (kN/m^3)
ω = Field Moisture Content (%)
G/SA/S&C = Gravel/ Sand / Silt & Clay

REMARKS

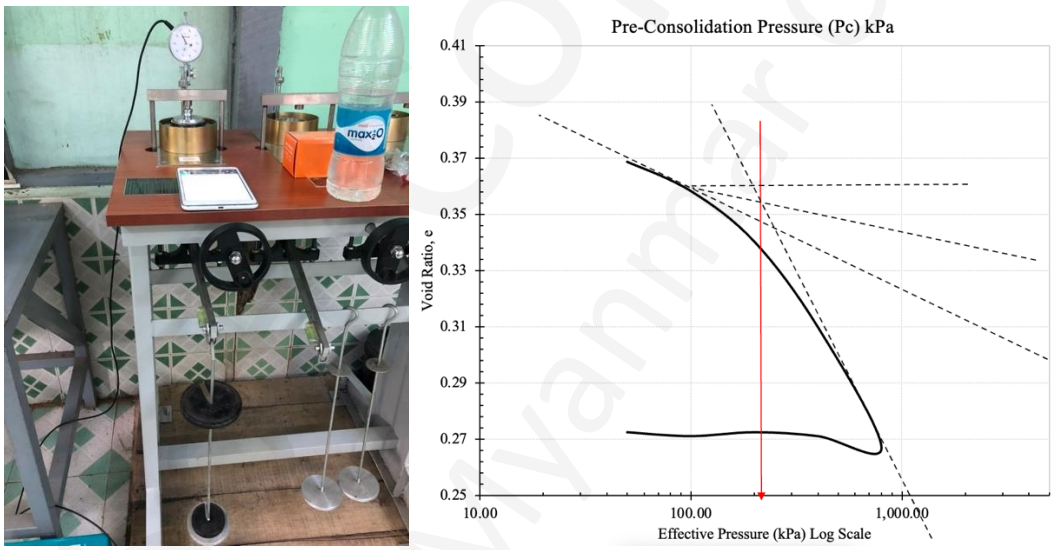
Figure 78: Example BH Cross Section



3.3.9 1-D Consolidation Test (Oedometer Test) ASTM-2435

The 1-D Oedometer Test, also called the one-dimensional consolidation test, is a laboratory test used to determine the compressibility and consolidation characteristics of soils under vertical loading. It is typically performed on undisturbed soil samples confined laterally to prevent horizontal deformation, while incremental vertical loads are applied. The test measures the settlement of the soil over time under each load, allowing engineers to calculate key parameters such as coefficient of consolidation, compression index, and preconsolidation pressure. These values are essential for predicting settlement behavior of foundations, embankments, and other structures, particularly on clayey or cohesive soils.

Figure 79: 1-D Oedometer Test



3.3.10 Hydraulic Conductivity Tests (Water Permeability Tests)

Water Permeability Tests determine the rate at which water flows through soil, which is crucial for drainage, foundation, and earthworks design. These tests are performed on soil samples in the laboratory (or in the field) to measure hydraulic conductivity. The main laboratory methods are:

- Constant Head Test – Water flows continuously through the soil sample at a steady head; mainly used for coarse-grained soils like sand and gravel.
- Falling Head Test – Water level drops over time through the soil; suitable for fine-grained soils like silts and clays.

Results help engineers assess soil drainage characteristics, seepage potential, and suitability for structures such as dams, embankments, and retaining walls.

Figure 80: Hydraulic Conductivity Tests

3.3.11 Laboratory Standard/Modified Proctor Compaction Tests

Soil Compaction is a densification of soil by repulsion of air and re arrangements of soil particles by means mechanical energy. It can be achieved in laboratory by either Standard Proctor Test or Modified Proctor Test.

Figure 81: Compaction Test Mould

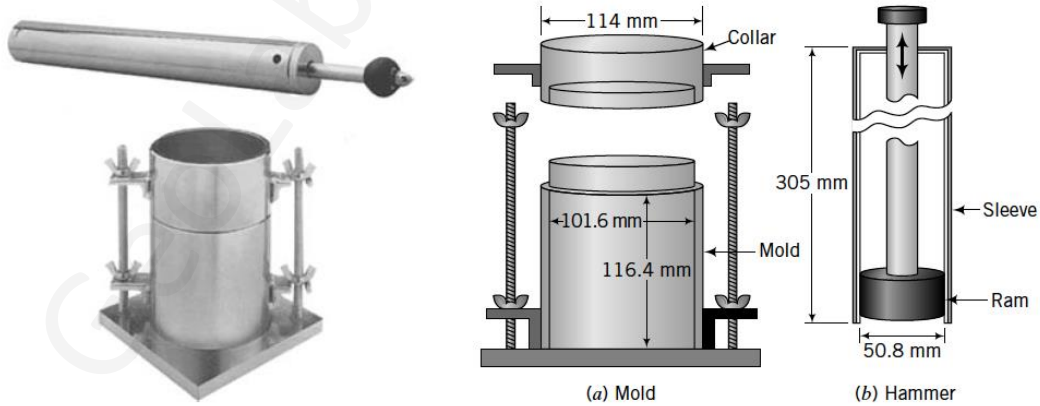
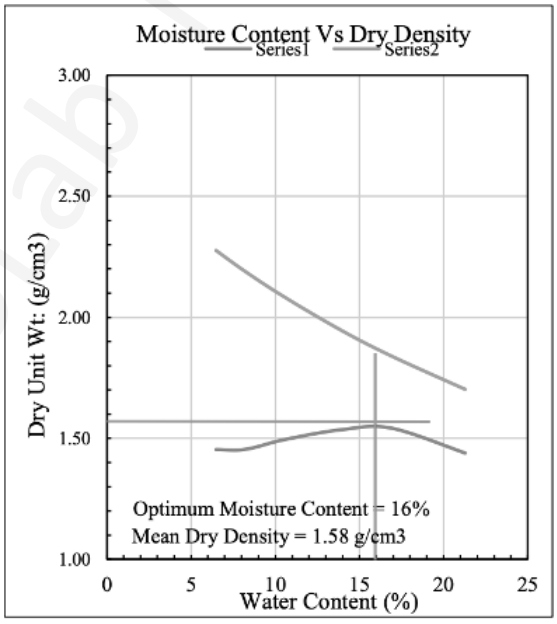


Figure 82: Compaction Testing Photos



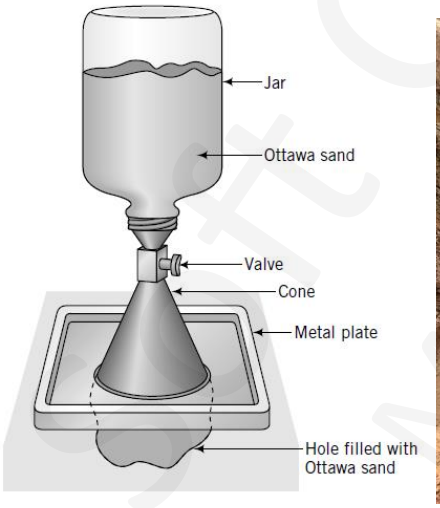
3.3.12 Sand Cone Test (ASTM D1556)

When soil is used to construct highway subgrades and base courses, waste containment liners, earth dams, embankments, and other purposes, the soil must be compacted in accordance with construction specifications.

Specifications for compacted soil are typically given in terms of an acceptable range of moisture content (w) and/or dry unit weight (γd) based on results of laboratory compaction tests (Standard or modified proctor compaction test).

To confirm that soil is compacted in accordance with construction specifications, γ and w of representative samples of compacted soil are measured as part of a Construction Quality Assurance (CQA) plan.

Figure 83: Sand Cone Test Equipment

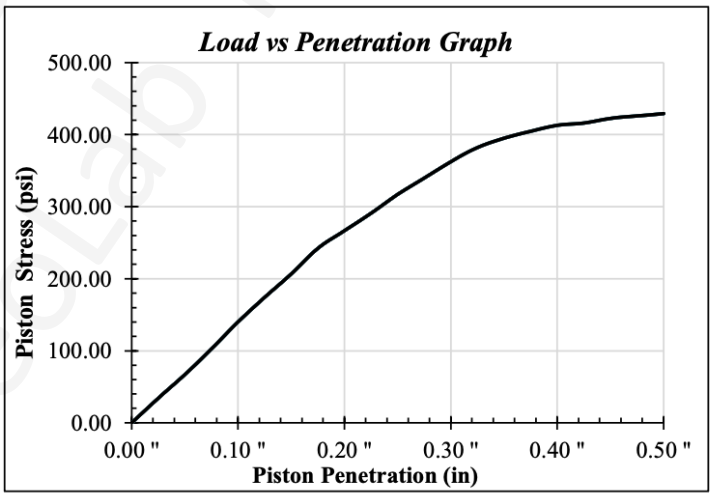


3.3.13 California Bearing Ratio Test

The California Bearing Ratio (CBR) Test is a laboratory or field test used to evaluate the strength and load-bearing capacity of subgrade soils and base materials for pavements and roads. In the test, a standard piston is pressed into a soil sample at a controlled rate, and the resistance to penetration is measured.

The result is expressed as a percentage of the resistance of a standard crushed rock material, indicating how well the soil can support traffic loads. CBR values are essential for pavement design, thickness determination, and assessing soil suitability for road construction.

