



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

COMPANY PROFILE

UPDATED

AS OF December 2019

EDITION



Operation Office

No.414, Aung Thitsar Street, U-10 Avenue, 48 Quarter, North Dagon Myothit Township
Yangon, Myanmar

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A Subsidiary of CSC Group of Companies
Civil Solution Consultants Ltd., Construction Chemicals, Geolab (Myanmar) Co., Ltd.



ကုမ္ပဏီမှတ်ပုံတင်လက်မှတ်
Certificate of Incorporation

ဂျီအိုလက်(ပြ)(မြန်မာ) ကုမ္ပဏီ လီမိတက်
GEOLAB (MYANMAR) COMPANY LIMITED
Company Registration No. 153906386

မြန်မာနိုင်ငံကုမ္ပဏီများအက်ဥပဒေ ၁၉၁၄ ခုနှစ် အရ
ဂျီအိုလက်(ပြ)(မြန်မာ) ကုမ္ပဏီ လီမိတက်
အား ၂၀၁၂ ခုနှစ် ဒီဇင်ဘာလ ၁၄ ရက်နေ့တွင်
အစုရှယ်ယာအားဖြင့် တာဝန်ကန္ဒုသတ်ထား သည့် အများနှင့်မသက်ဆိုင်သောကုမ္ပဏီ
အဖြစ် ဖွံ့ဖည်းမှတ်ပုံတင်ခွင့် 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

ရုံးနှီးမြှုပ်နှံများကုမ္ပဏီများသွန်ကြားမှုပါးစီးဌာန
Directorate of Investment and Company Administration



THE GEOLAB (MYANMAR) CO., LTD.

COMPANY PROFILE

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(1) The Firm

Geolab (Myanmar) Ltd. (**GEOLAB**) is a Soil Investigation and Testing, Instrumentation and Monitoring, Pile Load Tests (Static and Dynamic Load Tests, Sonic Integrity Test) firm 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 able to provide the wide range of technical services, i.e. Soil Investigation and Testing, Instrumentation and Monitoring, Pile Load Tests (Static and Dynamic Load Tests, Sonic Integrity Test). Apart from compact and strong founder team, GEOLAB has extensive professional network through CSC Group of Companies.

Operation Office is opened from Monday to Saturday (9:00 a.m. to 6:00 p.m.) at *No.414, U-10 Avenue, Aung Thitsar Street, 48 Quarter, North Dagonmyothit, Yangon, Myanmar* to serve customers with easy accessibility.

CSC contact numbers and e-mail address are +95-1-581562, +95-9-5003281, +95-9-5077153, +95-9-8625068, +95-9-8611406 and, geolab.myanmar@gmail.com, csc1999@gmail.com, csc1999@csc-group.org.

(2) The Main Tasks

GEOLAB is engaging with four main tasks as follows:

- 1) Soil Investigation and Testing
- 2) Geotechnical and Civil Laboratory
- 3) Geotechnical Instrumentation and Monitoring
- 4) Pile Load Tests such as, Static (SLT), Dynamic (PDA), Sonic Integrity (SIT)



SOIL INVESTIGATION AND TESTING

INTRODUCTION

The investigation of the geology and previous uses of any site, together with the determination of its engineering , environmental and contamination characteristics is fundamental to both safe and economic development. GEOLAB (MYANMAR) CO.,LTD is a specialist company that can provide guidance and management of the investigation process through all phases of study, ground investigation, testing and design.



Methods range from non-intrusive geophysics through to fully intrusive borehole installations. The method depends on parameters such as depth, soil type and access to the site. It is common for investigations to be phased - allowing the results of the early phases to guide the next stages.

Soil Investigation Techniques that employed for the majority of projects as followed:

- A. Boreholes
- B. In-situ Testing
- C. Dynamics Probe Testing



A. BOREHOLE

1. Rotary Drilled Borehole

Rotary drilling techniques are employed where boreholes are required into soil or bedrock. This utilises a rotary drilling to advance a hole into the ground. Soil samples are collected from a core device from the centre of the drill stem. The choice of drilling equipment depends on ground conditions. Equipment varies is relatively compact (2m x 1m x 2m High) self powered rig. Rotary drilling is particularly useful in difficult ground conditions or when rock coring is required.

Soil boring on Land



Soil boring on Coastal



B. In-Situ Testing

In-situ testing techniques includding Standard Penetration Testing, Permeability Testing, Borehole Vane Testing, Pressuremeter Testing and Packer Testing can all be carried out in the boreholes in order to provide information for geotechnical design. Disturbed and undisturbed samples are retireved from the boreholes for inspection and logging by engineers and subsequent testing in our laboratories.



Standard Penetration Test



Vane Shear Test

" All results are traceable to the technician who performs the analysis and their certification and training status are maintained "



C. Dynamic Probe Testing

1. Cone Penetration Test

To carry out the cone penetration test is pushed into a soil deposit while various measured parameters are recorded. The test is similar to Dutch Deep Sounding (Piezocene test) with the addition of a cone penetration element in the probe to measure water pressure. The test also known as pore pressure sounding or CPTU.

2. Mackintosh/ JKR Probe Test

This is a dynamic penetrometer test used to check the consistency of the subsoil. Mackintosh Probe which has 30' cone penetrometer while JKR Probes has 60' cone penetrometer. This is a light dynamic test and the cone is driven directly into the soil by driving a hammer 5kg. Weight dropping through a free height 280mm. The probe is unable to penetrate into medium strength soil and gravelly ground.



GEOTECHNICAL LABORATORY

INTRODUCTION

Geology laboratory maintains the ability to serve our client's needs related to geotechnical engineering. Significant contributions to testing in year have been follow from International Standards (BS 1377:1990). Geology Laboratory has been associated and committed to supplying quality complying with test specifications. The satisfactory solution of problem with required the use of standard method by trained and qualified engineers and technicians.

MOISTURE CONTNT

A sample of soil is dried to constant dry weight at a temperature of 105 degrees centigrade and the moisture content determined

SPECIFIC GRAVITY

The ratio of the unit weight of a material to the unit weight of distilled water at 4'C is a common definationof specific gravity. Soil specific gravities, however, are normally referred to the weight of water at 20'C. In itself, the specific gravity is not an index property of a soil. It is, however, required for determination of the unit weight of soil and in many computations.

ATTERBERG LIMIT TESTS

This is a valuable classification test in which an arbitrary procedure is used to determine the moisture contents at which a soil changes from a liquid through a plastic to a solid state and gives an indication of the clay quantities present in the soil. The results are used to assess soil properties, swelling and shrinkage potential, frost susceptibility and earthwork suitability.

TRIAXIAL COMPRESSION TEST (UU)

The objective of the unconfined compression test is to determine the UU (unconsolidated, undrained) strength of a cohesive soil in an inexpensive manner. Shear characteristics of the soil are obtained by the undrained triaxial test. In this test, 38mm diameter or 100mm diameter samples were tested in compression under a series of varied lateral pressures and the angle of shearing resistance and apparent cohesion obtained.

CONSOLIDATION TEST

In this test a sample of 75mm diameter and 20mm thickness is subjected to a uniform load over its surface and the rate and amount of movement recorded. When movement has ceased, the load is increased and similar recordings are taken for a number of loads.

The results are used in the estimation of magnitude and rate of settlement. Fine-grained soil is tested in long-term compression over two weeks to determine volume change behavior under load. Over time, water pressure decreases and load is carried by the soil structure itself. When a saturated soil mass is subjected to an increase in load (such as a new building), it is carried initially by increased pore water pressure. The resulting "excess hydro static pressure" causes water to drain from the soil pores, shifting the load to the soil structure. The volume of the soil also decreases (equivalent to the volume of water drained) causing settlement. The process is known as consolidation.

PARTICLE SIZE ANALYSIS (SEIVE & HYDROMETER)

In this test a riffled sample of soil is washed over a series of sieves and the percentages passing each sieve are determined and shown graphically on grading charts. This provides a method of determining the proportions of coarse, medium and fine silt and clay in a soil sample. The rate of fall of particles in water are proportional to their diameters and their specific gravity. The time intervals are selected such that all particles of a specified size (eg.silt size) have fallen past the sampling depth. The mass of suspended matter in the samples is determined by weighing and is used to determine the percentage of soil in the specimen which is finer than the specified size. In this way, the percentage of silt and clay fractions is calculated.



Three important soil properties found using a consolidation test are: The coefficient of consolidation, C_v , obtained from deformation-time curve data and an equation. It indicates the rate of compression under a load increment.

The pre-consolidation stress, $s'p$, obtained graphically from a log stress-void ratio curve. It indicates the maximum past effective stress the soil has been subjected to. The compression index, C_c , also obtained graphically from the log stress-void ratio curve, it indicates the compressibility of the specimen.

CONSOLIDATED UNDRAINED TRIAXIAL TEST

Fine-grained soil is tested in compression. Undisturbed specimens cut from tube samples and disturbed specimens are loaded in compression, recording load and deflection measurements. In this test a set of three 38mm diameter samples are consolidated under the proposed cell pressure, with back pressure applied to ensure the samples are fully saturated. After 24 hours, the samples are checked by pore pressure responses, and low rate of strain is applied and pore pressure monitored as the sample is failed. This test gives the effective stress parameters, as opposed to total stress obtained from the conventional quick undrained tests.

SMALL SHEAR BOX TEST (DIRECT SHEAR TEST)

In this test normal stress is applied to a soil sample 60x60x20 mm in thickness and the sample is then sheared under a lateral stress. During the test the volume change occurring during shear, the peak shear stress, and the normal stress are obtained. Three tests are carried out each under a different normal stress and the failure envelope and shear strength parameters are determined.

POINT LOAD TEST

This test is an indirect method to determine compressive strength of a sample. The point load strength index, $I_s(50)$ by using correction $UCS=20X \times I_s(50)$ to determine compressive strength. The sample can be categorised based on the point.

CIVIL LABORATORY

INTRODUCTION

From our first cube compression machine back in the early 2000, we have now a comprehensive laboratory with the latest equipment for all tests on construction materials. Our reputation has been strengthened over the years of providing quality reports to many clients over the Myanmar in all areas of construction.



in house Concrete Testing Equipment

Our Wide Rand of Testing Services Includes both Laboratory & Filed Tesing

- * Soil Strength & Bearing Capacity Field Test
- * Concrete Strength Test

" With years of experiences in civil engineering materials testing in lab or on-site professional testing technicians consisting of laboratory technicians and site personnel are always ready for your needs "

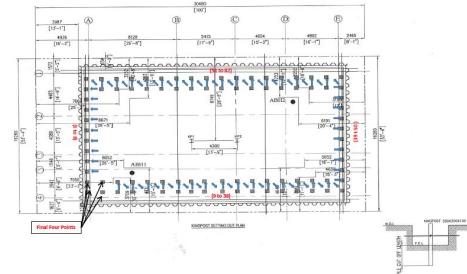
Geotechnical Instrumentation & Monitoring

INTRODUCTION

The combination of our vast experience in Geotechnical, Structural and Environmental Instrumentation and the latest cutting edge technology in instrumentation we are committed to providing quality products and services to our customers.

Instrumenting the ground or a structure is important to derive useful and also critical information as follows:

- * Site Investigation
- * Design Verification
- * Construction Control
- * Quality Control
- * Safety
- * Legal Protection



"Our latest real-time monitoring system and software can give users online data anytime, anywhere through the internet or SMS"

Instrumentation Made Easy

Let us plan, design and install an effective instrumentation plan for your site's needs. With our expertise and over 10 years of experience in this field, we have successfully designed, advised and monitored the most sensitive structures throughout Myanmar.

Your one-stop
geotechnical &
environmental
instrumentation
monitoring
center



Instrumentation Solutions for:

- * Deep Excavation
- * Backfilling
- * Reclamation
- * Slope Stabilisation
- * Meteorological
- * Tunnelling
- * Environmental effect of construction



" Caring for your instrumentation needs - we are there watching your site for you day & night, every time, everyday "

We provide small scale as well as large scale instrumentation system in following fields;

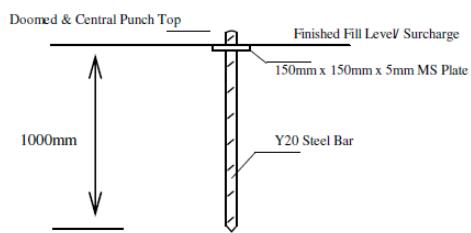
- * **Geotechnical Instrumentation & monitoring**
(Inclinometers, Extensometers, Piezometers, settlement systems, water stand pipe, etc.)
- * **Dam Instrumentation & monitoring**
(Stress cell, pressure cell, strain gauges, pendulum, etc.)
- * **Meteorological Instrumentation & monitoring**
(Mechanical & sonic wind sensors, humidity, visibility barometer, temperature sensor, rain gauge, tide gauge, current monitoring, weather satellite antenna etc.)
- * **Structural Instrumentation & monitoring**
(Strain gauge, load cell, tilt meter, crack meter, convergence bolt, thermocouple temperature monitoring, etc.)
- * **Environmental Instrumentation & Monitoring**
(Vibration monitoring, noise monitoring, air quality & water quality monitoring, gas monitoring etc.)



Inclinometer Reading Instruments



Portable MEMS Tilt Meter



Sketch of Settlement Marker



Auto Level Instrument

PILE LOAD TEST

FOR STRUCTURE AND FOUNDATION

INTRODUCTION

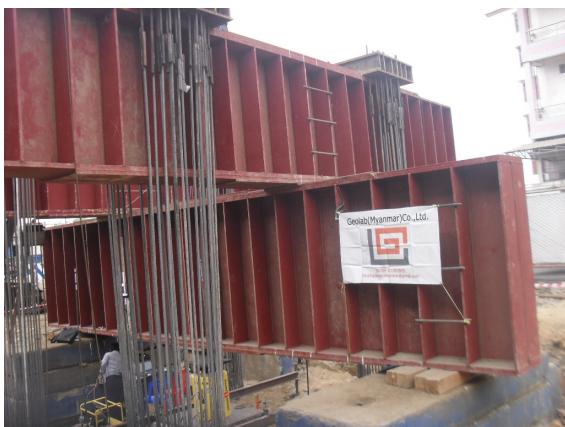
in order to meet the construction industry's demand for an accurate and cost-effective method to assess the quality of foundation and structure. Foundation section provides foundation services for all kind of construction through the country using state-of-the-art, high-tech techniques. The services provided by Structure and Foundation Section include as below.

Services provided:

- * Static Pile Load Test
- * Dynamic Load Test / Pile Deiving Analysis (PDA)
- * Vibraition Monitoring
- * Sonic Integrity Testing

STATIC PILE LOAD TEST

- 1- Inverted Beam System
- 2- Kentledge System



Inverted Beam System



Kentledge System

DYNAMIC LOAD TEST / PILE DRIVING ANALYSIS (PDA)

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.