Figure 84: CBR Testing Photos



$$CBR\% = \frac{Test\ Unit\ Load\ x\ 100\%}{Standard\ Load}$$

From Graph

CBR @ 0.1" = 14.0 %

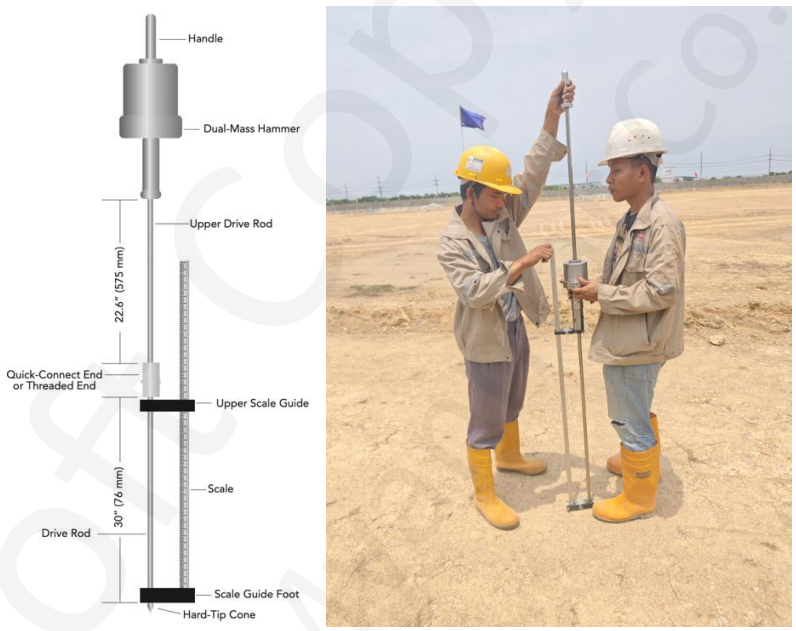
CBR @ 0.2" = 17.8 %

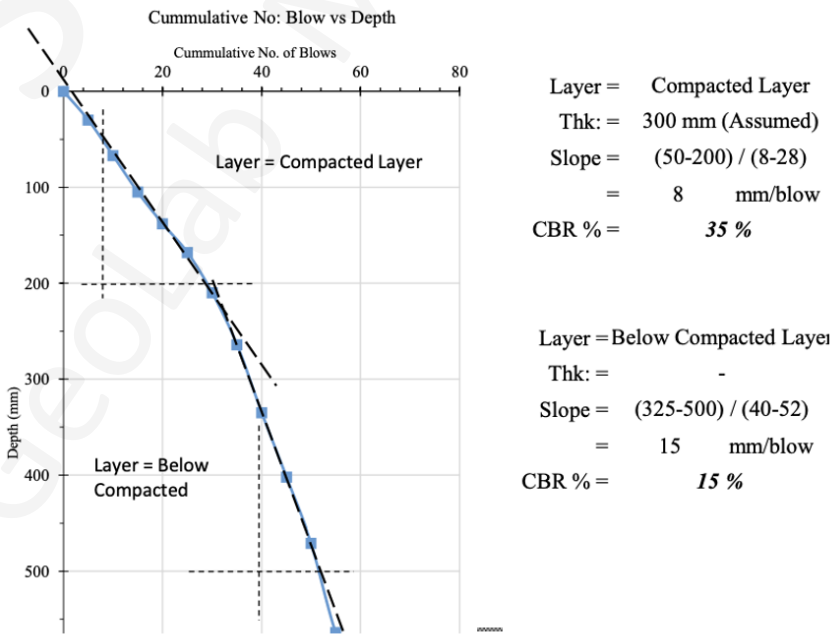
Therefore, ***Final CBR = 17.8 %***

3.3.14 Dynamic Cone Penetration Test

The Dynamic Cone Penetration Test (DCPT) is a field test used to assess the soil's strength and compaction characteristics. It involves driving a cone-shaped penetrometer into the ground using a series of hammer blows. The Dynamic Cone Penetration Test (DCPT) is a geotechnical field test used to evaluate the soil's resistance to penetration and thereby gauge its compaction and strength properties. It provides valuable information for soil characterization, construction site assessments, and quality control of compaction work.

Figure 85: DCP Equipment & Testing Photos





3.3.15 Concrete Compressive Strength Test (ASTM C39)

Concrete Compressive Strength Tests are used to determine the ability of concrete to withstand axial loads and assess its quality and structural performance. In these tests, concrete specimens—typically cubes or cylinders—are cast, cured for a specified period, and then subjected to a compressive load in a testing machine until failure. The maximum load at failure divided by the specimen's cross-sectional area gives the compressive strength. These tests are essential for quality control, design verification, and ensuring safety in construction projects.

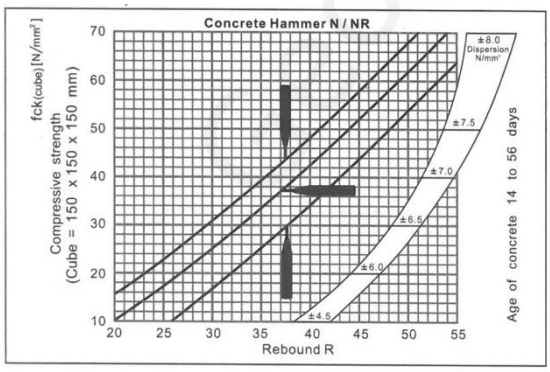
Figure 86: Concrete Compressive Strength Testing

Compressive Strength	N/mm^2 or MPa	22.22	22.28
	lb/in^2 or PSI	3222.48	3229.96
Average (PSI)			3226.22
Failure Pattern/Photo			
Remarks (if Any)		–	–

3.3.16 Concrete Rebound Test/Schmidt Hammer Test (ASTM C805)

The Concrete Rebound Test (also called the Schmidt Hammer Test) is a non-destructive method to estimate the surface hardness and compressive strength of concrete. It uses a spring-loaded hammer that impacts the concrete surface, and the rebound distance of the hammer is measured. Higher rebound values indicate harder and stronger concrete.

Figure 87: Concrete Rebound Hammer Testing



39 48 MPa	45 52 MPa	40 42 MPa
39 40 MPa	40 42 MPa	38 40 MPa
38 40 MPa	40 42 MPa	39 40 MPa

3.4 Geotechnical Design Services

Though GeoLab is mainly focused on the geotechnical investigation, testing, instrumentation & monitoring works, GeoLab is providing geotechnical design services as long as there is no conflict of interest. Meaning GeoLab doesn't involved in any project's design sector if GeoLab is to be participated in professional geotechnical testing scopes and vice visa.

However, that being the core principle, GeoLab has provided its unbiased professional design approach, design calculations, design considerations, FEM modeling for successful implementation of GeoLab's geotechnical testing projects, such as pile load tests, & soil investigation projects to be referenced in method statement preparations also to be considered as a reference for primary designer.

Please see following glances of modern geotechnical design calculation using FEM programs.

Figure 88: Pile Axial / Tension Capacity Checking for Pile Load Test Project

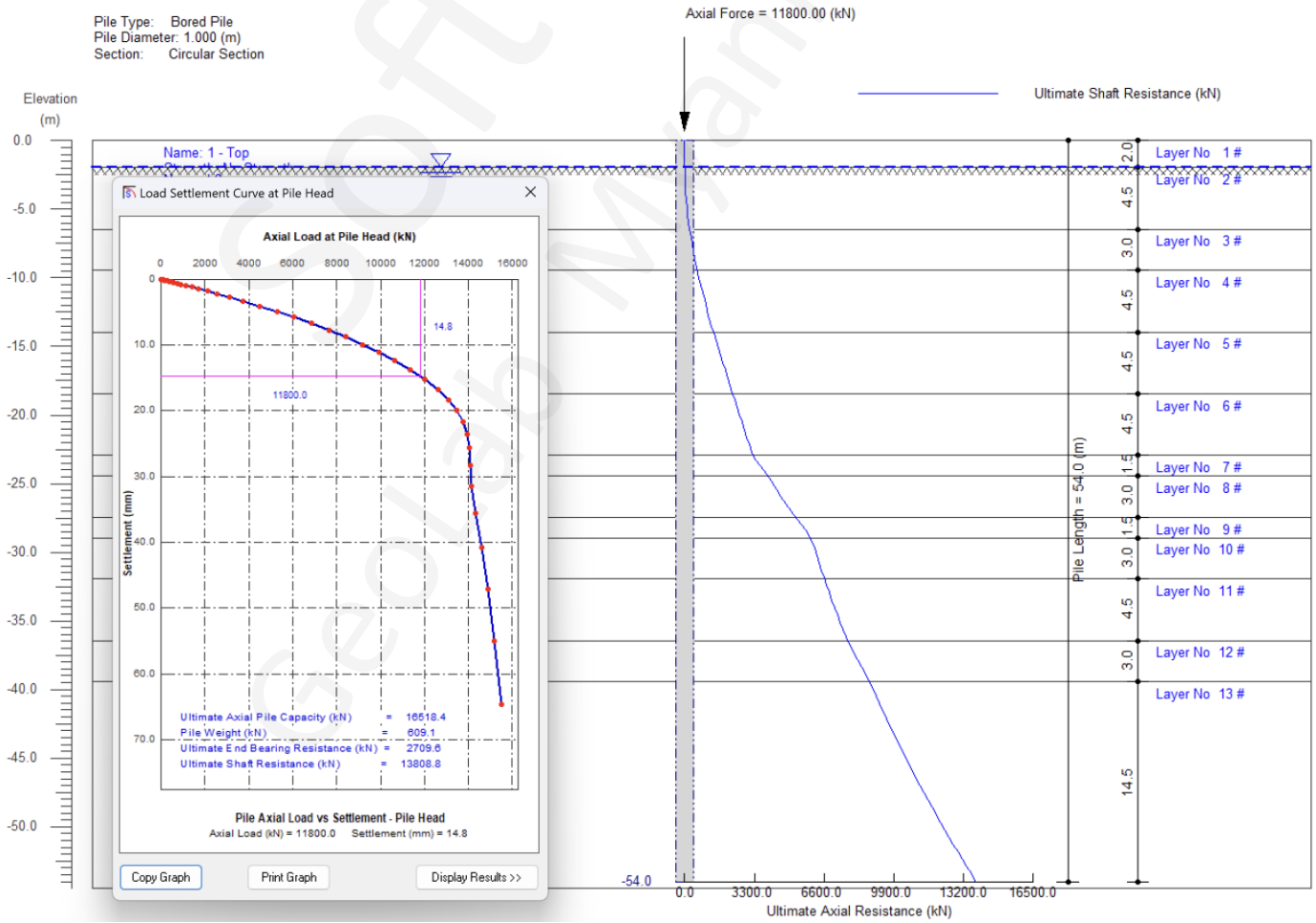
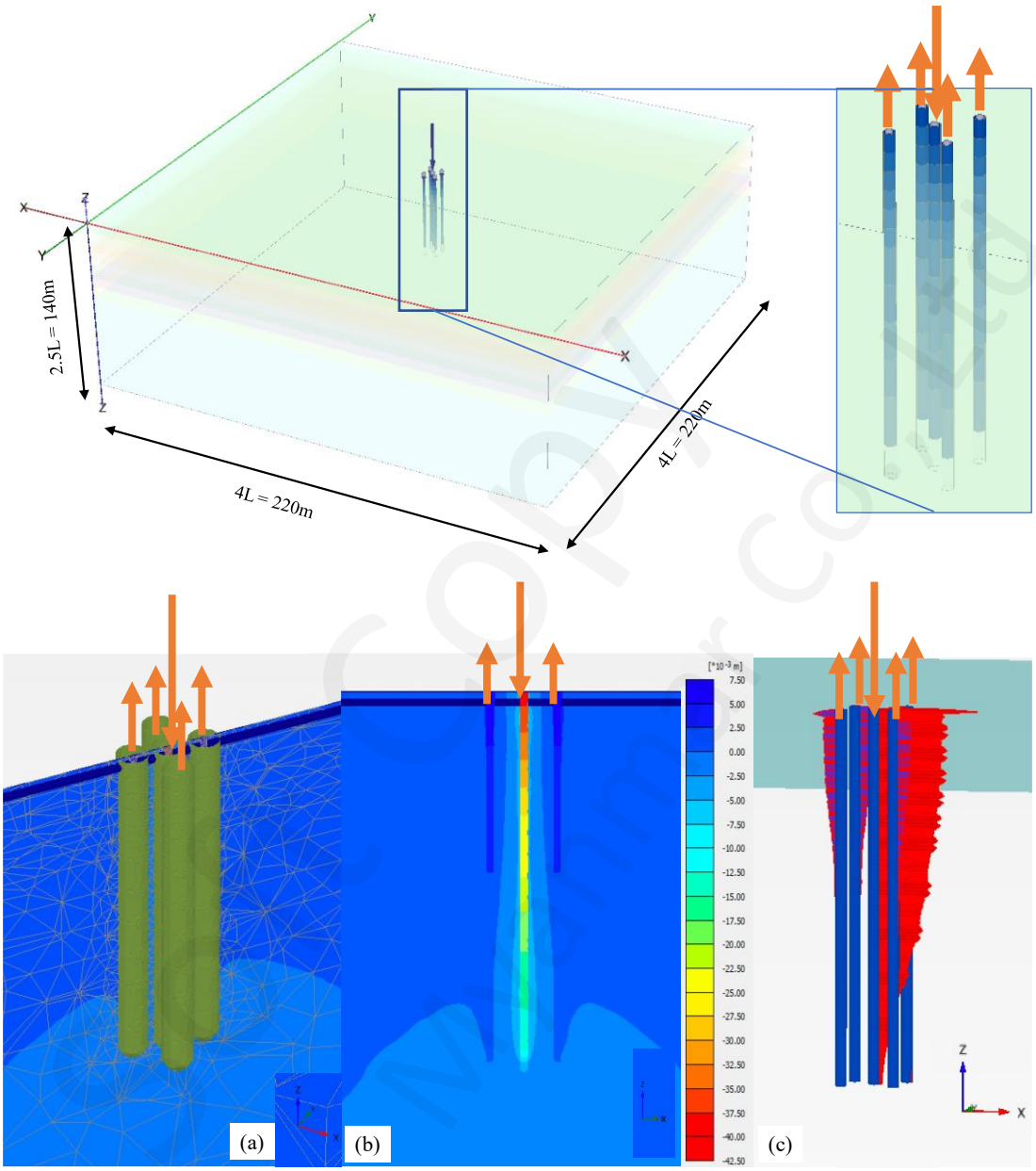