SONIC INTEGRITY TEST

Sonic Integrity Testing is an integrity test method for foundation piles such as bored pile and R.C pile. It is quick and cheap method to check the continuity of installed foundation piles. The method will identify the pile toe and detect pile defects like cracks, joints defect of R.C pile, soil incursions and diameter changes of bored pile. It can be used for any accessible piles.



PET: Sonic Integrity Test Equipments



VIBRATION MONITORING

Vibration Monitoring can be used to monitor and record vibrations caused by pile driving, traffic, machinery, explosions or other vibration sources.

Vibration sensors placed on the ground or connected to the structure, can be monitored simultaneously. Continuous recording or even triggering can be selected.



(3) The Codes and Standards

GEOLAB is applying following local and international codes and standards:

ACI	American Concrete Institute
ASTM	American Society for Testing Materials
ASCE	American Society for Civil Engineers
AASHTO	American Association of State Highway & Transportation Officials
BS	British Standard
DOH	Department of Highways, Thailand (based on AASHTO std.) Industrial
IEAT	Estate Authority of Thailand (based on AASHTO std.) Japanese
JIS	Industrial Standards
JSCE	Japan Society of Civil Engineers
MES	Myanmar Engineering Society
PTI	Post-tensioning Institute
PCA	Portland Cement Association
UBC	Uniform Building Codes
USBR	States Bureau of Reclamation
UN	United Nations Standards for Developing Countries
YCDC	Rules and Regulations of Yangon City Development Committee
CQHP	Committee for Quality Control of High-rise Building Construction Project

(4) The Software, Surveying and Office Automation Equipment

Geotechnical and Infrastructure Software

- CSC's Survey Coordinate Conversion Program, CCP Package
- CSC's Survey Setting-out Programs, SSP Package
- SB-Slope, Geo-Slope, Slope Stability Analysis
- Retaining Wall Stability Calculation Package
- AutoDesk Land Development, Land Desktop 2000i with Survey
- gINT Software for Boring Logs and Fencing
- Geo-system Software for Report Preparation
- Logger-net Software for Load Test instrumentation

Structural Design Software

- Graphical Rapid Analysis of Structures Program, ACECOMS, AIT
- Gear Series, ACECOMS, AIT
- SYSDesigner, Structural Steel Design, ACECOMS, AIT
- STADD Pro 3-Dimensional Structural Analysis and Design, RE, USA
- ADAPT Post-tensioning System Software, USA

Computer Aided Design and Drafting Software

- Auto-CADD 2013-2015
- Auto Desk 2000i Land Desktop

Office Automation Equipment

- Intel high memory personal computers
- MSI, ASUS, HP-Compaq and Acer Note Books

- Hewlett-Packard laser printers and photo quality color desk jets
- Genius 1212HRII digitizer for Auto-CADD
- Canon laser printer and large format color bubble jet for CADD
- Cannon and Pro-link high resolution scanner
- Epson overhead projector
- Liteon professional external CD-R/RW writer, DVD writer
- Kodak and Sony professional CD-R/RW writer
- Canon Photo-copiers and A3 Laser Printer

Surveying Instrument

- TOPCON GTS236N Total Station and accessories
- GOWIN Total Station and accessories
- TOPCON Auto Level G series for construction

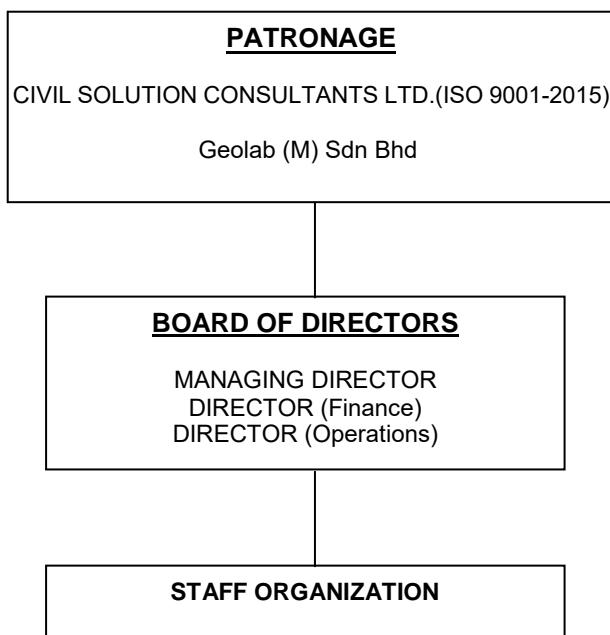
(5) The Customer Benefit

***GEOLAB TESTING STANDARD, PROFESSIONAL SOFTWARE
OFFICE AUTOMATION, MONITORING and INSTRUMENTATION QUALITY ARE FULLY
COMPATIBLE and
COMPARABLE WITH INTERNATIONAL CODES & STANDARDS;***

HOWEVER,

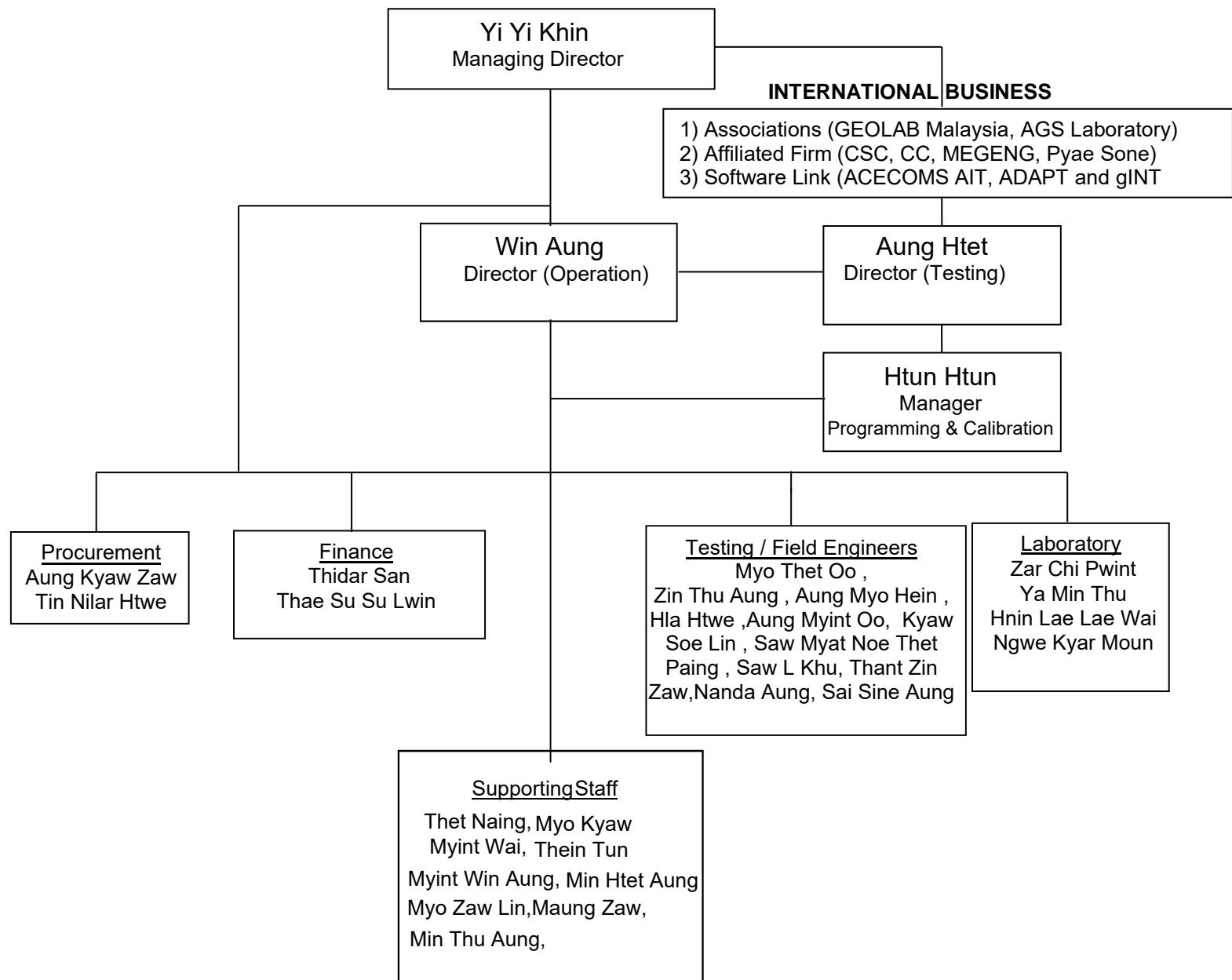
***GEOLAB SERVICE FEE, CONSULTATION FEE AND OPERATION COST ARE
VERY REASONABLE AS WE AIM TO MEET
CUSTOMER NEEDS WITH SATISFACTION.***

(6) The Management System



(7) The Organization Chart

GEOLAB (MYANMAR) CO., LTD. ORGANIZATION CHART



(8) 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 Base

2) Construction Chemicals

A Firm, Supplying Admixtures for High Strength Concrete, Concrete Repairs and Grouting Materials, Myanmar Base

3) AGS Laboratory

An associated Laboratory Facilities, Myanmar Base

Firms to be Associated:

4) GEOLAB (M) Sdn. Bhd.

Full-scale Soil and Engineering Testing Firm, Malaysia Base

5) Pyae Sone Engineering Group

Drilling, Water Well Development and Mini Bore Piles Firm, Myanmar Base

(9) The Software Link

GEOLAB is getting continuous support for professional engineering software from the Asian Center for Engineering Computations and Software, **ACECOMS**, School of Civil Engineering, Asian Institute of Technology (AIT), Thailand, **ADAPT** Software System, A member of Post-tensioning Institute, PI, USA and gINT of Australia.



(10) 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 item 10, The Experiences.

2) ***Ms. 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) ***Mr. Kyaw Htut Aung*** (*Drilling, Water and Sanitation*)

B.Sc. (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.

(11) The Experiences

Soil Investigation and Testing Projects:

- 1) Land Mark Project, Grand Mee Ya Htar Compound, SPA Management Co., Ltd., (2012)
- 2) Star City (Thanlyin) Zone-B Project, SPA Management Co., Ltd. (2012)
- 3) Kabaraye Executive Suit Project, Ever Seiko Co., Ltd. (2013)
- 4) Star City (Thanlyin) Zone-C Project, SPA Management Co., Ltd. (2014)
- 5) Illustra Condominium Project, Pyae Sone Win Naing Co., Ltd. (2014)
- 6) Chatrium Hotel Car Parking Project, Bangkok Bank Plc., SEAFCO (Myanmar) Co., Ltd. (2014)
- 7) TMW Building Project, TMW Enterprise (2014)
- 8) Kyauk Phyu SI Project, Rakhine State, Taisei Corporation and JICA (2015)
- 9) Laysu Buddha (Lotaya) Pagoda Retaining Wall Project, Phyu Tsp. (2015)
- 10) Yangon Technological University Student's Hub Project (2016)
- 11) Star City (City Loft) Project (2018)
- 12) Unicef Rakhine Project (2018)
- 13) Yoma Central Project (2019)
- 14) Star City (City Loft) Project (2019)
- 15) Unicef Rakhine Project (2019)
- 16) GGP (Japan Embassy) Project (2019)
- 17) Heho Airport Project (2019)
- 18) PYN Project (2019)
- 19) Soil Investigation in Hpa-An Prison Project (2019)
- 20) Soil Investigation in Insein Central Prison Project (2019)

Geotechnical Instrumentation and Monitoring Projects:

- 21) Landmark Project, SPA Management Co., Ltd. (2012)
- 22) Star City Zone B Project, Byma (Myanmar) Co., Ltd. (2013)
- 23) Kabaraye Executive Condo Project, SEAFCO (Myanmar) Co., Ltd. (2014)
- 24) Kabar Kyaw Building Construction Project, Min Dha Ma Co.,Ltd. (2015)
- 25) Ayeyarwaddy Bank (46th Street) Project (2016 to 2018)
- 26) Network International School (7 mile) Project (2019 to 2020)

Pile Load Test Projects

SLT Project List (Static Load Test conformed to ASTM D1143)

- 1 18 Storeyed Building Project, MESSRS A1 Construction Co., Ltd (2013)
- 2 Gold Tower Project, Geotech Pile Co., Ltd. (2013)
- 3 Myanmar Seilone, Golden Tristar Co., Ltd. (2013)
- 4 Landmark Building Construction Project,Golden Tristar Co.,Ltd. (2014)
- 5 M Tower Project, Mindhama Co., Ltd.(2014)
- 6 Merchant Suite Condominium Project, Naing Group Co., Ltd.(2014)
- 7 Shangrila Hotel Yangon Project,KHFOGES LTD.(2014)
- 8 Myanmar Scilone Project, Golden Tristar Co.,Ltd. (2014)
- 9 Paragon Residence Project , Kyawthar Construction Co., Ltd.(2014)
- 10 OSD and Liquid Building Construction Project,City Press Pile Co.,Ltd.(2014)
- 11 27 Acre Industrial Zone 5 Project,GLOBEL FOODWEAR FACTORY(2014)
- 12 34th Street Office Tower Project, Tagaungbwar Co.,Ltd.(2014)
- 13 77 Kabaraye Pagoda Road Project ULT, GEO FOUNDATION Co.,Ltd.(2014)
- 14 Aquarium Building Project, Asia Concrete Co.,Ltd.(2014)
- 15 The project of Chatrium Royal Lake Hotel Project , Seafco(Myanmar) Co.,Ltd. (2014)
- 16 East Race Course Condominium Project, GEO TECH PILE Co.,Ltd.(2014)
- 17 Grand Mya Kantha Condominium Project, MESSRS. TAGAUNG BWAR CONSTRUCTION Co.,Ltd.(2014)
- 18 Nawarat Condominium Project, iGreen Cnstruction Co.,Ltd.(2014)
- 19 Illustra Building Construction Project, Pyae Sone Win Naing Co.,Ltd.(2014)
- 20 Kabar Kyaw Builing Project, Mindhama Co.,Ltd.(2014)
- 21 Kan Thar Yar Consotium Tower Project, Asia Myanmar Construction Co.,Ltd.(2014)
- 22 Kabaraye Executive Residence Project,Seafco Co.,Ltd. (2014)
- 23 77 Kabaraye Poject , Geo Foundation Co.,Ltd. (2015)
- 24 iGreen Project, I Green Construction Co.,Ltd. (2015)
- 25 Thar Du Kan Project,Myanmar Pou Chen Co.,Ltd. (2015)
- 26 Star City Zone B Projct,Byma Myanmar Limited (2015)
- 27 M Green Apartment Project,Mindhama Co.,Ltd. (2015)
- 28 CPP Project ,China Petroleum Pipeline Bureau (2015)
- 29 Mandalay , Myit Nge Project (2015)
- 30 Pan Hlaing , Ever Green Phase 3 Project, SPA Management Co.,Ltd. (2015)
- 31 PME Tower Project, Mindama Co., Ltd. (2016)
- 32 Shwe Gone Daing Project, (2015)
- 33 Landmark Building Project, SPA Management Co., Ltd. (2015)
- 34 8mile Project, Living Square Co., Ltd. (2015)
- 35 Pristine Project, Pristine Global Development Co., Ltd. (2016)
- 36 San Yeik Nyein Project, Naing Group Capital Co., Ltd. (2016)
- 37 Season One Project, Season One Co., Ltd. (2016)
- 38 Myanmar Cluster Project, Haven Co., Ltd. (2016)
- 39 Inya Lake International Apartment Project, GD Myanmar Co., Ltd. (2016)
- 40 TMW Project, TMW Enterprise Co., Ltd. (2016)
- 41 Prinstine Project., (2016)
- 42 SanYeinNyein Project, Naing Group Capital Co., Ltd. (2016)
- 43 Season 1 Project (2016)
- 44 Myanmar Cluster Project, Heaven Construction Co., Ltd. (2016)
- 45 Inya Lake International Project, GD Myanmar Co., Ltd. (2016)
- 46 Myinchan 225 MW Combine Cycle Power Plant Project, ACP Co., Ltd. (2016)
- 47 Diamond Inya Palace Project (2016)
- 48 New Hope Factory Project, ACP Co., Ltd. (2016)
- 49 Thilawa SEZ Project, Myanmar Haixia Construction Co., Ltd. (2016)
- 50 The Secondary Central Business Min Dha Ma Project, First Myanmar Construction Co., Ltd. (2016)

- 51 Inno City Project, Myanmar V Pile Co., Ltd. (2016)
- 52 20 Storeyed Building Project, Mottama Construction Co., Ltd. (2016)
- 53 Ayayer Waddy Bank Project, ACP Co., Ltd. (2016)
- 54 Htoo Ice Skating Project, ACP Co., Ltd. (2016)
- 55 Myanmar Pouchen Project (2016)
- 56 Regalia Hotel Project, SEAFCO Myanmar (2017)
- 57 Myanmar Pouchen Extension Project (2017)
- 58 Land Mark Project, SPA Management, Yoma Strategic Holding Ltd. (2017)
- 60 KJCMM Japan Project, Thilawa SEZ, ACP Co., Ltd. (2017)
- 61 A1-OJI Expansion Japan Project, A1 Construction Co., Ltd. (2017)
- 62 Thilawa Oil Depot Project, MDC Max Oil Tank Co., Ltd., ACP Co., Ltd. (2017)
- 63 Meeyahta Development Expansion Project (Formerly Land Mark), Meeyahta Development Co., Ltd. (2017)
- 64. Detergent Factory Project, ACP Co.,Ltd. (2017)
- 65. The Project of Diamond Inya Palace, Mandalay Golden Wing Co., Ltd. (2017)
- 66. Yard Development Project MITT, Nippon Koei Engineering Consultants Co., Ltd. (2018)
- 67. YCDC Water Treatment Construction Project, Lagunpyin, YCDC, Mindama-POSCO Co., Ltd. (2018)
- 68. PTTEP Office Project, Sae Myaung Road, 8-mile, Yangon, SEAFCO Co., Ltd. (2018)
- 69. MDC FFI Project, North Dagon Myothit Tsp., Asia Concrete Products Co., Ltd. (2018)
- 70. HL Tower Project, 7-mile Pyay Road, Mindhama Co., Ltd. (2018)
- 71. Bago General Hospital Extension Project, Aung Thu Kha Sayadaw Donation, GEOLAB Contribution (2018)
- 72. Fully Automatic Mechanized Car Park Building Project, The Central, Marga Landmark Co., Ltd. (2018)
- 73. Wilmar Dormitory Building Construction Project, Golden Forest Co., Ltd. (2018)
- 74. The Central Project (2019)
- 75. Inyalay Club Project (2019)
- 76. Service Apartment Project (2019)
- 77. V Power Project (2019)
- 78. Kan Yeik Thar Project (2019)

SIT Project List (Sonic Integrity Test Conformed to ASTM D5882)

- 1 KBZ Cement Factory (Pangpet) Project, Kan Baw Za Co., Ltd (2011)
- 2 6th storeyed office building project, Geotech Pile Co., Ltd (2013)
- 3 6th storeyed office building project, Geotech Pile Co., Ltd (2013)
- 4 6th storeyed office building project, Geotech Pile Co., Ltd (2013)
- 5 6th storeyed office building project, Geotech Pile Co., Ltd (2013)
- 6 6th storeyed office building project, Geotech Pile Co., Ltd (2013)
- 7 6th storeyed office building project, Geotech Pile Co., Ltd (2013)
- 8 Feed Mill Project, Myanmar New Hope Farms Co., Ltd. (2013)
- 9 Thanlyin Star City Project (Zone B) Project, City Press Pile Co., Ltd (2013)
- 10 Thanlyin Star City Project (Zone D) Project, BYMA MYANMAR Co., Ltd (2013)
- 11 Twin Centro Project, Golden Tri Star Co., Ltd. (2013)
- 12 Twin Centro Project, Golden Tri Star Co., Ltd. (2013)
- 13 Twin Centro Project, Golden Tri Star Co., Ltd. (2013)
- 14 Twin Centro Project, Golden Tri Star Co., Ltd. (2013)
- 15 Twin Centro Project, Golden Tri Star Co., Ltd. (2013)
- 16 ERC Project, Geotech Pile Co., Ltd (2013)
- 17 Twin Centro Project, Golden Tri Star Co., Ltd. (2013)
- 18 ERC Project, Geotech Pile Co., Ltd (2013)
- 19 Twin Centro Project, Golden Tri Star Co., Ltd. (2013)
- 20 KER Project, SEAFCO Co., Ltd (2013)
- 21 Twin Centro Project, Golden Tri Star Co., Ltd. (2013)
- 22 Thilawah Oil Tank Farm Project, CAMCE & GDZR Co., Ltd (2013)
- 23 Thaketa PTTEP Project, Suntac Construction Co., Ltd. (2014)
- 24 Twin Centro Project, Golden Tri Star Co., Ltd. (2014)
- 25 Twin Centro Project, Golden Tri Star Co., Ltd. (2014)
- 26 Thilawah Oil Tank Farm Project, CAMCE & GDZR Co., Ltd (2014)
- 27 Thilawah Oil Tank Farm Project, CAMCE & GDZR Co., Ltd (2014)
- 28 Chatrium Hotel Car Parking Project, SEAFCO Co., Ltd (2014)
- 29 Thilawah Oil Tank Farm Project, CAMCE & GDZR Co., Ltd (2014)
- 30 Thilawah Oil Tank Farm Project, CAMCE & GDZR Co., Ltd (2014)
- 31 Chatrium Hotel Car Parking Project, SEAFCO Co., Ltd (2014)
- 32 Sedona Hotel Expension Project, WHO HUP Pte., Ltd (2014)
- 33 Sedona Hotel Expension Project, WHO HUP Pte., Ltd (2014)
- 34 Sedona Hotel Expension Project, WHO HUP Pte., Ltd (2014)
- 35 Sedona Hotel Expension Project, WHO HUP Pte., Ltd (2014)
- 36 Sedona Hotel Expension Project, WHO HUP Pte., Ltd (2014)
- 37 Grand Mya Kantha Project, Ta Gaung Bwar Co., Ltd (2014)
- 38 Landmark Project, Golden Tristar Co., Ltd (2014)
- 39 Thilawah Oil Tank Farm Project, CAMCE & GDZR Co., Ltd (2014)
- 40 Landmark Project, Golden Tristar Co., Ltd (2014)
- 41 Landmark Project, Golden Tristar Co., Ltd (2014)
- 42 OSD & Liquid Building Constuction Project, City Press Pile Co., Ltd (2014)
- 43 Gold Tower Project, Tat Lann Construction Co., Ltd.(2014)
- 44 Illustra Building Construction Project, Pyae Sone Wing Naing Co., Ltd. (2014)
- 45 Crystal Tower Project, HTCT Co., Ltd. (2014)

- 46 Mawlamyine Cement Limited (MCL) Power Plant Project (2014)
- 47 DCS Myanmar Project, Electro Pneumatics Hydraulics (India) PVT., Ltd. (2014)
- 48 PTTEP Supply Base Project, Suntac technologies Co., Ltd(2014)
- 49 100000, Cubic Meter Refined Oil Tank Farm Project, CAMCE Co., Ltd(2014)
- 50 Chatrium Hotel Carparking Project, Seafco Co., Ltd. (2015)
- 51 Sanlinchaung Bridge Project, Mindhama Co., Ltd. (2015)
- 52 Myanmar Navy Thanlyin Project, Electro Pneumatics Hydraulic (India) PVT., Ltd.
- 53 Myanmar Petroleum Products Storage and Distribution Terminal Thilawa Project (2015)
- 54 Kabaraye Executive Residence Project, Messrs. Seafco Co., Ltd. (2015)
- 55 Star City Project, Byma Myanmar Limited. (2015)
- 56 China Machinery Industry Fifth Construction Corporation Power Plant Mawlamyine Project, SC5. (2015)
- 57 Crystal Tower Project, HTCT Co., Ltd. (2015)
- 58 Grand Mya Kan Thar Project, Ta Gaung Bwar Construction Co., Ltd. (2015)
- 59 Kospa Cold Storage Construction Project, Kospa Cold Storage Construction Limited. (2015)
- 60 Insein Fly-over Project, Myanmar Golden Crown Co., Ltd. (2015)
- 61 Diamond Inya Palace Project, Mandalay Golden Wing Construction Co., Ltd. (2015)
- 62 Mitsubishi Car Showroom Project, Suntac Technologies Co., Ltd. (2015)
- 63 Golden Tri Star Project, Golden Tri Star Co., Ltd. (2015)
- 64 Thaketa East Dagon 230 KV Twin Bundle Double Circuit Project, Myanmar V Pile Co., Ltd. (2015)
- 65 Merchant Suite Condominium Project, Naing Group Co., Ltd. (2015)
- 66 Chaung Ku Pauk 66 KV Project, Win Hti La Limited. (2015)
- 67 Haven Project, Haven Co., Ltd. (2015)
- 68 500 KVA Meikhtila-Taungoo Electrical Tower Transmission Project, Dragon Emperor Group Co., Ltd. (2015)
- 69 77 Kabar Aye Infinity Project (2016)
- 70 Kathar -Bamaw Railway Project (2016)
- 71 Mawlamyine Cement Factory Project (2016)
- 72 Shwe Gone Daing Project (2016)
- 73 Myanmar Cluster Housing Project (2016)
- 74 Thaketa East Dagon 230kV Twin bundle double Circuit Project (2016)
- 75 TMW Office Tower Project (2016)
- 76 Thaketa-East Dagon 230 KVa Twin Bundle Double Circuit Project, Shwe Taung Development Co., Ltd. (2016)
- 77 Thanlyin Star City Zone C-1 Project, Byma Myanmar Ltd.
- 78 No. 77 Infinity Project, KHG Co., Ltd.
- 79 Mawlamyine Cement Factory Project, SSKD Co., Ltd.
- 80 Kathar-Bamaw Railway Project, Myanmar Railways
- 81 Myanmar Cluster Housing Project, Heaven Construction Co., Ltd.
- 82 Kyan Taing Aung Project, Dagon Myothit (North)
- 83 Maw Ya Waddy Condominium Project, Geotech Pile Co., Ltd.
- 84 Yadanar Myaing Kyeik Ka San Condominium Project.
- 85 Diamond Yankin Condominium Project, MGW Co., Ltd.
- 86 Inno City Project, Myanmar V-Pile Co., Ltd.
- 87 Thilawa Economic Zone Project, Myanmar Haixia Construction Co., Ltd.
- 88 Regalia Hotel Project, SEAFCO (Myanmar) Co., Ltd.
- 89 Ayeyar Chantha Project, Chan Thar Shwe Myay Co., Ltd.
- 90 225 Mega Watt Combined Cycle Power Plant Project, ACP Co., Ltd. (2016)

2017 SIT Project Up to Date

1	Ayeyar Chantha Project	Yangon	Chantha Shwe Myay Co., Ltd
2	Yan Kin Condominium Project	Yangon	M.G.W Construction Co.,Ltd
3	Thanlyin Star City Zone C Project	Thanlyin Tsp,Yangon,Myanmar	Byma Myanmar Limited
4	Thilawa Special Economic Zone Project	Thanlyin Tsp,Yangon,Myanmar	YNJG (Myanmar Co., Ltd)
5	Wilmar Myanmar Port Thilawa Terminal Project	Thanlyin Tsp,Yangon,Myanmar	Panta-Ocean Construction Co.,Ltd
6	Bridge 15-A (Pier No.2) Project	Latpatan Tsp,Bago Division,Myanmar	Myanmar Railway
7	Ngaphe-Owe Myay Twin 920' Bridge Project	Ngaphe Tsp,Magway Division,Myanmar	Mannayarwaddy Construction Co., Ltd
8	Bridge 15-A (Pier No.2) Project	Latpatan Tsp,Bago Division,Myanmar	Myanmar Railway
9	Zee Taw-Paung Kalay Mann Chaung Bridge Project	Ngaphe Tsp,Magway Division,Myanmar	Khit Hme Oo Construction Co.,Ltd
10	Landmark Project	Yangon,Myanmar	Seafco(Myanmar) Co.,Ltd
11	Thanlyin Star City Zone C Project	Thanlyin Tsp,Yangon,Myanmar	Byma Myanmar Ltd
12	225MW Combined Cycle Power Plant IPP Project	Myingyan	Asia Concrete Products Co.,Ltd
13	Landmark Project	Yangon,Myanmar	Seafco(Myanmar) Co.,Ltd
14	Landmark Project	Yangon,Myanmar	Seafco(Myanmar) Co.,Ltd
15	Pathein Industrial City Project	Pathein Township,Ayeyarwaddy Division,Myanmar	Golden Brave Construction Co.,Ltd
16	Shwe Tangar Bridge Project	Padaung Township,Pyay District,Bago Division,Myanmar	Pyay District Rual Development
17	225MW Combined Cycle Power Plant IPP Project	Myingyan	Asia Concrete Products Co.,Ltd
18	Pannisular Tower Project	No.95/D, Banyar Dala St, Bahan Tsp, Yangon, Myanmar	Great Cairo Construction Co., Ltd
19	Shwe Tangar Bridge Project	Padaung Township,Pyay District,Bago Division,Myanmar	Pyay District Rual Development
20	Regalia Hotel Project	Dhamazaydi Road,Bahan Tsp,Yangon,Myanmar	Alto Development
21	Pannisular Tower Project	No.95/D, Banyar Dala St, Bahan Tsp, Yangon, Myanmar	Great Cairo Construction Co., Ltd
22	Kanaung Tower Project	Yangon,Myanmar	Power Heaven Co.,Ltd
23	Ayeyar Chantha Project	Yangon,Myanmar	Chantha Shwe Myay Co., Ltd
24	Kanaung Tower Project	Yangon,Myanmar	Power Heaven Co.,Ltd
25	66-KV Athoke-GWA Transmission Line Project	Ayeyarwady,Myanmar	Myanma Electrical Power Enterprise
26	Kanaung Tower Project	Yangon,Myanmar	Power Heaven Co.,Ltd
27	Kanaung Tower Project	Yangon,Myanmar	Power Heaven Co.,Ltd
28	225MW Combined Cycle Power Plant Project	Myingyan,Mandalay Division,Myanmar	Joyance International Co.,Ltd
29	Mega Care Project	Yangon,Myanmar	Suntac E&G
30	Mottama Trading Project	Yangon,Myanmar	Mottama Trading Co.,Ltd
31	AYA Bank Project (46th Street)	Yangon,Myanmar	Mindhama Co.,Ltd
32	AYA Bank Project (46th Street)	Yangon,Myanmar	Mindhama Co.,Ltd
33	MICT Canteen and Office Project	Yangon,Myanmar	MICT DC
34	Pannisular Tower Project	No.95/D, Banyar Dala St, Bahan Tsp, Yangon, Myanmar	Great Cairo Construction Co., Ltd
35	Kabaraye AYA Bank Project	Yangon,Myanmar	Max Myanmar Construction Co.,Ltd
36	Landmark Project	Yangon,Myanmar	Seafco Myanmar Co.,Ltd
37	Kabaraye AYA Bank Project	Yangon,Myanmar	Max Myanmar Construction Co.,Ltd