Figure 89: Pile Test FEM model for Research



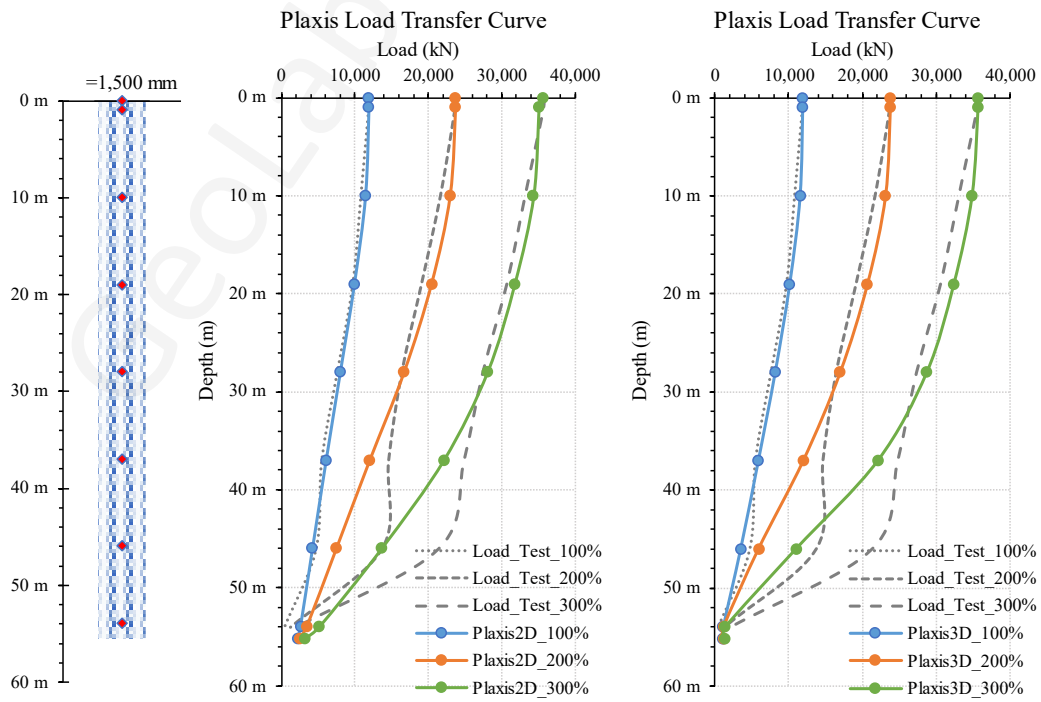


Figure 90: ERSS/TERS Stability Checks

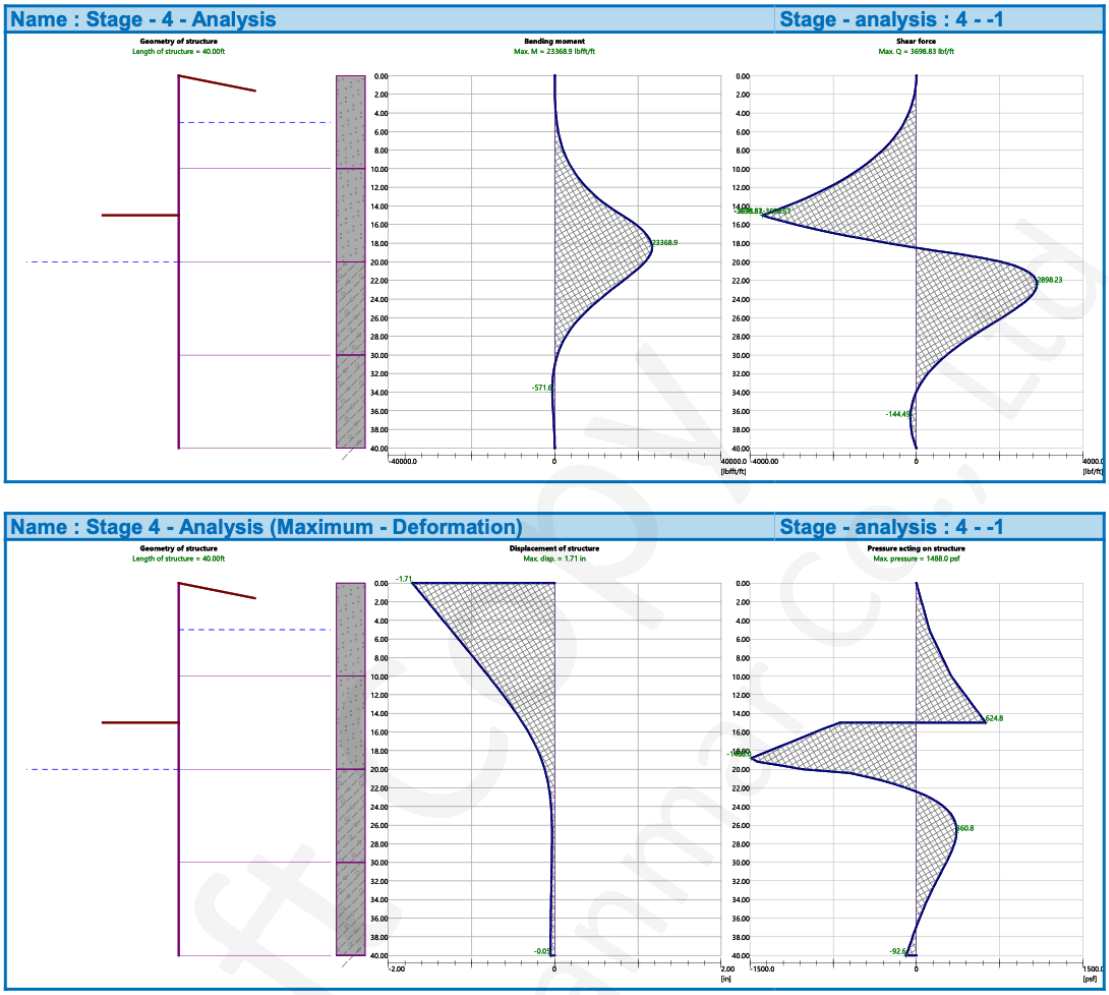


Figure 91: Slope Stability Checks

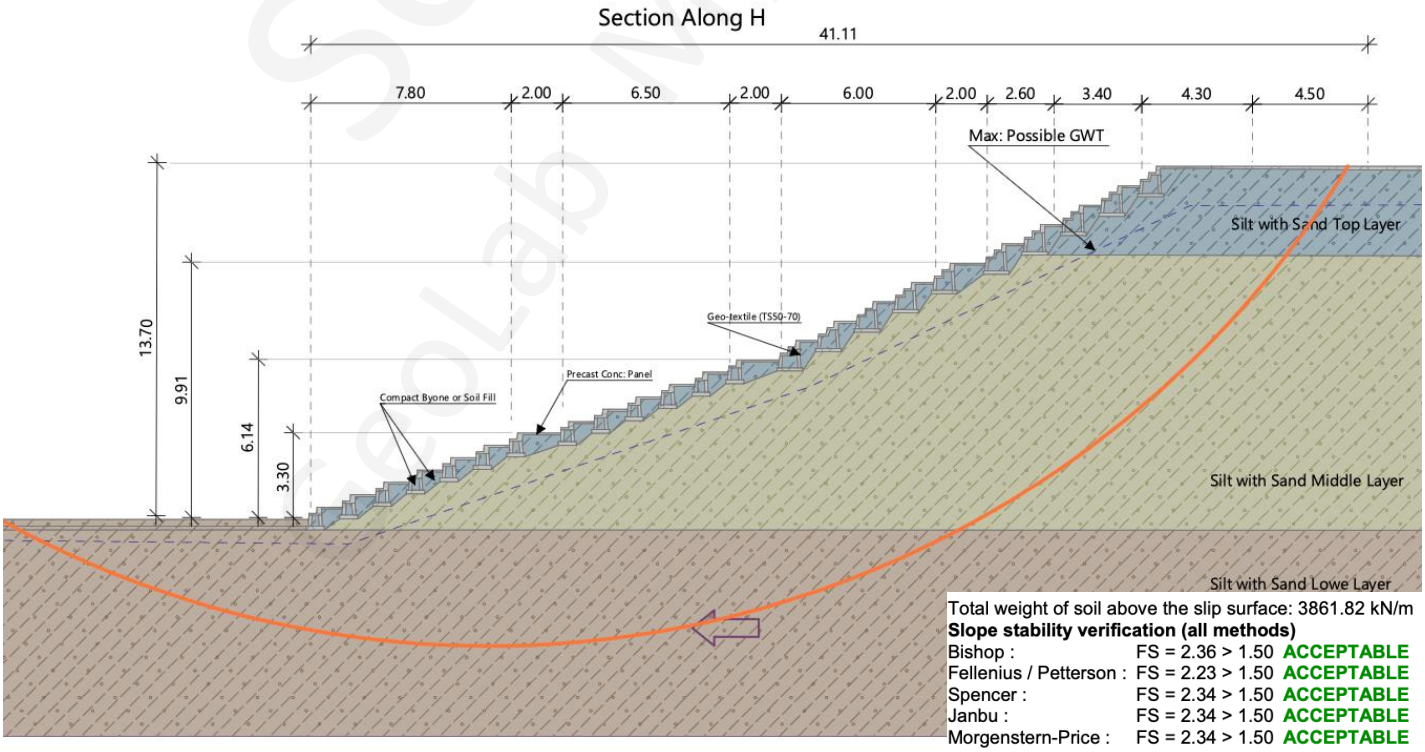
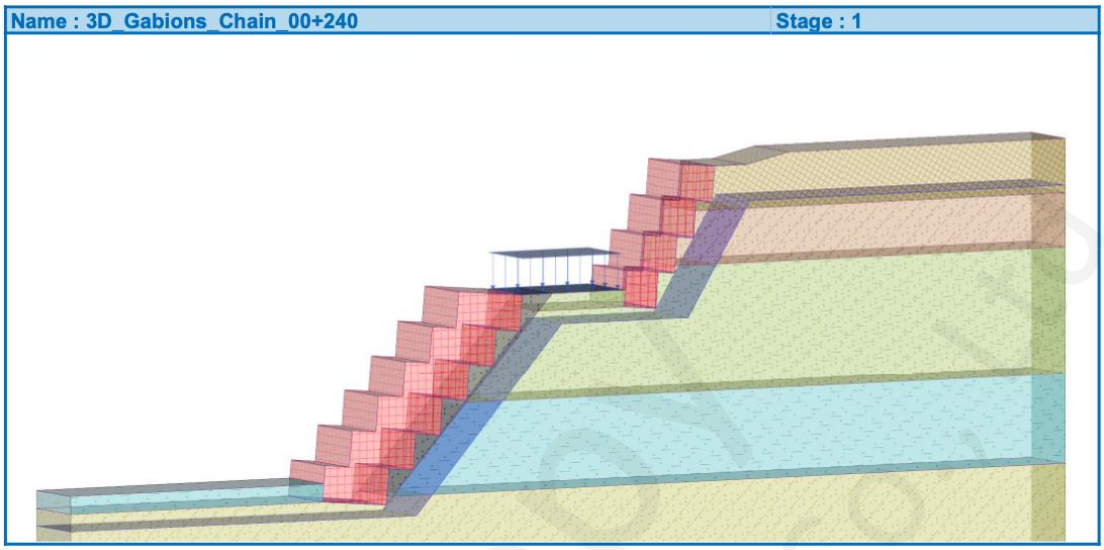
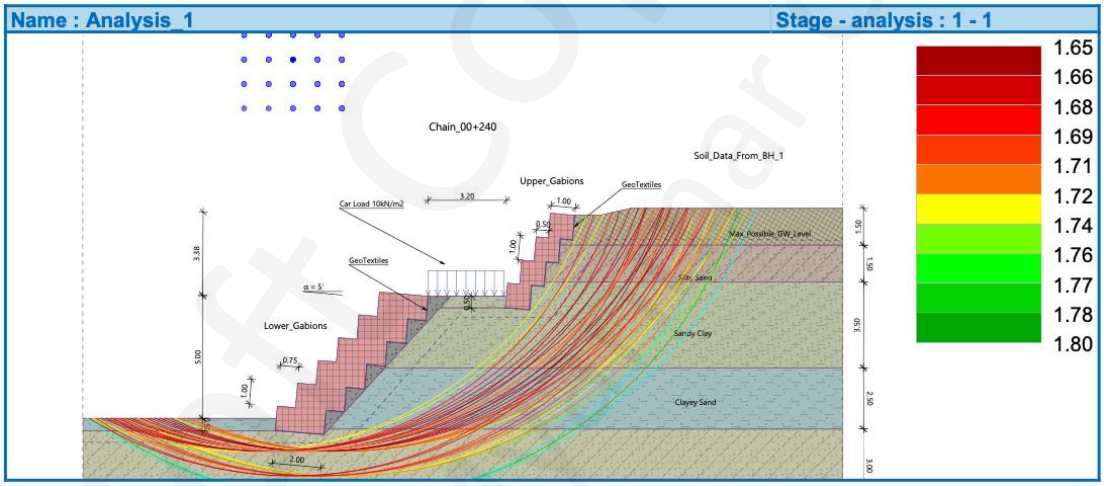


Figure 92: Gabion Slope Protection & Stability Checks





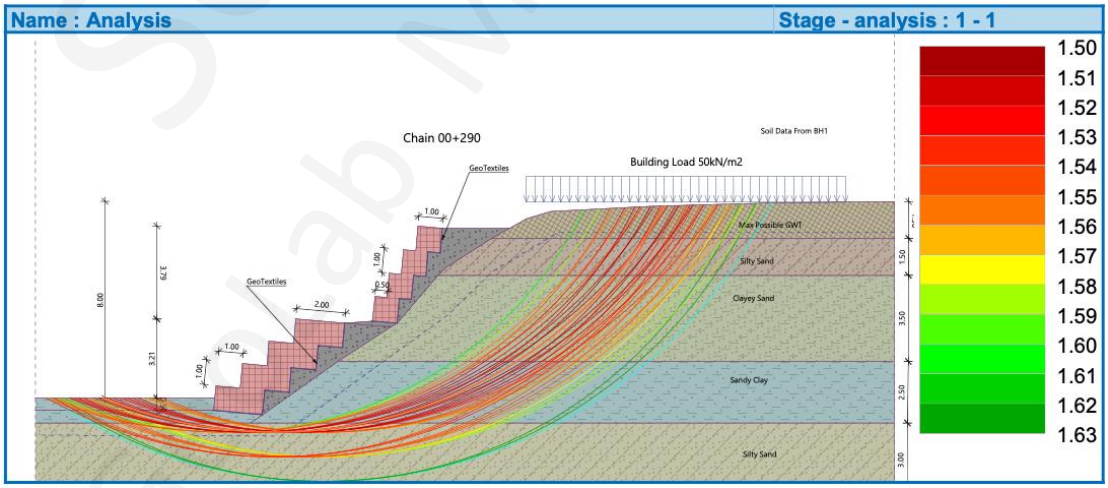
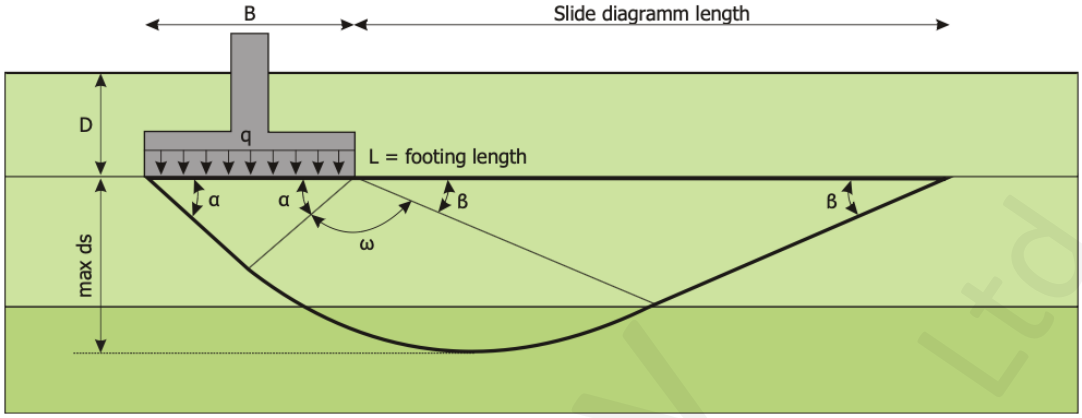


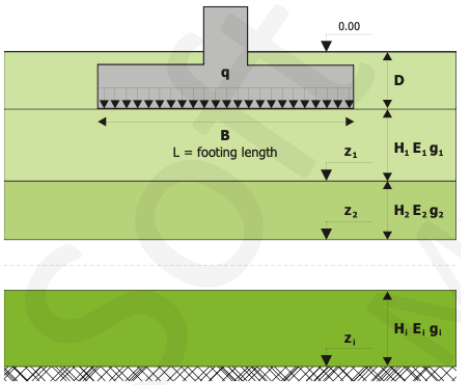
Figure 93: Shallow Footing Capacity & Elastic Settlement Checks



Bearing capacity results

Footing length L (m)	Footing width B (m)	Bearing capacity (kPa)	Vertical force (kN)	max d_s (m)	Calculated settlement (mm)	Calculated friction angle (°)	Calculated cohesion (kPa)	Calculated gamma 2 (kN/m³)	K_S (MN/m³)
1.00	1.00	126.49	126	0.80	21.5	5.17	12.03	8.19	5.88
1.20	1.20	128.53	185	0.95	25.8	4.72	12.77	8.19	4.97
1.40	1.40	130.10	255	1.09	29.2	4.41	13.30	8.19	4.45
1.60	1.60	131.84	338	1.25	32.4	4.24	13.71	8.19	4.06
1.80	1.80	132.56	430	1.40	35.1	4.04	14.03	8.19	3.77
2.00	2.00	137.59	550	1.55	39.1	3.90	14.85	8.19	3.52

The calculation procedure uses the analytical formulas taken from DIN 4017 while applying the partial factors from Eurocode 7.