SIT Project List

1. Grain Terminal Project Phase-1, ANTARA KOH PTE Co., Ltd. (2017)
2. Denko Thilawa Terminal Project, HSL Myanmar LTD. (2017)
3. Kabaraye AYA Bank Project, Max Myanmar Construction Co., Ltd (2017)
4. Ngaphe Owe Myay Twin 920 degree Bridge Project (2017)
5. Hlaing Tharyar Kyeik Lat 230KV Transmission Line Project, Myanma Electrical Power Enterprise (2017)
6. Yangon Excelsior Hotel Project, ARCHETYPE (2017)
7. Thilawa Special Economic Zone Project, YNJC(Myanmar) Co., Ltd (2017)
8. Hlaing Tharyar Kyeik Lat 230KV Transmission Line Project, Bright Way Co., Ltd (2018)
9. Dedaye Over River Tower Project, Power Heaven Co., Ltd (2018)
10. Grain Terminal Project Phase-1, ANTARA KOH PTE Co., Ltd. (2018)
11. Kyat Tu Yway Bridge Project, Myanmar Maker Home Co., Ltd (2018)
12. Lake Kalar Chaung Bridge Pj, Pyae Wa Toe Co., Ltd (2018)
13. Myauk Lett Gyi R.C.C Ridge Project, Yoma Link Co., Ltd (2018)
14. Parliament Staff Housing Bridge Project, Golden Brave Co., Ltd (2018)
15. No(7/110) Kyone Chaung Bridge Project, Yadanar Shwe Sin Co., Ltd. (2018)
16. Mau Dyne Bridge Project, Gone Shein Gone War Co., Ltd (2018)
17. Pathein SIT (Golden Bridge Co., Ltd.), Manchaung SIT (PyaeWa Toe Co., Ltd. (2018)
18. Zaw Gyi Taung Bridge Project, Soe Moe Yadana Co., Ltd. (2018)
19. MDC FFI Project, Asia Concrete Product Co., Ltd. (2018)
20. 230 KVA Power Transmission Line Projects (MEPE) (2018)
21. Bago Regional Government Projects(2018)
22. Magway Regional Government Projects(2018)
23. Myaung Dagar Bridge Project, Hmawbi, Golden Bridge Co., Ltd. (2018)
24. Mottama Trading Jetty Project, Hlaing Tharyar Township, Mindama Co., Ltd. (2018,2019)
25. Wartayar Electrical Transmission Tower Projects (MEPE) (2018, 2019)
26. Landmark Development Project, SEAFCO-SPA Co., Ltd. (2018, 2019)
27. Shwe Pyi Thar and Hlaing Tharyar Jetty Projects, Mottama Co., Ltd. (2018)
28. Warehouse Shwe Pyi Thar Project, Golden Forest Co., Ltd. (2018)
29. TMW Building Project, TMW Enterprise Ltd. (2018)
30. 12 PDA Projects stated below(2018)
31. Min Hla Project (2019)
32. Kalay Project (2019)
33. AK Project (2019)
34. Pyan Chi Tep Project (2019)
35. Pyay Project (2019)
36. Zee Gone Project (2019)
37. Kha Yan Project (2019)
38. The Central Project (2019)
39. Pauk Kaung Project (2019)
40. Mee Laung Chaung Kuu Bridge Project (2019)
41. Pyay District DRRD Project(2019)

42. Kantbalu Project (2019)
43. Nattakha Bridge Project (2019)
44. GTS Project (2019)
45. Dagon Project (2019)
46. E.E U Nay Min Oo Project (2019)
47. EPC Project (2019)
48. Lakeside Service Apartment Project (2019)
49. V Power Project (2019)

PDA Project List (Pile Dynamic Analysis Test conformed to ASTM D4945

- 1 I-KBZ Cement Factory (Pengpet), Kan BawZa Co., Ltd (2011)
- 2 Ahlone ContainerPort Project, Dawn Construction
- 3 Footwear Factory Projet, Myanmar New Hope Farms
- 4 18 Storyed Building Project , A1 Construction Co.,Lt
- 5 Feed Mill Construction Project, Myanmar New Hope Farms Co., Ltd (2013)
- 6 Ahlone ContainerPort Project ,Dawn Construction Co., Ltd.
- 7 Nga Moe Yeik Water Purification Project, YCDC
- 8 Puma Thilawa Terminal Project , Antara Koh Mawlamyine Cement Limited
- 9 (MCL) Power Plant Project
- 10 Establishment of Disastrous weather monitoring Project JICA Myanmar
- 11 Myanmar Navy, DNE (1) Project, Government of India
- 12 Puma Thilawa Terminal Project , Antara Koh
- 13 77 Kabaraye Project, GO FOUNDATION Co.,Ltd.(2015)
- 14 Radar Tower Project, DCA Campus , Mandalay, Myanmar (2016)
- 15 INH Engineering Precast Factory Project, Kyaw Thar Construction Co., Ltd.
- 16 SRI Asia Project, Bagan Royal Star Construction Co., Ltd.
- 17 Wilmar Myanmar Project, Penta Ocean Construction Co., Ltd., Japan
- 18 YTL Cement Project, YNKG Myanmar Co., Ltd. (2016)
- 19 YTL Cement Project Extension Project, YNKG Myanmar Co., Ltd. (2017)
- 20 Wilmar Myanmar Extension Projecct, Penta Ocean Construction Co., Ltd.,Japan
- 21 KJCMM Project, ACP Co., Ltd.
- 22 The Project of Enhancing Technological University in Myanmar, YTU, Sumitomo-Mitsui Co., Ltd., Japan
- 23 HBL 3.5 Million Project, Sumitomo-Mitsui Co., Ltd., Japan
- 24 Myinchan 225 MWa CCP-PWI Project, ACP Co., Ltd.
- 25 The Project of Mottama Trading Co., Ltd., ACP Co., Ltd.
- 26 Myaing Galay No.2 Cement Factory 4000 ton, Dual Burner Project, Kyae Wa Sesein Co., Ltd.
- 27 Denko Thilawa Terminal Project, HSL Myanmar Ltd. (2017)
- 28 KJCMM Project Thilawa SEZ, ACP Co., Ltd. (2017)
29. Grain Terminal Project Phase-1, ANTARA KOH PTE LTD. (2017)
30. IRCP Jetty Project, KTECG Co., Ltd. (2017)
31. The Project of Enhancing Technological University in Myanmar, Sumitomo Mitsui Construction Co., Ltd. (2017)
32. Grain Terminal Project Phase-1, ANTARA KOH PTE LTD. (2018)
33. Myainggalay 4000 ton Cement Factory Extension, Dual Burner Construction Project, Kyawel Wa Seasein Co., Ltd. (2018)
34. JFE Meranti Project, Thilawa SEZ, Myanmar V-Pile Co., Ltd. (2018)
35. Thilawa Fuel Tank Project, Thilawa SEZ, CCESCC (2018)
36. Mawlamyine Cement Ltd. Factory Construction Project (2018)
37. Taung Gyi Silo Project, Tekbumi Co., Ltd. (2018)
38. Thilawa Fuel Tank Project, Thilawa SEZ, CCESCC (2018)
39. Chin Corp. Office Building Construction Project, Mandalay, Capital Co., Ltd. (2018)
40. JICA Bridge Project, Thanlyin Infrastructure Development Project, Max.-Myanmar V-Pile Co., Ltd. (2018)
41. DENCO Thilawa Oil Storage Tank Project, Myanmar V-Pile Co., Ltd. (2018)
42. Padaukshewar Jetty Project, Thilawa SEZ, Antara Koh Pte. Ltd. (2018, 2019)
43. Wilmar Main Office Building Project, Golden Forest Co., Ltd. (2018)
44. Mingalardon Project (2019)
45. Shae Gyi Project (2019)
46. Bago Project (2019)
47. Sabal Gu Bridge Project (2019)
48. Nattakhar Kalay Project (2019)
49. Makro Store Project (2019)
50. Nar Nat Taw Project (2019)
51. Thilawa Lagunbin Receiving Facilities Project (2019)

(12) APPENDIX
The Presentation



INSTRUMENTATION & MONITORING

Kinds of Instruments

- 1. Inclinometer**
- 2. Ground Settlement Marker**



INCINOMETER MONITORING

1. Instruments

The following particular instruments are used for installation.

Inclinometer Casing

Geomonitor, S'pore (Model 2117-GS-IC02)

Inclinometer Probe & Readout

Geokon, (Model GK-604D)



Inclinometer Casings and Adaptor



Inclinometer Reading Instruments
(Probe, Reel and Field PC)

2. Method Statement for Installation & Monitoring of Inclinometer

2.1 Introduction

The inclinometer monitors lateral deformation of soil, typically behind a retaining wall system or slope. It can also be installed inside a retaining wall or piles to monitor lateral movement of these structures. The ABS casing of the inclinometer where the probe is to slide gives values of lateral deflection which is displayed in the readout unit. This is useful to show the location and magnitude of lateral movement in the structures.



2.2 Equipment

- 2.2.1 Drill rig capable of drilling hole of diameter 100 mm to the required depth.
- 2.2.2 ABS inclinometer casings (also known as access tubes), made of ABS plastic and of outer diameter 70mm and inner diameter 60mm, with four equispaced longitudinal grooves (keyways) on the side of the casing. The length of the casing shall be 3m. Coupling and telescopic coupling are made of ABS plastic and of a minimum of 0.2 m and 0.4 m respectively.
- 2.2.3 End caps are made of ABS plastic used for the top and bottom of the casing to prevent mud and foreign material from entering the casing.
- 2.2.4 Inclinometer system consists of Logger Readout Unit, Sensor Probe and Control Cable. Also included are an interface cable for downloading into PC, and analysis software for the management of the data.
- 2.2.5 Protective Device made of steel and lockable to cover the top of the casing to minimize vandalism.



Inclinometer Casings with longitudinal grooves (keyways)



ABS plastic end and top caps



On Ground Protective Steel Housing with Lockabe cover

2.3 Installation Procedure

- 2.3.1 A borehole of 100mm diameter will be dug at the instrument location at the existing ground level, temporary steel casing will be used. The borehole will be drilled as vertical as possible and checking will be carried out using a spirit level on the spindle of the drilling rig. Rotary washed boring method will be employed and only water will be used during the drilling. The borehole will be terminated at the depth of 20m unless otherwise specified by the client/consultant.
- 2.3.2 An end cap is attached to the end of the inclinometer casing using ABS cement or equivalent and riveted. For all other sections of the casing, a coupling is attached to one end only. The casings are marked with numbers using a marker in sequence of installation.
- 2.3.3 The first section of the casing is lowered into the borehole, with the cap on the lower end. A casing clamp is used to prevent the casing from falling into the hole. The next section of the casing, with a coupling already fixed at lower end, inserted onto the first casing and secured with ABS cement or equivalent. The casing ends are butted together for proper fit. More section is added as described previously until the casing rest on the bottom of the borehole. The casing joints will be made sure to be watertight. It is necessary to pour clean water into the inclinometer casing during installation to counter buoyancy (especially when there is water in the borehole). A removable cap is inserted at the top end of the last casing to prevent foreign material from entering the casing.
- 2.3.4 Backfilling of the annular space between the steel casing and the outside of the inclinometer casing will be next carried out by using pump able grout up to the ground level. The grout is trimmed through a small diameter pipe and the steel casing is gradually pulled out.
- 2.3.5 If there is the further surcharge or filling, the inclinometer casing will be extended by adding on more inclinometer casings as require.
- 2.3.6 When the further surcharge or filling is completed, or the final level is reached, the stick up portion of the inclinometer, if any, is cut off with hacksaw leaving about 0.3m above ground.
- 2.3.7 After 24 hours, a concrete pad will be cast around the top of the casing. A steel lockable device is placed over the concrete pad. The identification number of the extensometer will be marked on the steel and/or concrete.



2.3.8 A dummy probe or the actual probe will be gently lowered down into the casing till the base to check for any blockage, obstruction or constrictions. This shall be done in 2-directions A-A and B-B. (See Figure 1)

2.4 Monitoring Procedure of Inclinometer

2.4.1 Checking the probe

- i. Check for excess play in the wheel bearings and wheel yokes. There should be almost no side-to-side movement.
- ii. Check that the wheel turns smoothly. If necessary, clean the wheels and apply a spray lubricant or a few drops of oil to each bearing. Afterwards, the wheels should turn freely.
- iii. Check to see that the wheel yokes move freely. Push the wheel yokes into the probe body and slowly release them. Each yoke should return to its fully extended position.
- iv. Check that no screws are loose.
- v. Check connectors and O-rings for wear and corrosion.
- vi. Check the control cable, probe, and readout and observe its display. The inclinometer reading should be a positive value when the probe is tilted in the A0 and B0 directions. The reading should be a negative value when the probe is tilted in the A180 and B180 direction.



Assembly of Inclinometer Probe



2.4.2 Connecting the control cable

- i. Position the probe. Insert the probe into the casing with the upper wheels of both wheel assemblies in the A₀ groove. If the pulley assembly is used, take out the pulley wheel, insert the probe, and then replace the wheel.
- ii. Lower the probe slowly to the bottom. Do not allow it to strike the bottom. Allow the probe to the temperature inside the casing. Five or ten minutes interval is usually sufficient.

2.4.3 Record data

- i. Raise the probe to the starting depth. Wait for the numbers on the readout to stabilize. Press the button to record both A and B axis readings.

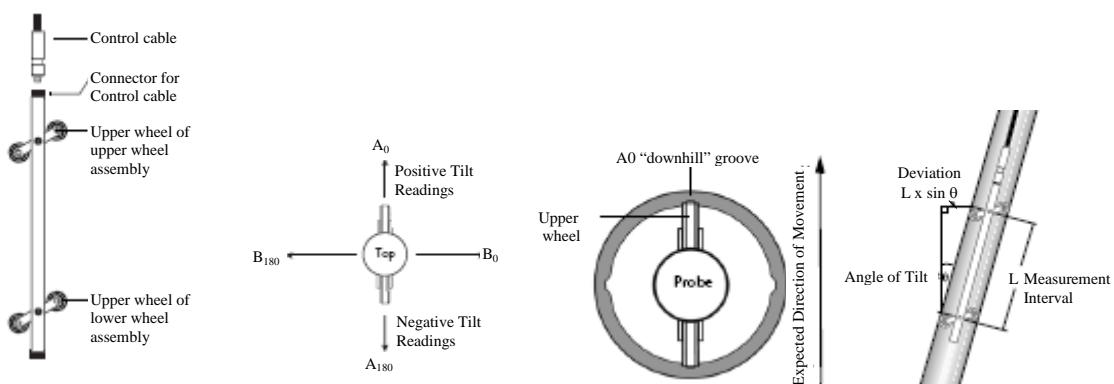


FIGURE 1: Inclination is measured by two forced balanced servo-accelerometers. One accelerometer measures tilt in the plane of the inclinometer wheels (the A axis). The other accelerometer measures tilt in a vertical plane perpendicular to the wheels (the B axis).

- ii. Raise the probe to the next depth. Wait for the stable reading. And then record it. Repeat this process with 0.5m interval until the probe reaches at the top of the casing.
- iii. Remove the probe and rotate it 180°. This time the lower wheel assemblies are inserted into the A₀ groove.
- iv. Lower the probe to the bottom, raise it to the straight depth, and continue the survey. Take readings at every 0.5m depth until the probe is reached to the top. Remove the probe.

2.4.4 Logger Readout

- i. Records data from sensor probe.
- ii. Logger Readout stores a list of inclinometer reading in memory. Each entry in the list includes information about the reading, such as its depth, compass orientation, etc.

- iii. The Logger Readout automatically shows the depth in meters or feet, the A-axis reading and the B-axis reading (the opposite face) reading.
- iv. Data provides checksum statistics as well as simple checksums to help the operator to validate the data set. Questionable reading can be verified with the inclinometer probe. When the operator repositions the probe in the casing, the Logger Readout displays live and recorded readings side for comparison.
- v. To transfer data on a computer, connect the Logger Readout to the computer and runs the special analysis software. The software stores the data in project database for quick access.
- vi. The program can calculate cumulative deviation for a single data set and cumulative displacement when a previous data set is in memory.



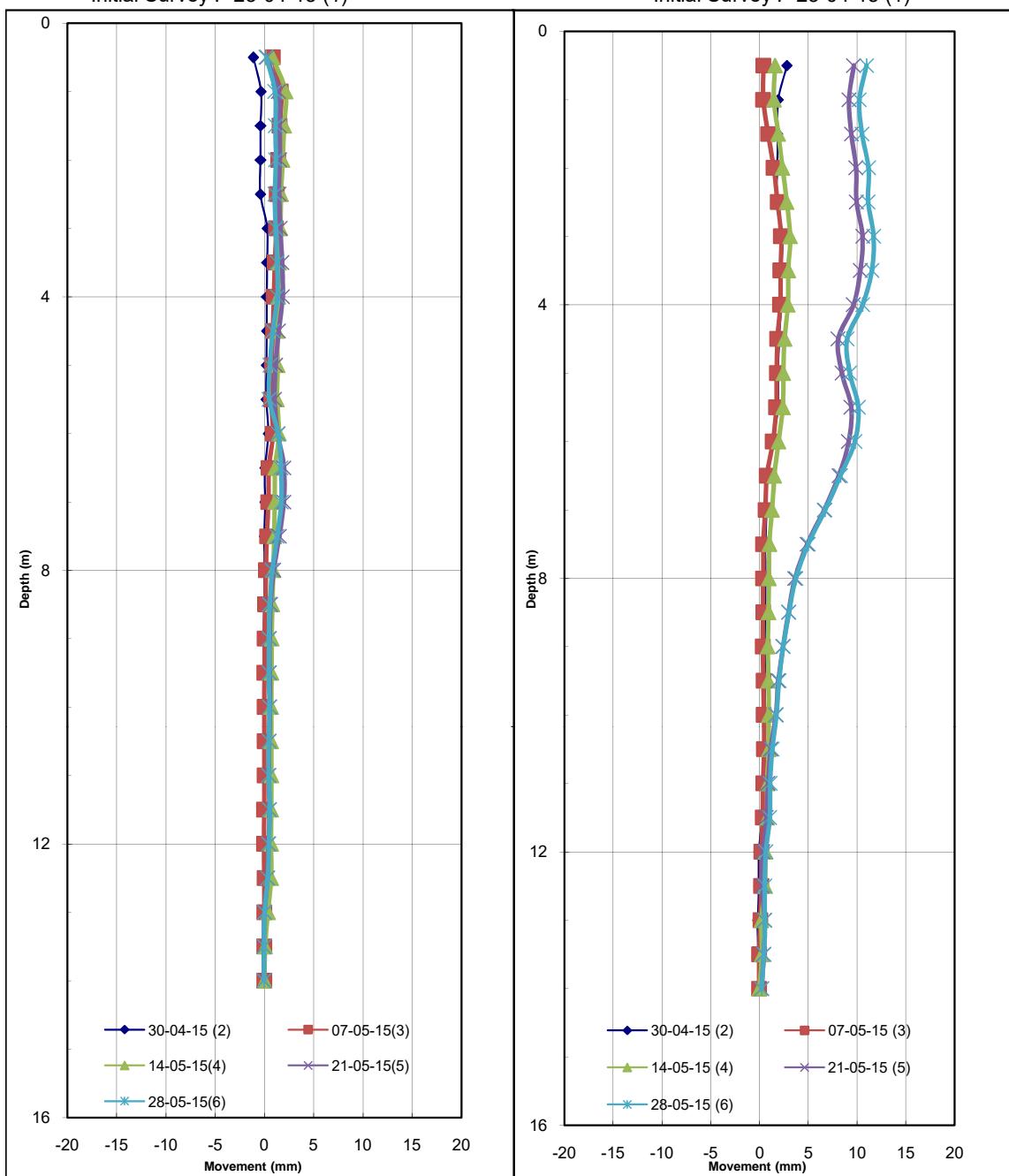
Live Reading from Field PC

3. Summary of Monitoring Results (In Appendix)

The report represents the initial base line monitoring report and subject to consultant's approval subsequent monitoring will be taken as frequency and schedule provided by consultant. (if any)

IM 1_A AXIS
Initial Survey : 23-04-15 (1)

IM 1_B AXIS
Initial Survey : 23-04-15 (1)



PROJECT: KBK (KyiMyinDaing)



SITE : KBK

INSTALLATION : IM-1

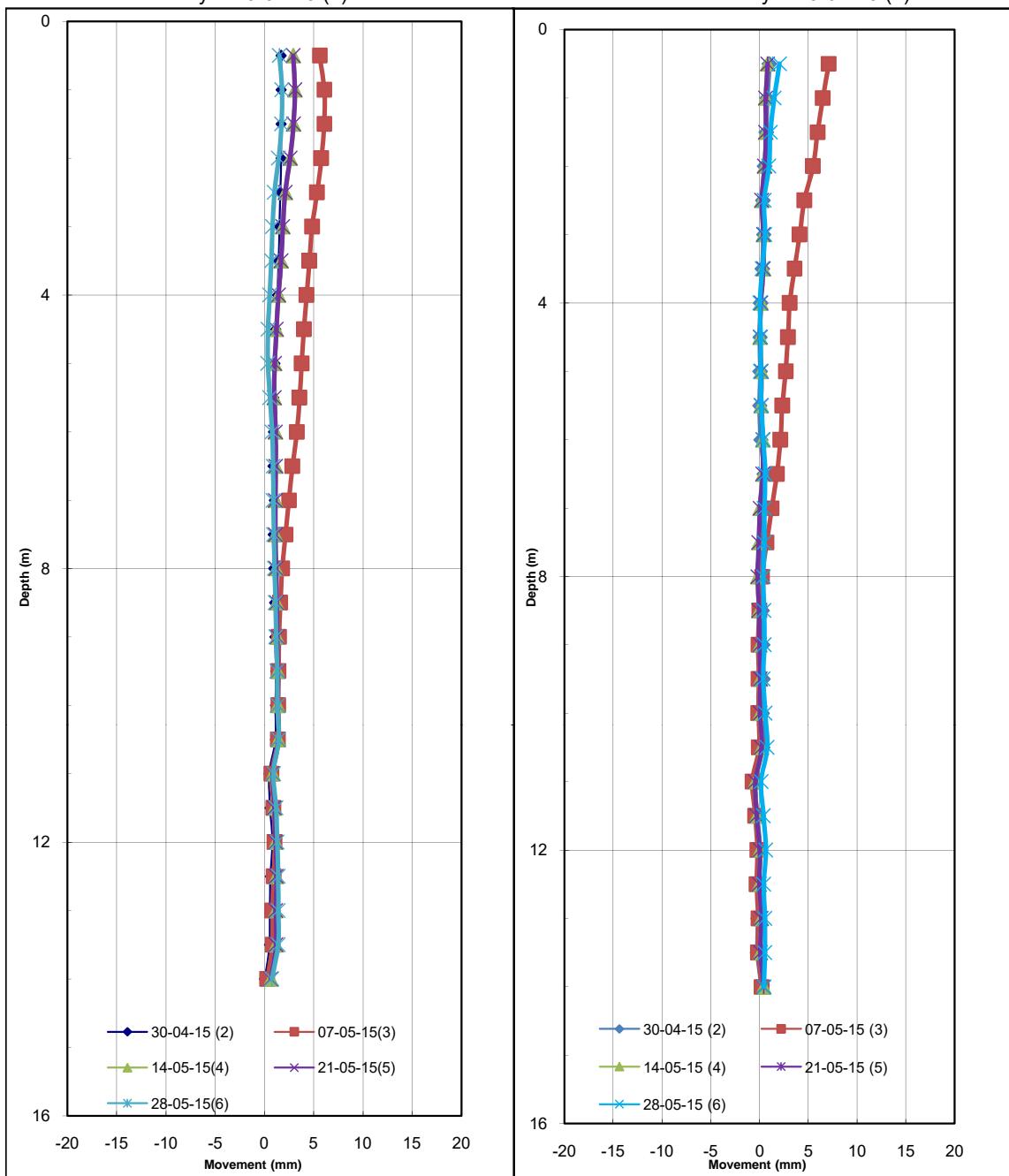
INSTALLED DATE :

CLIENT :

NOTE: TOP LEVEL = 0.500mRL
G.L = 0.000mRL

BOTTOM LEVEL = -13.500mRL
MONITORING DEPTH = 14.0 m

IM 2_A AXIS
Initial Survey : 23-04-15 (1)



PROJECT: KBK (KyiMyinDaing)



SITE : KBK

INSTALLATION : IM-2

INSTALLED DATE :

CLIENT :

NOTE: TOP LEVEL = 0.500mRL
G.L = 0.000mRL

BOTTOM LEVEL = -13.500mRL
MONITORING DEPTH = 14.0 m

SITE : Kabar Kyaw Project
 INSTALLATION : IM_1
 DESCRIPTION : Initial Reading
 CURRENT SURVEY :
 INITIAL READING : 23-04-15



	Initial	Initial	Initial	Initial
Depth	23-04-15	23-04-15	23-04-15	23-04-15
(m)	A+	A-	B+	B-
0.5	316	-346	-131	109
1	272	-273	-80	44
1.5	284	-289	-61	29
2	276	-288	-25	-2
2.5	223	-231	-10	-1
3	155	-162	-109	87
3.5	161	-170	-80	31
4	174	-182	-19	-33
4.5	157	-167	11	-66
5	139	-146	60	-102
5.5	170	-118	148	-115
6	308	-351	183	-241
6.5	353	-358	253	-299
7	331	-339	284	-322
7.5	300	-304	281	-334
8	245	-259	248	-295
8.5	209	-222	179	-201
9	196	-201	-67	38
9.5	136	-144	-52	13
10	36	-46	4	-47
10.5	-3	-1	62	-104
11	-90	78	70	-107
11.5	-92	76	66	-91
12	174	-178	66	-73
12.5	194	-201	67	-117
13	222	-234	110	-143
13.5	255	-263	104	-155
14	262	-271	135	-173

SITE : Kabar Kyaw Project
 INSTALLATION : IM_2
 DESCRIPTION : Initial Reading
 CURRENT SURVEY :
 INITIAL READING : 23-04-15



	Initial	Initial	Initial	Initial
Depth	23-04-15	23-04-15	23-04-15	23-04-15
(m)	A+	A-	B+	B-
0.5	-257	240	247	-228
1	-387	364	292	-329
1.5	-699	659	394	-444
2	-977	931	501	-585
2.5	-1116	1065	617	-677
3	-1270	1184	754	-922
3.5	-1312	1181	912	-1086
4	-1265	1142	991	-1142
4.5	-1231	1097	1060	-1183
5	-1210	1102	1165	-1256
5.5	-1183	1078	1202	-1295
6	-1262	1116	1232	-1352
6.5	-1246	1109	1320	-1432
7	-1250	1088	1347	-1495
7.5	-1240	1052	1356	-1496
8	-1230	1032	1347	-1511
8.5	-1172	983	1346	-1485
9	-1210	998	1375	-1515
9.5	-1225	1030	1402	-1550
10	-1182	973	1443	-1589
10.5	-1188	1091	1430	-1470
11	-1178	1124	1443	-1451
11.5	-1154	1143	1445	-1414
12	-1186	1218	1509	-1379
12.5	-1226	1208	1499	-1536
13	-1174	1162	1516	-1559
13.5	-1110	1155	1491	-1543
14	-1081	1063	1451	-1567



SETTLEMENT MONITORING

Settlement Check by Auto Level Report

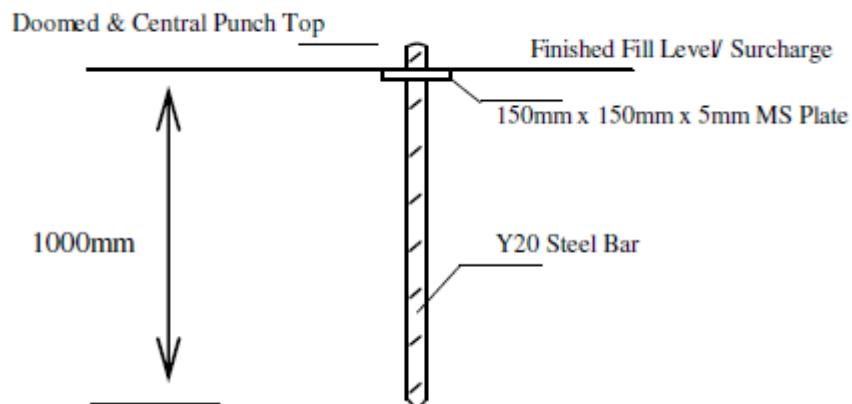
1.0 Introduction

Prefabricated surface settlement marker displacement marker will be used to monitor ground movement at specific locations. The settlement marker's reduced level is compared against a temporary or permanent benchmark to monitor its settlement or heave. The displacement ground settlement and building Settlement marker's initial reading by auto level.