Parametric analysis data

Footing type:	Rigid
Ground water:	0.30 (m)
L/B ratio:	1.00
Minimum footing width B_{min}:	1.00 (m)
Maximum footing width B_{max}:	2.00 (m)
Minimum footing pressure q_{min}:	100.00 (kPa)
Maximum footing pressure q_{max}:	150.00 (kPa)
Embedment depth D:	2.50 (m)

Soil layer input data

Layer No	Bottom z (m)	Layer thickness (m)	Modulus of elasticity (MPa)	Gamma (kN/m³)
1	1.00	1.00	2.00	18.00
2	2.00	1.00	3.00	18.00
3	3.00	1.00	3.00	18.00
4	4.00	1.00	3.00	18.00
5	5.00	1.00	3.00	18.00

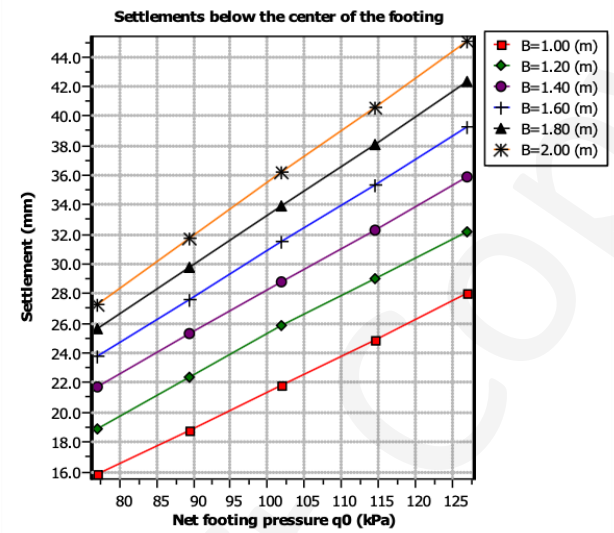
Figure 94: Shallow Footing Capacity & Elastic Settlement Checks

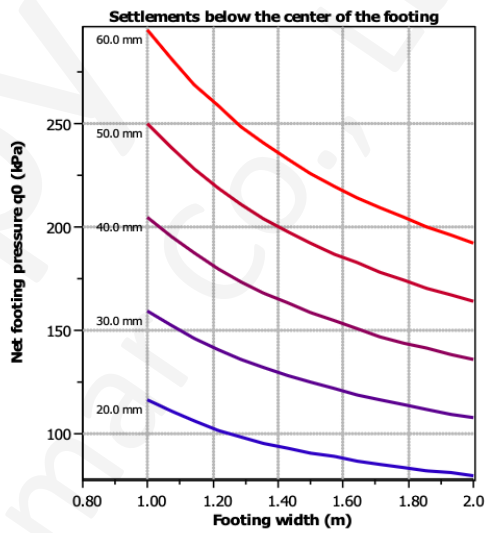
$$\text{Settlement} = \frac{1}{E_s} \times \int_0^{ds} I \times \sigma_1 dz$$

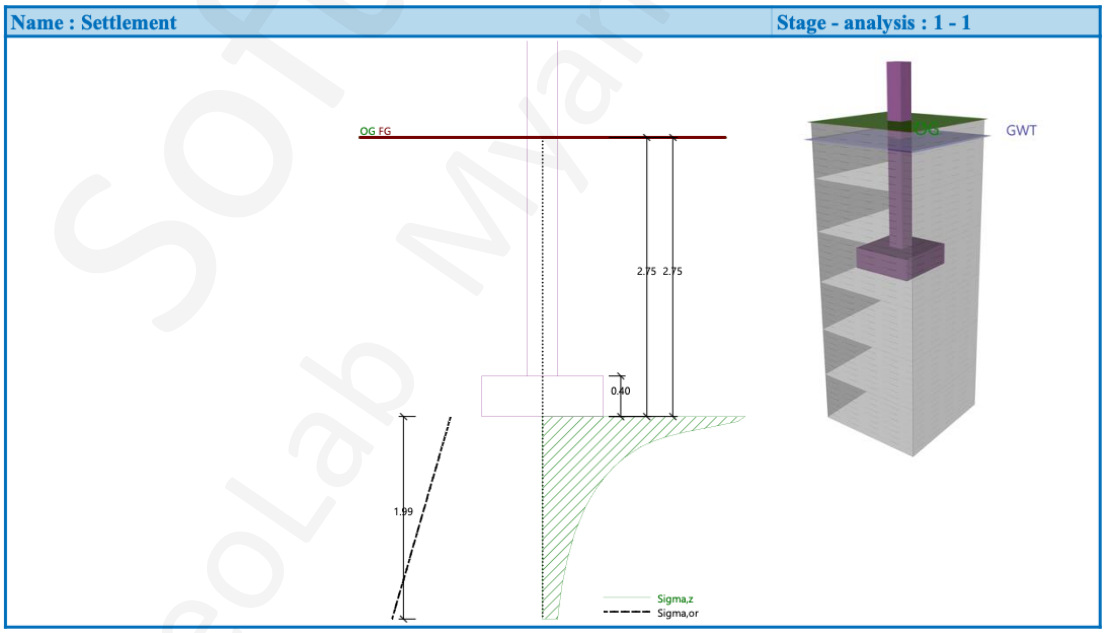
Calculations are carried out using the procedure described in DIN 4019. The general equation for a single soil layer is presented above. The software uses an analytical procedure to calculate the above integral.

Expected settlements (mm)

q_0 (kPa)	B = 1.00	B = 1.20	B = 1.40	B = 1.60	B = 1.80	B = 2.00
77.00	15.84	18.87	21.75	23.79	25.64	27.32
89.50	18.83	22.38	25.28	27.65	29.80	31.75
102.00	21.89	25.83	28.81	31.51	33.96	36.19
114.50	24.86	28.99	32.35	35.37	38.12	40.62
127.00	28.02	32.15	35.88	39.24	42.28	45.05







Overall settlement and rotation of foundation:
Foundation settlement = 24.5 mm
Depth of influence zone = 1.99 m

Rotation in direction of x = 0.000 (tan*1000); (1.7E-16 °)
Rotation in direction of y = 0.000 (tan*1000); (1.7E-16 °)

4. GeoLab Commitments

In 2025, GeoLab Myanmar proudly celebrates 15 years of excellence in Myanmar geotechnical engineering. Over this journey, we have grown with perseverance, overcoming global and regional uncertainties while remaining dedicated to shaping a stronger foundation for Myanmar.

Throughout our journey, we have successfully contributed to many of Myanmar's landmark projects. We continue to innovate and embrace modern technologies, keeping pace with the IoT era.

Among GeoLab's range of services, pile load testing, instrumentations with staate of art real time monitoring system stands as a core expertise. With extensive experience and proven methodologies, we have carried out numerous successful pile load tests across Yangon, Myanmar, ensuring the reliability and safety of foundation systems for major infrastructure and development projects.

As Myanmar embraces a new era of modern construction, GeoLab is dedicated to advancing with it—delivering innovative, reliable, and future-ready geotechnical solutions that strengthen the nation's foundations.


CASE

APPENDIX A
PILE STATIC LOAD TEST EXPERIENCES

Table A0: GeoLab Successful Pile Test Projects across Yangon City

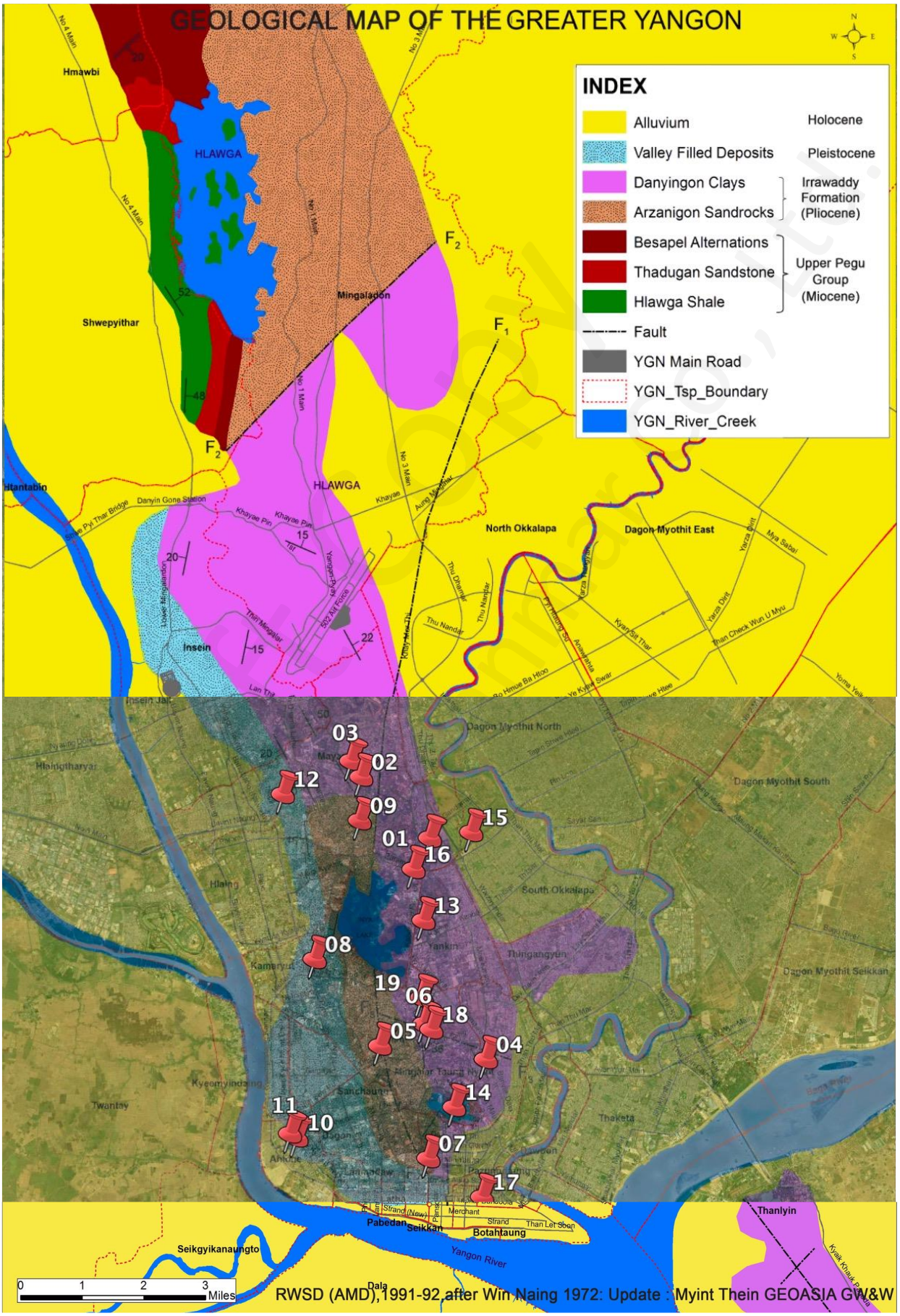


Table A1: Pile Static Load Test Project Experiences List Summary

No:	*Year*	*Particular*
1	2013	18 Storeyed Building Project, MESSRS A1 Construction Co., Ltd (2013)
2	2013	Gold Tower Project, Geotech Pile Co., Ltd. (2013)
3	2013	Myanmar Seilone, Golden Tristar Co., Ltd. (2013)
4	2014	Landmark Building Construction Project,Golden Tristar Co.,ltd. (2014)
5	2014	M Tower Project, Mindhama Co., ltd.(2014)
6	2014	Merchant Suite Condominium Project, Naing Group Co., ltd.(2014)
7	2014	Shangrila Hotel Yangon Project,KHFOGES LTD.(2014)
8	2014	Myanmar Scilone Project, Golden Tristar Co.,Ltd. (2014)
9	2014	Paragon Residence Project , Kyawthar Construction Co., Ltd.(2014)
10	2014	OSD and Liquid Building Construction Project,City Press Pile Co.,ltd.(2014)
11	2014	27 Acre Industrial Zone 5 Project,GLOBEL FOODWEAR FACTORY(2014)
12	2014	34th Street Office Tower Project, Tagaungbwar Co.,Ltd.(2014)
13	2014	77 Kabaraye Pagoda Road Project ULT, GEO FOUNDATION Co.,ltd.(2014)
14	2014	Aquarium Building Project, Asia Concrete Co.,ltd.(2014)
15	2014	The project of Chatrium Royal Lake Hotel Project , Seafco(Myanmar) Co.,Ltd. (2014)
16	2014	East Race Course Condominium Project, GEO TECH PILE Co.,ltd.(2014)
17	2014	Grand Mya Kanthar Condominium Project, MESSRS. TAGAUNG BWAR CONSTRUCTION Co.,Ltd.(2014)
18	2014	Nawarat Condominium Project, iGreen Cnstruction Co.,ltd.(2014)
19	2014	Illustra Building Construction Project, Pyae Sone Win Naing Co.,ltd.(2014)