2.0 Method Statement for Installation & Monitoring of Displacement Marker

2.1 Equipment

- a. Prefabricated 1075mm steel rod, 20mm diameter with (150mm x150mm x 5mm) steel plate attached at top. The steel rod is assembled as to protrude about 70mm, top rounded and centre punched. (See Sketch of /Displacement Marker)
- b. Surveying equipment – Auto Level (Model NI-32) for displacement marker.



Sketch of Settlement Marker/Displacement Marker



2.2 Installation Procedure

- a. Preassembled settlement marker/displacement marker will be driven vertically into the embankment or undisturbed ground or filled for a depth about 1m and .75m protruding from the ground surface.
- b. The rod's top will be center punched.
- c. The surface settlement marker/displacement marker will be identified by red paint and numbered and placed necessary protection. All necessary precautions will be taken to protect instrument from vehicles and plant including readily visible barriers as per construction drawings. The instruments will be maintained in good working order throughout the monitoring period.
- d. The level and position of the surface settlement marker/displacement marker will be measured using standard leveling & surveying techniques referenced to a stable benchmark which is remote from all possible movements
- e. These movement results and movement plots will be displayed in the periodic monitoring reports progressively.

3.0 Function of Instruments Installed

- a. Function of Ground Settlement Marker, (See sketch)
The settlement marker is used to measure a localised settlement or heave of roads, slopes, Embankments, utility pipes and cables.
- b. Function of Building Settlement Marker, (Nail on concrete)
The settlement marker is used to measure a settlement or heave of buildings.



Autolevel Instrument



4.0 Summary of Monitoring Results

The report represents the initial base line monitoring report and subject to consultant's approval subsequent monitoring will be taken as frequency and schedule provided by consultant.

Geolab (Myanmar) Co., LTD.

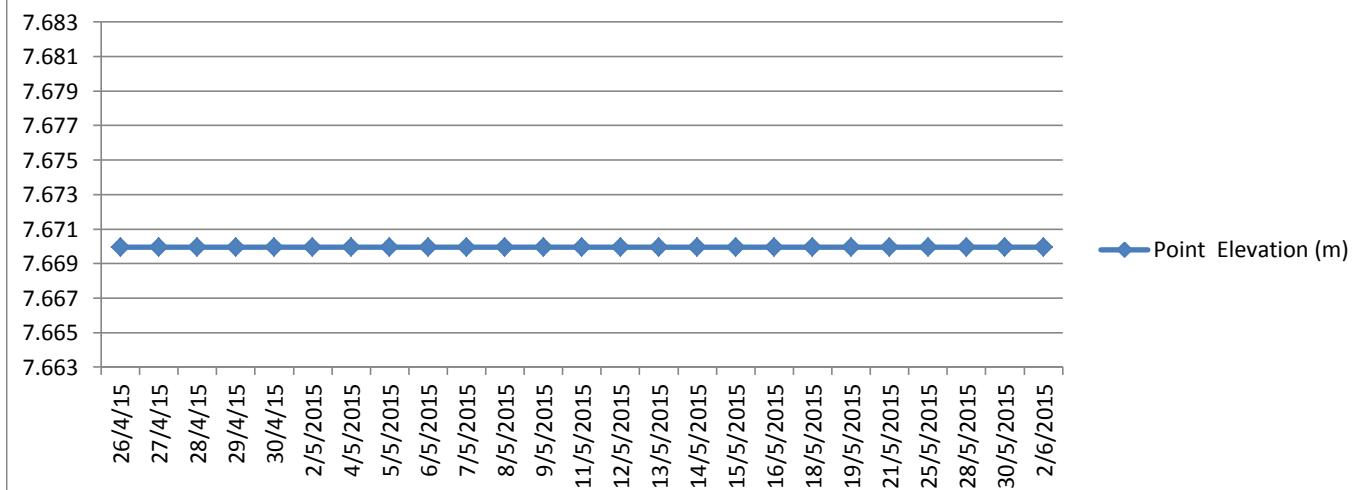
Settlement Check By Auto Level

Project : Kabarkyaw
 Location : KyeeMyinDaing Kanner Road
 Installed Date : 26/4/2015

**Ground Settlement Marker Daily Records**

BM Elevation = 7.274 m

Date	GSM No.	BM Reading Data (m)	Point Reading Data (m)	Point Elevation (m)
26/4/15	1	2.280	1.884	7.670
27/4/15	1	2.233	1.837	7.670
28/4/15	1	1.805	1.409	7.670
29/4/15	1	1.905	1.509	7.670
30/4/15	1	1.693	1.297	7.670
2/5/2015	1	1.845	1.449	7.670
4/5/2015	1	1.735	1.339	7.670
5/5/2015	1	1.849	1.453	7.670
6/5/2015	1	2.286	1.890	7.670
7/5/2015	1	1.845	1.449	7.670
8/5/2015	1	2.000	1.604	7.670
9/5/2015	1	2.071	1.675	7.670
11/5/2015	1	2.008	1.612	7.670
12/5/2015	1	2.065	1.669	7.670
13/5/2015	1	2.335	1.939	7.670
14/5/2015	1	2.296	1.900	7.670
15/5/2015	1	2.072	1.676	7.670
16/5/2015	1	2.203	1.807	7.670
18/5/2015	1	2.211	1.815	7.670
19/5/2015	1	2.188	1.792	7.670
21/5/2015	1	2.232	1.836	7.670
25/5/2015	1	2.283	1.887	7.670
28/5/2015	1	1.946	1.550	7.670
30/5/2015	1	1.977	1.581	7.670
2/6/2015	1	1.986	1.590	7.670

Point Elevation (m)

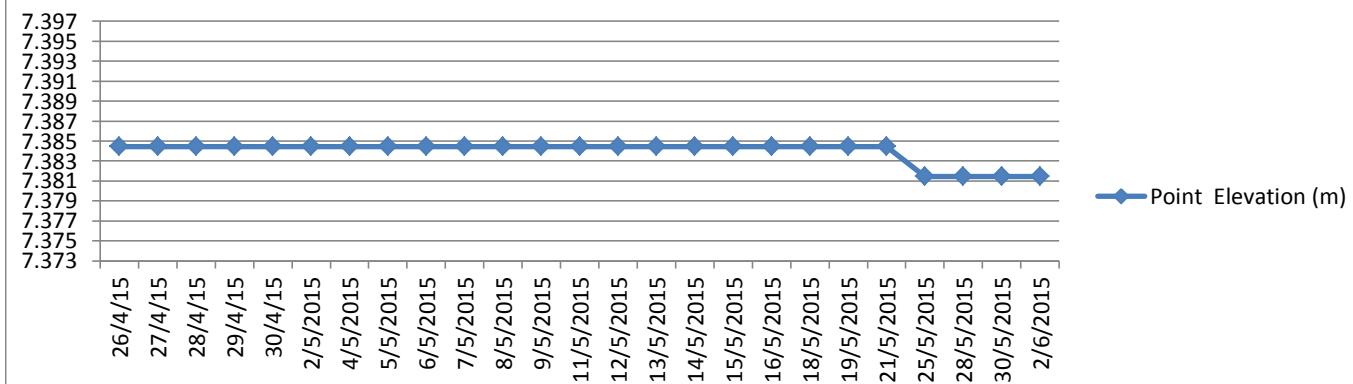
Settlement Check By Auto Level

Project : Kabarkyaw
 Location : KyeeMyinDaing Kanner Road
 Installed Date : 26/4/2015

**Ground Settlement Marker Daily Records**

BM Elevation = 7.274 m

Date	GSM No.	BM Reading Data (m)	Point Reading Data (m)	Point Elevation (m)
26/4/15	13	1.820	1.710	7.384
27/4/15	13	1.838	1.728	7.384
28/4/15	13	1.905	1.795	7.384
29/4/15	13	1.830	1.720	7.384
30/4/15	13	1.693	1.583	7.384
2/5/2015	13	1.845	1.735	7.384
4/5/2015	13	1.735	1.625	7.384
5/5/2015	13	2.013	1.903	7.384
6/5/2015	13	2.209	2.099	7.384
7/5/2015	13	2.007	1.897	7.384
8/5/2015	13	2.000	1.890	7.384
9/5/2015	13	2.071	1.961	7.384
11/5/2015	13	2.008	1.898	7.384
12/5/2015	13	2.065	1.955	7.384
13/5/2015	13	2.335	2.225	7.384
14/5/2015	13	2.296	2.186	7.384
15/5/2015	13	2.072	1.962	7.384
16/5/2015	13	1.920	1.810	7.384
18/5/2015	13	1.890	1.780	7.384
19/5/2015	13	1.913	1.803	7.384
21/5/2015	13	2.232	2.122	7.384
25/5/2015	13	2.283	2.176	7.381
28/5/2015	13	1.946	1.839	7.381
30/5/2015	13	1.977	1.870	7.381
2/6/2015	13	1.986	1.879	7.381

Point Elevation (m)

Settlement Check By Auto Level

Project : Kabarkyaw
 Location : KyeeMyindaing Kanner Road
 Installed Date : 26/4/2015

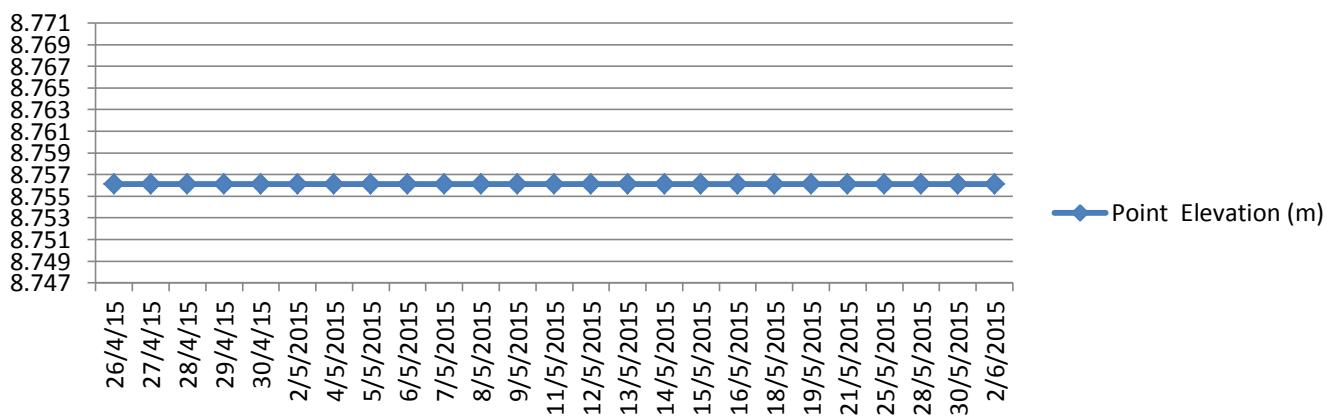


Building Settlement Marker Daily Records

BM Elevation = 7.274 m

Date	BSM No.	BM Reading Data (m)	Point Reading Data (m)	Point Elevation (m)
26/4/15	1	2.280	0.798	8.756
27/4/15	1	1.840	0.358	8.756
28/4/15	1	1.805	0.323	8.756
29/4/15	1	1.905	0.423	8.756
30/4/15	1	1.693	0.211	8.756
2/5/2015	1	2.045	0.563	8.756
4/5/2015	1	1.735	0.253	8.756
5/5/2015	1	2.013	0.531	8.756
6/5/2015	1	2.286	0.804	8.756
7/5/2015	1	2.007	0.525	8.756
8/5/2015	1	2.000	0.518	8.756
9/5/2015	1	2.071	0.589	8.756
11/5/2015	1	2.008	0.526	8.756
12/5/2015	1	2.065	0.583	8.756
13/5/2015	1	2.335	0.853	8.756
14/5/2015	1	2.296	0.814	8.756
15/5/2015	1	2.093	0.611	8.756
16/5/2015	1	2.203	0.721	8.756
18/5/2015	1	2.211	0.729	8.756
19/5/2015	1	2.188	0.706	8.756
21/5/2015	1	2.232	0.750	8.756
25/5/2015	1	2.283	0.801	8.756
28/5/2015	1	1.946	0.464	8.756
30/5/2015	1	1.977	0.495	8.756
2/6/2015	1	1.986	0.504	8.756

Point Elevation (m)



Settlement Check By Auto Level

Project : Kabarkyaw
 Location : KyeeMyindaing Kanner Road
 Installed Date : 26/4/2015

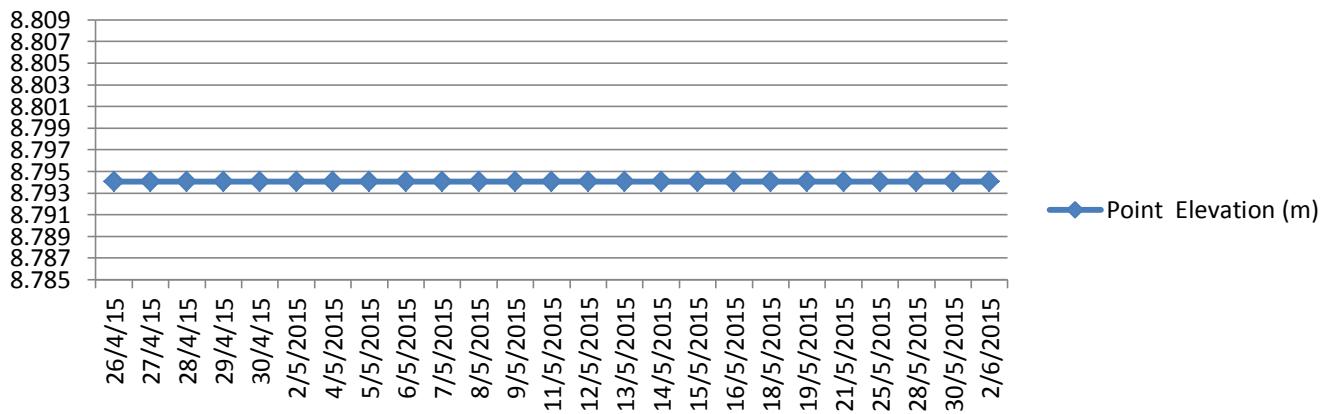


Building Settlement Marker Daily Records

BM Elevation = 7.274 m

Date	BSM No.	BM Reading Data (m)	Point Reading Data (m)	Point Elevation (m)
26/4/15	2	2.280	0.760	8.794
27/4/15	2	1.840	0.320	8.794
28/4/15	2	1.805	0.285	8.794
29/4/15	2	1.905	0.385	8.794
30/4/15	2	1.693	0.173	8.794
2/5/2015	2	2.045	0.525	8.794
4/5/2015	2	1.910	0.390	8.794
5/5/2015	2	2.013	0.493	8.794
6/5/2015	2	2.286	0.766	8.794
7/5/2015	2	2.007	0.487	8.794
8/5/2015	2	2.000	0.480	8.794
9/5/2015	2	2.071	0.551	8.794
11/5/2015	2	2.008	0.488	8.794
12/5/2015	2	2.065	0.545	8.794
13/5/2015	2	2.024	0.504	8.794
14/5/2015	2	2.026	0.506	8.794
15/5/2015	2	2.093	0.573	8.794
16/5/2015	2	1.920	0.400	8.794
18/5/2015	2	1.890	0.370	8.794
19/5/2015	2	1.913	0.393	8.794
21/5/2015	2	2.094	0.574	8.794
25/5/2015	2	2.045	0.525	8.794
28/5/2015	2	1.946	0.426	8.794
30/5/2015	2	1.977	0.457	8.794
2/6/2015	2	1.820	0.300	8.794

Point Elevation (m)





SITE INVESTIGATIONS

1.0 INTRODUCTION.

The classification of the soil as represented in the report follows the ASTM D1586-99 "Code of Practice for Site Investigations". The report is limited to the representation of the soil information data gathered from the field works and laboratory tests.