No:	Year	Particular
20	2014	Kabar Kyaw Builing Project, Mindhama Co.,ltd.(2014)
21	2014	Kan Thar Yar Consotium Tower Project, Asia Myanmar Construction Co.,ltd.(2014)
22	2014	Kabaraye Executive Residence Project,Seafco Co.,ltd. (2014)
23	2015	77 Kabaraye Poject , Geo Foundation Co.,Ltd. (2015)
24	2015	iGreen Project, I Green Construction Co.,Ltd. (2015)
25	2015	Thar Du Kan Project,Myanmar Pou Chen Co.,Ltd. (2015)
26	2015	Star City Zone B Projcet,Byma Myanmar Limited (2015)
27	2015	M Green Apartment Project,Mindhama Co.,Ltd. (2015)
28	2015	CPP Project ,China Petroleum Pipeline Bureau (2015)
29	2015	Mandalay , Myit Nge Project (2015)
30	2015	Pan Hlaing , Ever Green Phase 3 Project, SPA Management Co.,Ltd. (2015)
31	2015	Shwe Gone Daing Project, (2015)
32	2015	Landmark Building Project, SPA Management Co., Ltd. (2015)
33	2015	8mile Project, Living Square Co., Ltd. (2015)
34	2016	PME Tower Project, Mindama Co., Ltd. (2016)
35	2016	Pristine Project, Pristine Global Development Co., Ltd. (2016)
36	2016	San Yeik Nyein Project, Naing Group Capital Co., Ltd. (2016)
37	2016	Season One Project, Season One Co., Ltd. (2016)
38	2016	Myanmar Cluster Project, Haven Co., Ltd. (2016)
39	2016	Inya Lake International Apartment Project, GD Myanmar Co., Ltd. (2016)

No:	Year	Particular
40	2016	TMW Project, TMW Enterprise Co., Ltd. (2016)
41	2016	Prinstine Project., (2016)
42	2016	SanYeinNyein Project, Naing Group Capital Co., Ltd. (2016)
43	2016	Season 1 Project (2016)
44	2016	Myanmar Cluster Project, Heaven Construction Co., Ltd. (2016)
45	2016	Inya Lake International Project, GD Myanmar Co., Ltd. (2016)
46	2016	Myinchan 225 MW Combine Cycle Power Plant Project, ACP Co., Ltd. (2016)
47	2016	Diamond Inya Palace Project (2016)
48	2016	New Hope Factory Project, ACP Co., Ltd. (2016)
49	2016	Thilawa SEZ Project, Myanmar Haixia Construction Co., Ltd. (2016)
50	2016	The Secondary Central Business Min Dha Ma Project, First Myanmar Construction Co., Ltd. (2016)
51	2016	Inno City Project, Myanmar V Pile Co., Ltd. (2016)
52	2016	20 Storeyed Building Project, Mottama Construction Co., Ltd. (2016)
53	2016	Ayayer Waddy Bank Project, ACP Co., Ltd. (2016)
54	2016	Htoo Ice Skating Project, ACP Co., Ltd. (2016)
55	2016	Myanmar Pouchen Project (2016)
56	2017	Regalia Hotel Project, SEAFCO Myanmar (2017)
57	2017	Myanmar Pouchen Extension Project (2017)
58	2017	Land Mark Project, SPA Management, Yoma Strategic Holding Ltd. (2017)
59	2017	KJCMM Japan Project, Thilawa SEZ, ACP Co., Ltd. (2017)

No:	Year	Particular
60	2017	A1-OJI Expansion Japan Project, A1 Construction Co., Ltd. (2017)
61	2017	Thilawa Oil Depot Project, MDC Max Oil Tank Co., Ltd., ACP Co., Ltd. (2017)
62	2017	Meeyahta Development Expansion Project (Formerly Land Mark), Meeyahta Development Co., Ltd. (2017)
63	2017	Detergent Factory Project, ACP Co.,Ltd. (2017)
64	2017	The Project of Diamond Inya Palace, Mandalay Golden Wing Co., Ltd. (2017)
65	2018	Yard Development Project MITT, Nippon Koei Engineering Consultants Co., Ltd. (2018)
66	2018	YCDC Water Treatment Construction Project, Lagunpyin, YCDC, Mindama-POSCO Co., Ltd. (2018)
67	2018	PTTEP Office Project, Sae Myaung Road, 8-mile, Yangon, SEAFCO Co., Ltd. (2018)
68	2018	MDC FFI Project, North Dagon Myothit Tsp., Asia Concrete Products Co., Ltd. (2018)
69	2018	HL Tower Project, 7-mile Pyay Road, Mindhama Co., Ltd. (2018)
70	2018	Bago General Hospital Extension Project, Aung Thu Kha Sayadaw Donation, GEOLAB Contribution (2018)
71	2018	Fully Automatic Mechanized Car Park Building Project, The Central, Marga Landmark Co., Ltd. (2018)
72	2018	Wilmar Dormitory Building Construction Project, Golden Forest Co., Ltd. (2018)
73	2019	The Central Project (2019)
74	2019	Inyalay Club Project (2019)
75	2019	Service Apartment Project (2019)
76	2019	V Power Project (2019)
77	2019	Kan Yeik Thar Project (2019)
78	2022	MSP East Dagon, Jet Group Column Project (2022)
79	2022	Min Bu Solar Farm Proejct (2022)

No:	Year	Particular
80	2022	The Central R3 Project (2022)
81	2023	Gold Emperor Factory Project (2023)
82	2023	Eden Group CM's Residence Project (2023)
83	2023	City Loft West Tower C1 Project (2023)
84	2024	City Loft West Tower C2 Project (2024)
85	2024	Propser KanYeit Thar Porject (2024)
86	2024	City Loft West Tower TD-1 Project (2024)
87	2024	City Loft West Tower TD-2 Project (2024)
88	2024	City Loft West Tower TD-3 Project (2024)
89	2024	Mindhama, Makro, ARO Project (2024)
90	2024	Herrington Hotel Proejct (2024)
91	2024	Ssasana Pyo Ou Yin, Dhamma Building Project Donation (2024)
92	2025	Capital, lluvia Project, Mindhama ACP Co., Ltd. (2025)

APPENDIX B

PILE DYNAMIC LOAD TEST EXPERIENCES

Table B1: Pile Dynamic Load Test Project Experiences List Summary

No:	*Year*	*Particular*
1	2011	I-KBZ Cement Factory (Pengpet), Kan BawZa Co., Ltd (2011)
2	2012	Ahlone ContainerPort Project, Dawn Construction
3	2012	Footwear Factory Projet, Myanmar New Hope Farms
4	2012	18 Storyed Building Project , A1 Construction Co.,Lt
5	2013	Feed Mill Construction Project, Myanmar New Hope Farms Co., Ltd (2013)
6	2014	Ahlone ContainerPort Project ,Dawn Construction Co., Ltd.
7	2014	Nga Moe Yeik Water Purification Project, YCDC
8	2015	Puma Thilawa Terminal Project , Antara Koh Mawlamyine Cement Limited
9	2015	(MCL) Power Plant Project
10	2015	Khokine Flyover Bridge Project, Capital Construction Co., Ltd. (2015)
11	2015	Establishment of Disastrous weather monitoring Project JICA Myanmar
12	2015	Myanmar Navy, DNE (1) Project, Government of India
13	2015	Puma Thilawa Terminal Project , Antara Koh
14	2015	77 Kabaraye Project, GO FOUNDATION Co.,Ltd.(2015)
15	2016	Radar Tower Project, DCA Campus , Mandalay, Myanmar (2016)
16	2016	INH Engineering Precast Factory Project, Kyaw Thar Construction Co., Ltd.
17	2016	SRI Asia Project, Bagan Royal Star Construction Co., Ltd.
18	2016	Wilmar Myanmar Project, Penta Ocean Construction Co., Ltd., Japan
19	2016	YTL Cement Project, YNKG Myanmar Co., Ltd. (2016)

No:	Year	Particular
20	2017	YTL Cement Project Extension Project, YNKG Myanmar Co., Ltd. (2017)
21	2017	Wilmar Myanmar Extension Projecct, Penta Ocean Construction Co., Ltd.,Japan
22	2017	KJCMM Project, ACP Co., Ltd.
23	2017	The Project of Enhancing Technological University in Myanmar, YTU, Sumitomo-Mitsui Co., Ltd., Japan
24	2017	HBL 3.5 Million Project, Sumitomo-Mitsui Co., Ltd., Japan
25	2017	Myinchan 225 MWa CCPP-RWI Project, ACP Co., Ltd.
26	2017	The Project of Mottama Trading Co., Ltd., ACP Co., Ltd.
27	2017	Myaing Galay No.2 Cement Factory 4000 ton, Dual Burnner Project, Kyae Wa Sesein Co., Ltd.
28	2017	Denko Thilawa Terminal Project, HSL Myanmar Ltd. (2017)
29	2017	KJCMM Project Thilawa SEZ, ACP Co., Ltd. (2017)
30	2017	Grain Terminal Project Phase-1, ANTARA KOH PTE LTD. (2017)
31	2017	IRCP Jetty Project, KTECG Co., Ltd. (2017)
32	2018	The Project of Enhancing Technological University in Myanmar, Sumitomo Mitsui Construction Co., Ltd. (2017)
33	2018	Grain Terminal Project Phase-1, ANTARA KOH PTE LTD. (2018)
34	2018	Myainggalay 4000 ton Cement Factory Extension, Duel Burner Construction Project, Kyawel Wa Seasein Co., Ltd. (2018)
35	2018	JFE Meranti Project, Thilawa SEZ, Myanmar V-Pile Co., Ltd. (2018)
36	2018	Thilawa Fuel Tank Project, Thilawa SEZ, CCESCC (2018)
37	2018	Mawlamyine Cement Ltd. Factory Construction Project (2018)
38	2018	Taung Gyi Silo Project, Tekbumi Co., Ltd. (2018)

No:	Year	Particular
39	2018	Thilawa Fuel Tank Project, Thilawa SEZ, CCESCC (2018)
40	2018	Chin Corp. Office Building Construction Project, Mandalay, Capital Co., Ltd. (2018)
41	2018	JICA Bridge Project, Thanlyin Infrastructure Development Project, Max.-Myanmar V-Pile Co., Ltd. (2018)
42	2018	DENCO Thilawa Oil Storage Tank Project, Myanmar V-Pile Co., Ltd. (2018)
43	2018	Padaukshwewar Jetty Project, Thilawa SEZ, Antara Koh Pte. Ltd. (2018, 2019)
44	2018	Wilmar Main Office Building Project, Golden Forest Co., Ltd. (2018)
45	2019	Mingalardon Project (2019)
46	2019	Shae Gyi Project (2019)
47	2019	Bago Project (2019)
48	2019	Sabal Gu Bridge Project, Ministry of Construction(2019)
49	2019	Nattakhar Kalay Project (2019)
50	2019	Makro Store Project (2019)
51	2019	Nar Nat Taw Project, YCDC (2019)
52	2019	Thilawa Lagunbin Receiving Facilities Project (2019)
53	2020	Kyauk Phyu Jetty Project, (2020)
54	2020	Wilmar Jetty Priject (2020)
55	2020	Mybaco Project (2020)
56	2020	Nyaung Tone, River Crossing Power Transmission Prohject, MOEE, (2020)
57	2020	LL1-Lot A Bridge, Mingalar Oo-ti Htay, Mong Pawn, Shan State, Kham wo Co., Ltd. (2020)
58	2020	Pin Laung Bridge Pooject, Kham Wo Co., Ltd., MOC, (2020)

No:	Year	Particular
59	2020	Hilton Mandalay, Car Park Project, Eden Group, MDY, (2020)
60	2021	ThanLwin Bridge Tarson Project, MOC, Shan State (2021)
61	2022	ChinTwin River, Htamanthi Bridge Project, MOC, (2022)
62	2023	GrandRoyal Foundation Reuse Project, Yangon, (2023)
63	2024	YTU Archi Department Building Project, Truman Co., Ltd. (2024)
64	2025	Capital lluvia CFF Project, Press Piles, ACP Co., Ltd. (2025)
65	2025	Capital lluvia CFF Project, Bored Piles, BMKS Co., Ltd. (2025)
66	2025	Grand Royal Distallary Project, Yangon, Mindhama Co., Ltd. (2025)

APPENDIX C

PILE INTEGRITY TEST EXPERIENCES

Table C1: Pile Integrity Test Project Experiences List Summary

No:	*Year*	*Particular*
1	2011~2012	KBZ Cement Factory (Pangpet) Project, Kan Baw Za Co., Ltd (2011)
2	2013	6th storeyed office building project, Geotech Pile Co., Ltd (2013)
3	2013	Feed Mill Project, Myanmar New Hope Farms Co., Ltd. (2013)
4	2013	Thanlyin Star City Project (Zone B) Project, City Press Pile Co., Ltd (2013)
5	2013	Thanlyin Star City Project (Zone D) Project, BYMA MYANMAR Co., Ltd (2013)
6	2013	Twin Centro Project, Golden Tri Star Co., Ltd. (2013)
7	2013	ERC Project, Geotech Pile Co., Ltd (2013)
8	2013	Twin Centro Project, Golden Tri Star Co., Ltd. (2013)
9	2013	ERC Project, Geotech Pile Co., Ltd (2013)
10	2013	KER Project, SEAFCO Co., Ltd (2013)
11	2013	Thilawah Oil Tank Farm Project, CAMCE & GDZR Co., Ltd (2013)
12	2014	Thaketa PTTEP Project, Suntac Construction Co., Ltd. (2014)
13	2014	Thilawah Oil Tank Farm Project, CAMCE & GDZR Co., Ltd (2014)
14	2014	Chatrium Hotel Car Parking Project, SEAFCO Co., Ltd (2014)
15	2014	Sedona Hotel Expension Project, WHO HUP Pte., Ltd (2014)
16	2014	Grand Mya Kanthar Project, Ta Gaung Bwar Co., Ltd (2014)
17	2014	Landmark Project, Golden Tristar Co., Ltd (2014)
18	2014	OSD & Liquid Building Constuction Project, City Press Pile Co., Ltd (2014)
19	2014	Gold Tower Project, Tat Lann Construction Co., Ltd.(2014)

No:	Year	Particular
20	2014	Illustra Building Construction Project, Pyae Sone Wing Naing Co., ltd. (2014)
21	2014	Crystal Tower Project, HTCT Co., ltd. (2014)
22	2014	Mawlamyine Cement Limited (MCL) Power Plant Project (2014)
23	2014	DCS Myanmar Project, Electro Pneumatics Hydraulics (India) PVT., ltd. (2014)
24	2014	PTTEP Supply Base Project, Suntac technologies Co., Ltd(2014)
25	2014	PTTEP Supply Base Project, Suntac technologies Co., Ltd(2014)
26	2015	Chatrium Hotel Carparking Project, Seafco Co., ltd. (2015)
27	2015	Sanlinchaung Bridge Project, Mindhama Co., ltd. (2015)
28	2015	Myanmar Navy Thanlyin Project, Electro Pneumatics Hydraulic (India) PVT., ltd.
29	2015	Myanmar Petroleum Products Storage and Distribution Terminal Thilawa Project (2015)
30	2015	Kabaraye Executive Residence Project, Messrs. Seafco Co., ltd. (2015)
31	2015	Star City Project, Byma Myanmar Limited. (2015)
32	2015	China Machinery Industry Fifth Construction Corporation Power Plant Mawlamyine Project, SC5. (2015)
33	2015	Crystal Tower Project, HTCT Co., ltd. (2015)
34	2015	Grand Mya Kan Thar Project, Ta Gaung Bwar Construction Co., ltd. (2015)
35	2015	Kospa Cold Storage Construction Project, Kospa Cold Storage Construction Limited. (2015)
36	2015	Insein Fly-over Project, Myanmar Golden Crown Co., ltd. (2015)
37	2015	Diamond Inya Palace Project, Mandalay Golden Wing Construction Co., ltd. (2015)
38	2015	Mitsubishi Car Showroom Project, Suntac Technologies Co., ltd. (2015)
39	2015	Golden Tri Star Project, Golden Tri Star Co., ltd. (2015)

No:	Year	Particular
40	2015	Thaketa East Dagon 230 KV Twin Bundle Double Circuit Project, Myanmar V Pile Co., ltd. (2015)
41	2015	Merchant Suite Condominium Project, Naing Group Co., ltd. (2015)
42	2015	Chaung Ku Pauk 66 KV Project, Win Hti La Limited. (2015)
43	2015	Haven Project, Haven Co., ltd. (2015)
44	2015	500 KVA Meikhtila-Taungoo Electrical Tower Transmission Project, Dragon Emperor Group Co., ltd. (2015)
45	2016	77 Kabar Aye Infinity Project (2016)
46	2016	Kathar -Bamaw Railway Project (2016)
47	2016	Mawlamyine Cement Factory Project (2016)
48	2016	Shwe Gone Daing Project (2016)
49	2016	Myanmar Cluster Housing Project (2016)
50	2016	Thaketa East Dagon 230kV Twin bundle double Circuit Project (2016)
51	2016	TMW Office Tower Project (2016)
52	2016	Thaketa-East Dagon 230 KVa Twin Bundle Double Circuit Project, Shwe Taung Development Co., Ltd. (2016)
53	2016	Thanlyin Star City Zone C-1 Project, Byma Myanmar Ltd.
54	2016	No. 77 Infinity Project, KHG Co., Ltd.
55	2016	Mawlamying Cement Factory Project, SSKD Co., Ltd.
56	2016	Kathar-Bamaw Railway Project, Myanmar Railways
57	2016	Myanmar Cluster Housing Project, Heaven Construction Co., Ltd.
58	2016	Kyan Taing Aung Project, Dagon Myothit (North)
59	2016	Maw Ya Waddy Condominium Project, Geotech Pile Co., Ltd.

No:	Year	Particular
60	2016	Yadanar Myaing Kyeik Ka San Condominium Project.
61	2016	Diamond Yankin Condominium Project, MGW Co., Ltd.
62	2016	Inno City Project, Myanmar V-Pile Co., Ltd.
63	2016	Thilawa Economic Zone Project, Myanmar Haixia Construction Co., Ltd.
64	2016	Regalia Hotel Project, SEAFCO (Myanmar) Co., Ltd.
65	2016	Ayeyar Chantha Project, Chan Thar Shwe Myay Co., Ltd.
66	2016	225 Mega Watt Combined Cycle Power Plant Project, ACP Co., Ltd. (2016)
67	2017	Grain Terminal Project Phase-1, ANTARA KOH PTE Co., Ltd. (2017)
68	2017	Denko Thilawa Terminal Project, HSL Myanmar LTD. (2017)
69	2017	Kabaraye AYA Bank Project, Max Myanmar Construction Co., Ltd (2017)
70	2017	Ngaphe Owe Myay Twin 920 degree Bridge Project (2017)
71	2017	Hlaing Tharyar Kyeik Lat 230KV Transmission Line Project, Myanma Electrical Power Enterprise (2017)
72	2017	Yangon Excelsior Hotel Project, ARCHETYPE (2017)
73	2017	Yan Kin Condo Project, M.G.W Co., Lt.d (2017)
74	2017	Thanlyin Star City Zone C Project, Byma Myanmar Ltd. (2017)
75	2017	Thaliwa SEZ Project, YNJG Myanmar Co., Ltd. (2017)
76	2017	Wilmar Myanmar Port Thilawa Terminal Prohject, Penta-Ocean Co., Ltd. (2017)
77	2017	Bridge 15-A Pier No-2, Myanmar Railway (2017)
78	2017	MICT Canteen Project, (2017)
79	2017	Thilawa Special Economic Zone Project, YNJG(Myanmar) Co., Ltd (2017)