2.1 SCOPE OF WORKS

The scope of works involved in this investigation includes the following: -

1. To explore the subsurface condition of proposed development area and to provide general data relating to the project.
2. To carry out Standard Penetration Test (SPT – 63.5kg hammer having a free fall of 762mm) to determine the natural bearing resistance of the subsoil for the purpose of design.
3. To obtain disturbed and or undisturbed soil samples for carrying out the laboratory tests to determine the natural and relevant physical properties of the subsoil pertaining to the site for the purpose of design.

3.1 FIELD EXPLORATION.

3.2 GENERAL

Field exploration programme will conduct one or two days supervise by our personnel from our office. The exploration of works as follow,

* Number of Boreholes

* Site condition

3.3 DEEP BORING

3.3.1 Deep Boring Equipment

The Boring equipment used was “Rotary Drilling Rig” which is capable of boring and drilling to the depth. These boring rigs are also suitable for advancing the borehole, sampling, in-situ testing and rock drilling in accordance with the relevant specifications of each of these operations.

3.3.2 Method of Advancing Boreholes

Soil drill was carried out by the rotary action of drill bit attached to the bottom of a hollow rod, which cuts/discharges all material within the diameter of borehole washed to the ground surface by drilling fluid pumped down the drilling rod. Normally the drill bit is rarely allowed to extend more than 150mm ahead of the bottom of the casing (if casing is used). Advancing of the borehole is using drill rods with suitable drill bit and casing or where permitted, proper drilling fluids. Advancing of the borehole will be such that the disturbance to and contamination of the soil(s) immediately below the borehole will be kept to minimum.

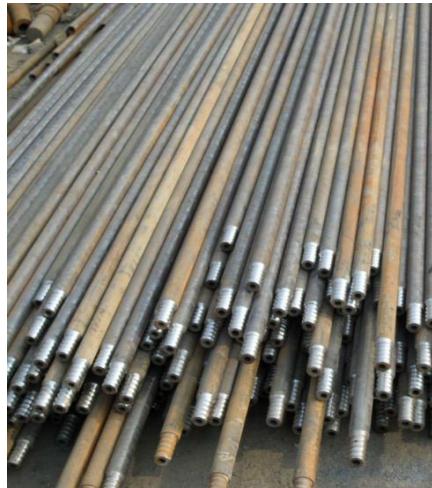
Casing was required in the soft or cohesionless soils, but is often omitted in stiff, cohesive soils when only small representative samples are desired.



Drill Rig Model HGY-200



Casings



Drilling Rods

3.3.3 Sampling in Boreholes

i. Disturbed Sample

Disturbed samples may be obtained by any means as long as the soil sample obtained is representative and unchanged in the constituent contents. After the completion of the test, the sampler tube is removed and disassembled to provide 'disturbed' but representative samples.

Disturbed samples were taken from continuous sampling and split barrel samples in conjunction with penetration resistance tests for purpose of laboratory soil classification.

Disturbed samples were normally preserved immediately after being recovered in doubled layered heavy polyethylene bags sealed to form an airtight bag. Properly contained samples were stored under a shelter away from the sun and rain.

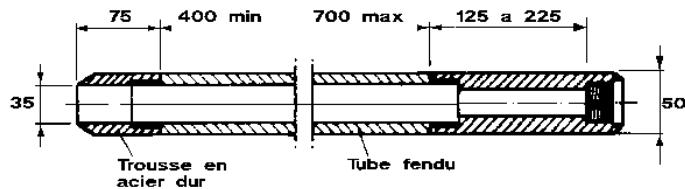


Diagram of Disturbed Sampler



Disturbed Samples

ii. Undisturbed Sample

Undisturbed samples were taken with the in-wall tube sampler or stationary piston sampler as according to the site conditions or as directed. The minimum internal diameter of the tube used was 75mm and the maximum length of the tube was 1000mm.

A minimum of 10.0mm of undisturbed materials was removed from the top and the bottom of the tube to take up a jar sample for both the top and bottom. Subsequent to the penetration of these samples, both ends of the sample will be coated with a non-shrinking wax to ensure airtight seal. The void at the top and bottom of the tube was then filled.



Undisturbed Samplers



Undisturbed Samples taking process

3.4 Field Testing

3.4.1 Standard Penetration Test

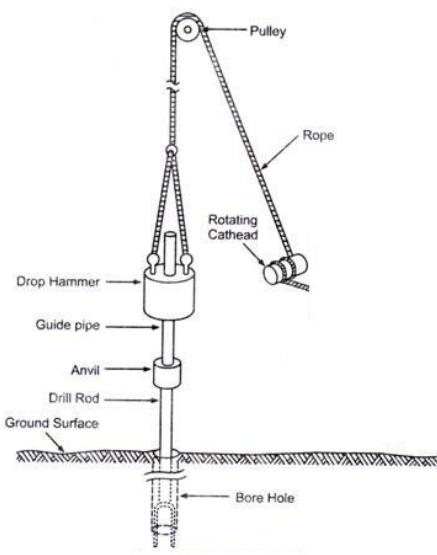
The standard penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test procedure is standardized as ASTM D 1586. The N-value provides an indication of the relative density of the subsurface soil, and it is used in empirical geotechnical correlation to estimate the approximate shear strength properties of the soils.

The test uses the standard split-barrel sampler. This is driven into the ground at the bottom of a borehole by using 63.5 kg hammer falling free from a height of 760 mm.

The sample tube is driven 150 mm into the ground and then the number of blows needed for the tube to penetrate each 150 mm (6 in) up to a depth of 450 mm (18 in) is recorded. The sum of the number of blows required for the second and third 6 in. of penetration is reported as SPT blow count value, commonly termed "standard penetration resistance" or the "N-value".

The boring log shows refusal and the test is halted if

- 50 blows are required for any 150 mm increment.
- 100 blows are required (to drive the required 300 mm)
- 10 successive blows produce no advance.



Standard Penetration Test

(SPT – 63.5kg hammer having a free fall of 762mm)



63.5kg SPT Hammer

3.5 Water Table Measurement

The measurement of water table in the borehole was done using either a measuring tape or tape rod diameter or dip-meter as directed by the Client.

The recordings were repeated daily while boring for the drilled hole in progress and were taken in the following time intervals: -

1. Before work commences in the morning
2. At the end of the day's work.

The water levels recorded in the borehole logs were levels observed in these investigation holes during the period of the site investigation. Such observed levels may not necessarily be the actual groundwater levels that are subject to seasonal fluctuations from time to time. For boreholes involving impervious stratum, the casing top was capped overnight to prevent entry of rainwater and subsurface water.



Water Level in Drilling Bore hole



Water Level Indicator



4.0 LABORATORY TESTING

The following laboratory tests are carried out to know the physical and engineering properties of soil. All the tests are conducted in accordance with American Society for Testing and Material (ASTM) standard procedures.

1. Water content determination test (ASTM D 2216)
2. Specific gravity test by pycnometer method (ASTM D 854)
3. Atterberg's limits test
 - i. Liquid limit determination test (ASTM D 4318)
 - ii. Plastic limit determination test (ASTM D 4318)
4. Particle size analysis test
 - i. Sieve analysis test (ASTM D 421)
 - ii. Hydrometer analysis test (ASTM D 422)
5. Triaxial test (ASTM D 2850)
6. Direct shear test (ASTM D 3080)
7. One Dimensional Consolidation test (ASTM D 2435).



Sieve Analysis Test



Hydrometer Analysis Test



Plastic Limit Determination Test



Liquid Limit Determination Test



Specific Gravity Test



Triaxial Test



Direct Shear Test



One Dimensional Consolidation Test

PROJECT: Myanmar Makro Industrial Project

CLIENT:

PROJECT NO:

LOCATION:

DRILLING DATE STARTED: 11/May/2015

DRILLING DATE COMPLETED: 13/May/2015

LOGGED BY: Win Hlaing

CHECKED BY: U Ko Ko

DRILLING RIG: Drill Rig

BOREHOLE DIA: 76.2mm

CORE DIA:

DRILLING METHOD: RWB

DRILLED BY: Myo Min Aung

BORING LOG:

BH-3

Page - 1 of 3

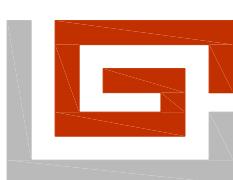
NORTHING: m

EASTING: m

REDUCED LEVEL: m

GWL: 1.50m Dated: 13/May/2015

scale	Reduced level(m)	Depth(m)	Graphic Log	Legend	Sample No.	Description	SPT N blows/300 mm				SPT (N) Value	Rock	Grain Size Analysis	Shear Strength	PL 20 20	WC 40 40	LL 60 80	Bulky Density Mg/m³ 1.5 1.8 2.1 2.4	
							20	40	60	80									
					D1	Top Soil - Pale yellowish brown with light grey spotted back filled SAND.	-	-	-	-	-								
1	1.50				1.50 P1/D2	Soft, medium grey CLAY.	●	+	+	+	+	1,0,1,1,0,1 N=3							
2	2.00				3.00 P2/D3	Very Soft, medium grey CLAY with dark grey mottled decay wood.	●	+	+	+	+	1,0,0,1,0,0 N=1							
3	3.00				4.50 P3/D4	Soft, medium grey CLAY.	●	+	+	+	+	1,1,0,1,1,1 N=3							
4	4.50				6.00 P4/D5	Soft, medium to dark grey with light grey spotted sandy SILT.	●	+	+	+	+	1,1,0,1,1,1 N=3							
5	6.00				7.50 P5/D6	Very Soft, medium grey with light grey spotted silty CLAY.	●	+	+	+	+	1,0,0,0,1,0 N=1							
6	7.50				9.00 P6/D7	Loose, medium grey with light grey spotted silty SAND.	●	+	+	+	+	2,1,1,1,1,2 N=5	0,43,49,8						
7	9.00				10.50 P7/D8	Soft to Firm, medium to dark grey with light grey spotted silty CLAY.	●	+	+	+	+	1,1,1,1,1,1 N=4							
8	10.50				12.00 P8/D9	Medium Dense, medium grey with light grey spotted medium SAND.	●	+	+	+	+	2,1,1,2,4,6 N=13							
9	12.00				13.50 P9/D10		○	+	+	+	+	2,1,2,2,4,2 N=10							
10	13.50				15.00 P10/D11	Medium Dense, greenish grey with light grey spotted fine to medium SAND.	●	+	+	+	+	4,5,6,6,5,9 N=26							
11	15.00																		
12	15.00																		
13	15.00																		
14	15.00																		
15	15.00																		
16	15.00																		



- Sample
- Permeability/Packer Test(PKT)
- Pressuremeter Test(PRM)
- Core Run
- Vane Shear Test(VST)

- SPT N Value
- Attempt TW/P/MZ/U
- SPT Sample
- Undisturbed Sample

- M — Mazier
- PZS — Cassagrande Piezometer
- U — Thick Wall Open Drive
- WSP — Water Standpipe
- C — Core Run
- W — Water

REMARKS:

DATA QUALITY RATING

PROJECT: Myanmar Makro Industrial Project

CLIENT:

PROJECT NO:

LOCATION:

DRILLING DATE STARTED: 11/May/2015

DRILLING DATE COMPLETED: 13/May/2015

LOGGED BY: Win Hlaing

CHECKED BY: U Ko Ko

DRILLING RIG: Drill Rig

BOREHOLE DIA: 76.2mm

CORE DIA:

DRILLING METHOD: RWB

DRILLED BY: Myo Min Aung

BORING LOG:

BH-3

Page - 2 of 3

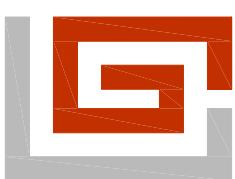
NORTHING: m

EASTING: m

REDUCED LEVEL: m

GWL: 1.50m Dated: 13/May/2015

scale	Reduced level(m)	Depth(m)	Graphic Log	Legend	Sample No.	Description	 SPT N blows/300 mm 20 40 60 80  Undrained Shear Strength kPa 20 40 60 80	SPT (N) Value	Rock		Grain Size Analysis G/SA/S/C	Shear Strength		 PL  WC  LL  Bulb Density Mg/m³ 1,5 1,8 2,1 2,4	
									TCR(%)	ROD(%)		C (kPa)	φ (%)		
16.50					16.50 P11/D12	Medium Dense, greenish grey with light grey spotted medium to coarse SAND with dark mortared decay wood and trace of gravel.		3,3,4,4,3,5 N=16							
17					18.00 P12/D13	Medium Dense, greenish grey with light grey spotted clayey medium to coarse SAND.		2,0,2,3,5,5 N=15							
18	18.00				19.50 P13/D14	Medium Dense, greenish grey with light grey spotted medium SAND.		6,7,4,4,3,6 N=17							
19					21.00 P14/D15			5,3,4,3,5,4 N=16							
20					22.50 P15/D16	Medium Dense to Dense, greensih grey with light grey spotted slightly clayey fine to medium SAND.		4,5,7,9,10,8 N=34							
21					24.00 P16/D17	Medium Dense, greenish grey with light grey spotted fine to medium SAND.		5,7,7,6,4,7 N=24							
22					25.50 P17/D18			4,2,3,5,8,6 N=22							
23					27.00 P18/D19			3,3,6,7,6,6 N=25							
24					28.50 P19/D20			5,4,6,6,8,7 N=27							
25					30.00 P20/D21			3,3,4,6,4,6 N=20							
26					31.50 P21/D22	Dense to Very Dense, greenish grey with light grey spotted and dark grey mottled slightly silty fine SAND.		4,3,9,12,13,16 N=50							
27															
28															
29															
30															
31															
32															