No:	Year	Particular
80	2018	Hlaing Tharyar Kyeik Lat 230KV Transmission Line Project, Bright Way Co., Ltd (2018)
81	2018	Dedaye Over River Tower Project, Power Heaven Co., Ltd (2018)
82	2018	Grain Terminal Project Phase-1, ANTARA KOH PTE Co., Ltd. (2018)
83	2018	Kyat Tu Yway Bridge Project, Myanmar Maker Home Co., Ltd (2018)
84	2018	Lake Kalar Chaung Bridge Pj, Pyae Wa Toe Co., Ltd (2018)
85	2018	Myauk Lett Gyi R.C.C Ridge Project, Yoma Link Co., Ltd (2018)
86	2018	Parliament Staff Housing Bridge Project, Golden Brave Co., Ltd (2018)
87	2018	No(7/110) Kyone Chaung Bridge Project, Yadanar Shwe Sin Co., Ltd. (2018)
88	2018	Mau Dyne Bridge Project, Gone Shein Gone War Co., Ltd (2018)
89	2018	Pathein SIT (Golden Bridge Co., Ltd.), Manchaung SIT (PyaeWa Toe Co., Ltd. (2018)
90	2018	Zaw Gyi Taung Bridge Project, Soe Moe Yadana Co., Ltd. (2018)
91	2018	MDC FFI Project, Asia Concrete Product Co., Ltd. (2018)
92	2018	230 KVA Power Transmission Line Projects (MEPE) (2018)
93	2018	Bago Regional Government Projects (2018)
94	2018	Magway Regional Government Projects (2018)
95	2018	Myaung Dagar Bridge Project, Hmawbi, Golden Bridge Co., Ltd. (2018)
96	2018	Mottama Trading Jetty Project, Hlaing Tharyar Township, Mindama Co., Ltd. (2018, 2019)
97	2018	Wartayar Electrical Transmission Tower Projects (MEPE) (2018, 2019)
98	2018	Landmark Development Project, SEAFCO-SPA Co., Ltd. (2018, 2019)
99	2018	Shwe Pyi Thar and Hlaing Tharyar Jetty Projects, Mottama Co., Ltd. (2018)

No:	Year	Particular
100	2018	Warehouse Shwe Pyi Thar Project, Golden Forest Co., Ltd. (2018)
101	2018	TMW Building Project, TMW Enterprise Ltd. (2018)
102	2019	Min Hla Project (2019)
103	2019	Kalay Project (2019)
104	2019	AK Project (2019)
105	2019	Pyan Chi Tep Project (2019)
106	2019	Pyay Project (2019)
107	2019	Zee Gone Project (2019)
108	2019	Kha Yan Project (2019)
109	2019	The Central Project (2019)
110	2019	Pauk Kaung Project (2019)
111	2019	Mee Laung Chaung Kuu Bridge Project (2019)
112	2019	Pyay District DRRD Project (2019)
113	2019	Kantbalu Project (2019)
114	2019	Nattakha Bridge Project (2019)
115	2019	GTS Project (2019)
116	2019	Dagon Project (2019)
117	2019	Lakeside Service Apartment Project (2019)
118	2019	V Power Project (2019)
119	2020	Kyauk Phyu Dorm Project (2020)

No:	Year	Particular
120	2020	Landmark Project, Seafco (2020)
121	2020	Zaykabar Project, (2020)
122	2020	YGN-Pathein, HWY imporvement project, (2020) Oreintal Highway Co., Ltd.
123	2020	Lakeside Service Apartment Project (2020)
124	2020	Power Transmission Project (2020)
125	2021	Australia Embassy Residence Project, (2021)
126	2021	Yay Twin Yoe Briudge Project, Ayeyawaddy (2021)
127	2021	Kutoe Taw Chaung Bridge Project, Dawei, (2021)
128	2021	EGCH Project, Eden Group (2021)
129	2021	Shwe Pyi Thar Bridge Project, Twantay, (2021)
130	2021	National Tower Develppement Projects,m NTD Co., Ltd. (Yangon) (2021)
131	2022	Bridge 1/28, Thanatpyin, Yangon, Golden Brave Co., Ltd. (2022)
132	2022	Bridge 1/22, ShanTaeGyi Project, Max Myanmar, Yangon, (2022)
133	2022	The Central R3 Test Piles Proejct, (2022)
134	2022	Bridge, 4/80, Tharyarwaddy Project (2022)
135	2022	Bridge, 2/73, Thonze Project (2022)
136	2022	Min Bu Solar Farm Project, (2022)
137	2022	Department of Fisheries Studiesm Twantay, Great Zaw Gyi Project, (2022)
138	2022	ThoneGwa - Thanlyn Portion, Bridge Project, Golden Brave Co., Ltd. (2022)
139	2022	Gold Emperor Factory Project, (2022)

No:	Year	Particular
140	2023	National Tower Develppement Projects, Yangon NTD Co., Ltd. (2023)
141	2023	3-Storey, RCC Building, Stecon Construction, Co., Ltd (2023)
142	2023	GrandRoyal Factory Extension, (2023)
143	2023	Heineken Beer Factory Projhect, (2023)
144	2023	မာရဝိဇယ ရုပ်ပွားတော်ကြီး-သံဃာ၅၀ပါးဆွမ်းစာဆောင် Project, Napyitaw (2023)
145	2023	Attran Bridge Project, Mawlamying , (2023)
146	2023	Zathapyin Bridge Project, Mawlamying (2023)
147	2023	City Loft West Tower C1, Project, (2023)
148	2023	YGN-Pyay Bridge Projects, Max Highway Co., Ltd. (2023)
149	2023	River King Aya Project, East Dagon Project, Yangon (2023)
150	2024	City Loft West Tower C2, Project, (2024)
151	2024	ရေကြည်မြို့နယ် ကျေးလက်လမ်း Project, Ayawaddy, (2024)
152	2024	TenMile Hotel RW Project, (2024)
153	2024	YGN-Pyay Bridge Projects, Max Highway Co., Ltd. (2024)
154	2024	Centig Project, Mindhama, (2024)
155	2024	City Loft West Tower TD-1, Test Piles, (2024)
156	2024	City Loft West Tower TD-2, Test Piles, (2024)
157	2024	City Loft West Tower TD-3, Test Piles, (2024)
158	2024	YTU, Archi Dep Building Project, Truman Co., Ltd. (2024)

No:	*Year*	*Particular*
159	2024	Herrington Hotel Test Piles Project (2024)
160	2024	National Tower Development, Tower 1994 Project, Yangon NTD Co., Ltd. (2024)
161	2024	5 Sotrey Buidling Project, Yangon, Hlaing, MTP Construction Co., Ltd. (2024)_
162	2025	Thardukan WasteWaterTreatement Project, ATP Solution Co., Ltd. (2025)
163	2025	City Loft West, River Bank Project, Royal Myanmar Rivers Co., Ltd. (2025)
164	2025	သာသနာ့ပျိုးငယ်ကျောင် ဓမ္မာရုံ Project (2025) (Donation by GeoLab)
165	2025	Fair Deal Office Building Project, (2025)
166	2025	ပုဂံတောင်တံတား-Abutment-Project, (Apperant Co., Ltd.) (2025)
167	2025	City Loft West – Tower TD-1 Working Piles Project, (2025)
168	2025	Capital lluvia Project, BMKS Co., Ltd. (2025)
169	2025	Electrical Transmission Line Tower Foundation Project, Hpa-An, MOEE (2025)

APPENDIX D
SOIL INVESTIGATION EXPERIENCES

Table D1: SI Experiences List Summary

No:	*Year*	*Particular*
1	2012	Landmark Project, SPA Management Co., Ltd. (2012)
2	2012	Star City (Thanlyin) Zone-B Project, SPA Management Co., Ltd. (2012)
3	2013	Kabaraye Executive Suit Project, Ever Seiko Co., Ltd. (2013)
4	2014	Star City (Thanlyin) Zone-C Project, SPA Management Co., Ltd. (2014)
5	2014	Illustra Condominium Project, Pyae Sone Win Naing Co., Ltd. (2014)
6	2014	Chatrium Hotel Car Parking Project, Bangkok Bank Plc., SEAFCO (Myanmar) Co., Ltd. (2014)
7	2014	TMW Building Project, TMW Enterprise (2014)
8	2015	Kyauk Phyu SI Project, Rakhine State, Taisei Corporation and JICA (2015)
9	2015	Laysu Buddha (Lotaya) Pagoda Retaining Wall Project, Phyu Tsp. (2015)
10	2016	Yangon Technological University Student's Hub Project (2016)
11	2018	Star City (City Loft) Project (2018)
12	2018	Unicef Rakhine Project (2018)
13	2019	Yoma Central Project (2019)
14	2019	Star City (City Loft) Project (2019)
15	2019	Unicef Rakhine Project (2019)
16	2019	GGP (Japan Embassy) Project (2019)
17	2019	Heho Airport Project (2019)
18	2019	PYN Project (2019)
19	2019	Soil Investigation in Hpa-An Prison Project (2019)

No:	Year	Particular
20	2019	Soil Investigation in Insein Central Prison Project (2019)
21	2021	Pindaya MTRV4 Studio Projects (2021)
22	2022	YGN, Mawlamying, Bago, Myit Kyi Nar Unicef SubDepot Projects (2022)
23	2023	Bago, Dawei, Taungoo, Unicef SubDepot Projects (2023)
24	2024	MI Steel Factory Project South Dagon
25	2024	Lightion Proejct Soil Tests, DCP, FDT, Plate Load Tests
26	2025	Capital lluvia Soil Tests, DCP, FDT
27	2025	YTU Archi Building Soil Tests, DCP, FDT

APPENDIX E
INSTRUMENTATION EXPERIENCES

Table E1: Instrumentation Experiences List Summary

No:	*Year*	*Particular*
1	2012	Landmark Project, SPA Management Co., Ltd. (2012)
2	2013	Star City Zone B Project, Byma (Myanmar) Co., Ltd. (2013)
3	2014	Kabaraye Executive Condo Project, SEAFCO (Myanmar) Co., Ltd. (2014)
4	2015	Kabar Kyaw Building Construction Project, Min Dha Ma Co.,Ltd. (2015)
5	2018	Ayeyarwaddy Bank (46th Street) Project (2016 to 2018)
6	2019	Temperature Monitoring Works (PME Tower, YCDC Building), ACP Co., Ltd.
7	2020	Network International School (7 mile) Project (2019 to 2020)
8	2022	Material Shape Testing, @ YTU
9	2023	Myit Nge Bridge Performance Monitoring
10	2023	MOC (YGN-MDY) Bridge Stress-Strain Monitoring
11	2023	Ahlone Project, ERSS Monitoring, Inclinometer, Tilt Meter,
12	2025	Herring Htoel ERSS Jacking

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