-  - Sample
-  - Pressuremeter Test (PRM)
-  - Core Run
-  - Vane Shear Test (VST)

-  - Permeability/Packer Test (PKT)
-  - SPT N Value
-  - Attempt TW/P/MZ/U
-  - SPT Sample
-  - Undisturbed Sample

- M - Mazier
- U - Thick Wall Open Drive
- C - Core Run
- W - Water

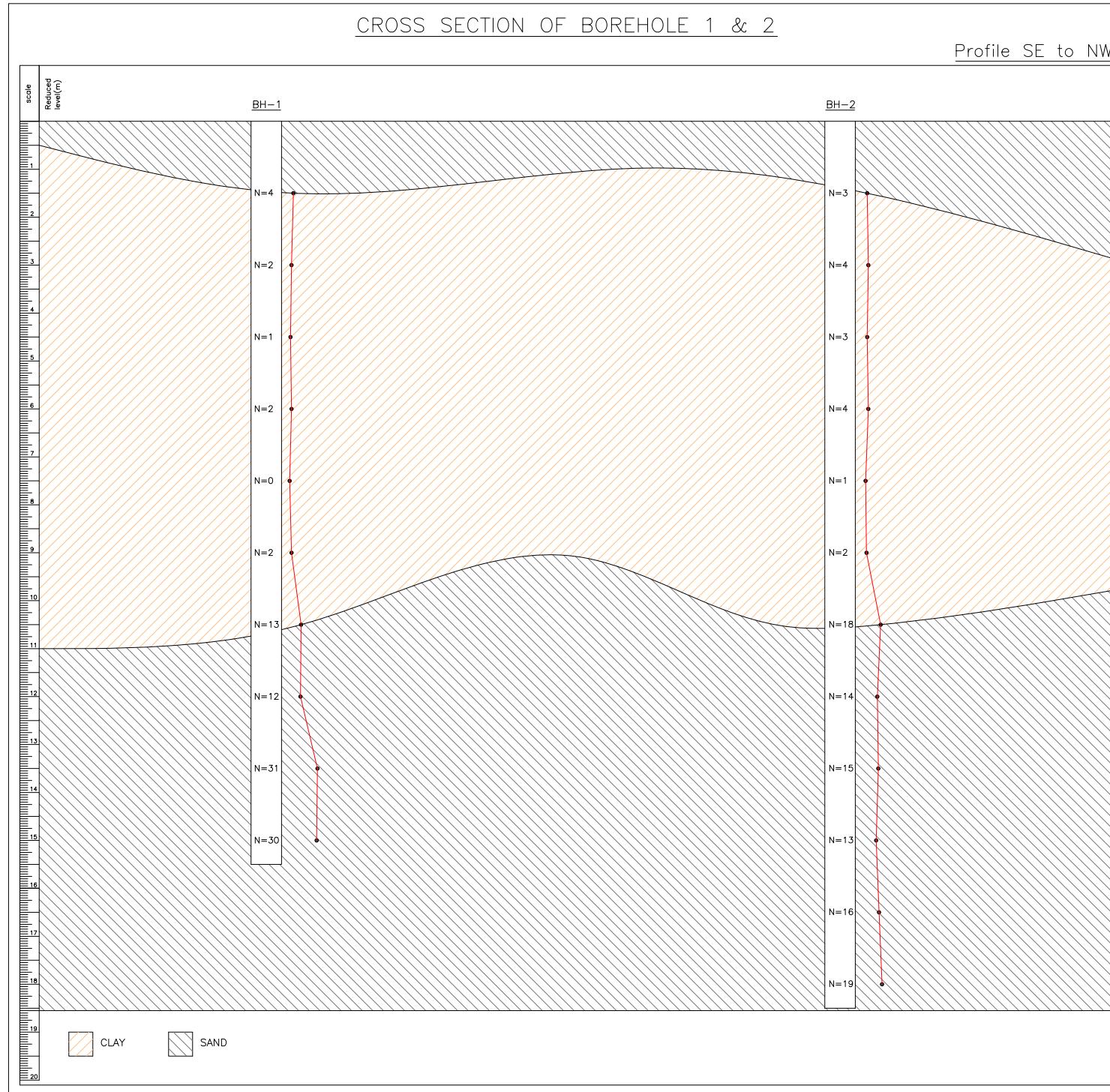
- PZS - Cassagrande Piezometer
- WSP - Water Standpipe

REMARKS:

DATA QUALITY RATING

CROSS SECTION OF BOREHOLE 1 & 2

Profile SE to NW



SUMMARY OF LABORATORY TEST RESULTS



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SUMMARY OF LABORATORY TEST RESULTS



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CLIENT:	GEOLAB (MYANMAR) CO., LTD						Job No.AGS1266
PROJECT:	SITE INVESTIGATION WORKS FOR MYANMAR MAKRO INDUSTRIAL PROJECT						
BORING NO:	BH-3						
SAMPLE NO:		D22	D23				
DEPTH (m)	From	31.50	33.00				
	To	31.95	33.45				
Natural Moisture Content	%		23				
Bulk Density	Mg/m3		1.97				
Dry Density	Mg/m3		1.60				
Particle Density of Soil	Mg/m3						
Grain Size Analysis	Gravel	%	0				
	Sand	%	73				
	Silt	%	26				
	Clay	%	1				
Atterberg Limits	Liquid Limit	%	31				
	Plastic Limit	%	18				
	Plasticity Index	%	13				
Penetrometer	Cohesion	kPa					
Torvane	Cohesion	kPa					
Direct Shear Test	Cohesion	C'	kPa				
	Friction Angle	ϕ	degree				
Unconfined Compression	Cohesion		kPa				
Total Stress Triaxial Compression	Cohesion	C'	kPa				
	Friction Angle	ϕ	degree				
Effective Stress Triaxial Compression	Cohesion	C'	kPa				
	Friction Angle	ϕ'	degree				
One Dimensional Consolidation Properties (Oedometer)	Initial Void Ratio						
	Degree of Saturation	%					
	Preconsolidation Press.	kPa					
	Compression Index						
Rock Test	Point Load Strength	N/mm ²					
	Compressive Strength	N/mm ²					
Legend :	Remarks						
	Checked by	25/05/2015	Approved by	25/05/2015			
	Note:						



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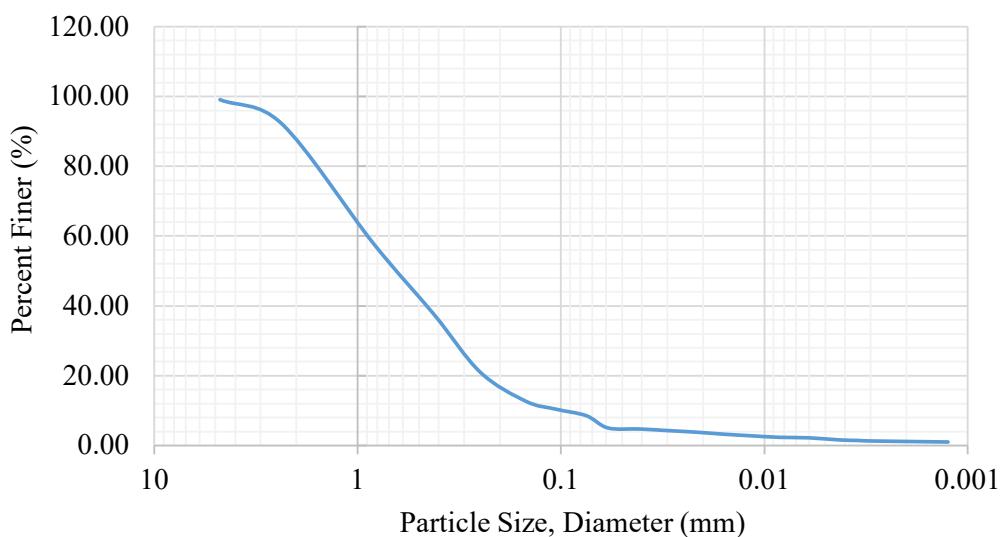
No. 414, Aung Thitsar Str., 48 Ward, North Dagon Tps., 11421, Yangon,
Myanmar
Ph: 09798476843; Mobile Ph. 09-5003281, 09-5077153
E-mail: csc1999@gmail.com, Web: csc1999.com



Registration No. QS 4625

SIEVE ANALYSIS TEST (ASTM D 421)

Sieve No	Sieve Opening (mm)	Wt. of Sieve (g)	Wt. of Sieve & Soil (g)	Wt. of Soil Retained (g)	Percent Retained (%)	Cumulative Percent Retained (%)	Percent Finer (%)
4	4.75	94.15	95.98	1.83	0.91	0.91	99.09
8	2.36	94.15	107.94	13.79	6.90	7.81	92.19
20	0.841	94.15	162.36	68.21	34.11	41.92	58.09
40	0.42	94.15	135.34	41.19	20.60	62.51	37.49
60	0.25	94.15	126.98	32.83	16.42	78.93	21.08
100	0.149	94.15	110.89	16.74	8.37	87.30	12.71
140	0.106	94.15	98.72	4.57	2.29	89.58	10.42
200	0.075	94.15	97.91	3.76	1.88	91.46	8.54
Pan							



Tested by >> TP

Checked by >> ZCP



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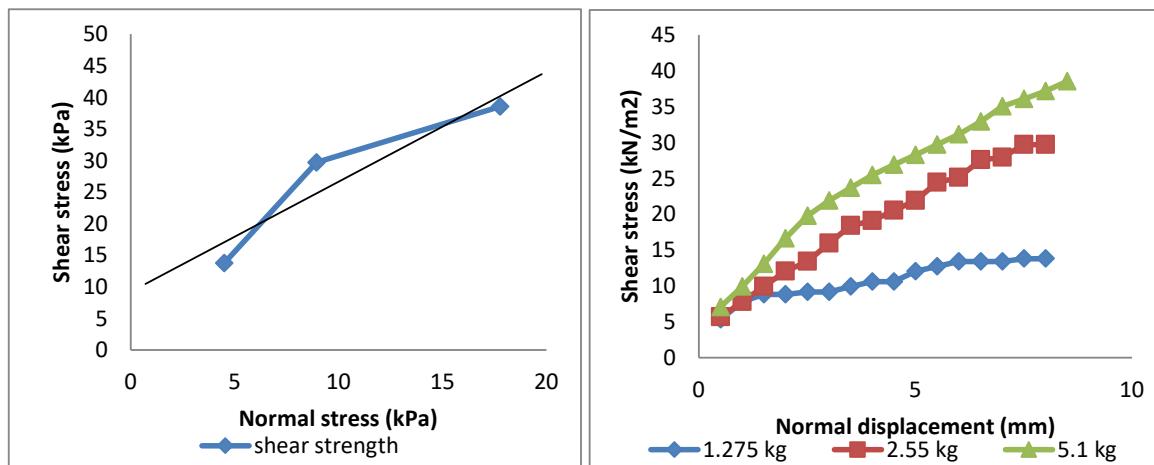


Registration No. QS 4625

Shear box

Diameter (cm)	6
Height (cm)	2
Area (cm ²)	28.29
Area (mm ²)	2828.57

Applied load (kg)	1.275	2.55	5.1
Normal stress (kPa)	4.5	8.9	17.8
Shear Stress (kPa)	13.79	29.70	38.54
Cohesion,c (kPa)	9.8		
Friction Angle, φ (°)	30		



Tested by >> NKM

Checked by >> YMT



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Registration No. QS 4625

ATTERBERG LIMITS TEST (ASTM D 4318)

ATTERBERG LIMITS TEST PLASTIC LIMIT DETERMINATION

Determination No	1	2	3
Container No	1	2	3
Weight of Container+ Wet Soil (g)	14.54	14.87	15.05
Weight of Container+ Dry Soil (g)	12.88	13.25	13.42
Weight of Water, W_W (g)	1.66	1.62	1.63
Weight of Container in (g)	7.62	8.04	8.1
Weight of Dry Soil, W_S (gm)	5.26	5.21	5.32
Water Content, w (%)	31.56	31.09	30.64
Average Water Content, w (%)		31.10	

Plastic Limit, PL (%) 31.10

Tested by >> TP

Checked by >> ZCP



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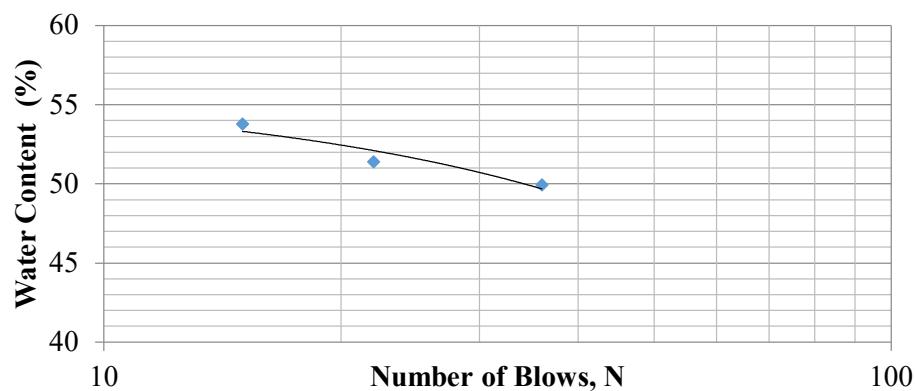


Registration No. QS 4625

ATTERBERG LIMITS TEST (ASTM D 4318)

ATTERBERG LIMITS TEST LIQUID LIMIT DETERMINATION

Determination No	1		2		3	
No of Blows, N	36		22		15	
Container No	1	2	3	4	5	6
Weight of Container+ Wet Soil(g)	12.34	12.55	12.37	12.71	12.36	12.26
Weight of Container+ Dry Soil(g)	10.87	11.06	10.81	11.1	10.69	10.84
Weight of Water, W _W (g)	1.47	1.49	1.56	1.61	1.67	1.42
Weight of Container in (g)	7.89	8.11	7.81	7.93	7.62	8.17
Weight of Dry Soil, W _S (g)	2.98	2.95	3	3.17	3.07	2.67
Water Content, w (%)	49.33	50.51	52	51	54.40	53.18
Average Water Content, w (%)	49.92		51.39		53.79	



Liquid limit (%) 52

Tested by >> TP

Checked by >> ZCP







Thank You for your attention!



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