Geomotion
SINGAPORE

Company Profile

Efficient Services & Precision Monitoring

Geomotion Singapore Pte Ltd

Geomotion Singapore is a company specializing in Geotechnical Engineering with wealth of experience. Geomotion (Singapore)'s services and expertise do encompass total solutions for Geotechnical Investigation, Instrumentation and Laboratory Services.

Geomotion (Singapore) – formerly known as GeoLS Pte Ltd - was incorporated in Singapore on 29th of June 2001. Soon after the establishment, Geomotion (Singapore) became one of the flagships in geotechnical engineering because of its quality service at reasonable price. Early of 2016, Geomotion (Singapore) became part of Geomotion Group of Companies that extensively operating in Singapore, Perth, Sydney and Yangon.

Geomotion (Singapore) is registered with Building and Construction Authority (BCA) in Singapore. Detailed information of Geomotion (Singapore) is as per following.

- Business Registration : 200104293D (CR15 & CR01)
- Building and Construction Authority : Specialist Builder (Site Investigation Work)
- Workplace Safety & Health Council : bizSAFE STAR
- International Certification : ISO 9001:2005 & BS OHSAS 18001:2007
- Singapore Accreditation Council : IB-2016-127F (ISO/IEC 17020:2012) Eurocode 7 Compliance

Management & Resources

The key management of Geomotion (Singapore) are from various backgrounds especially in geotechnical engineering field with over three decades of experiences. They are;

- **Kim Malcom** (CEO) — Director and CEO of Geomotion Group of Companies. Involved since First generation of Geotech (Slope Indicator in 1970s) until today
- **Mervyn Tan** (Managing Director) — Mr Tan has a Master of Science in Engineering Business Management. He brings with him a wealth of experience and expertise gained in the construction industry over the last 20 years.
- **Allen Ng** (Director) — Former director from Soil & Foundation Pte Ltd and Soil Investigation Pte Ltd

Current employed staff is more than 140. Well-experienced Geologists, Civil Engineers, Geotechnical Engineers, Etc., with both local and overseas experts, administrative and management staffs are propelling Geomotion (Singapore) to produce the quality services required by the industry. Geomotion (Singapore) has a large fleet of boring machines, laboratory and geotechnical equipment.

Efficient Services

Geomotion (Singapore) offers a comprehensive coverage of Geotechnical Instrumentation & Monitoring Works for building developments, reclamation, bridges, dams and tunneling projects inclusive of Manual-Read and Remote Real-Time Automatic Monitoring Systems together with alarm warning features via GSM, GPRS, Radio Frequency and Wifi

II.A Deformation of Ground and Structural Observation

- Inclinometer (Automatic)
- Electrolytic Level Sensor
- Tilt meter
- Settlement Point
- Deep Settlement Gauge
- Multi-level Settlement Devices
- Convergence & Divergence Measurement of Structure
- 3 D measurement of the structure & tunnel by Automatic Systems

II.B Ground Water Observation

- Water Standpipe
- Piezometer
  - Open type Piezometer
  - Pneumatic Piezometer
  - Vibrating wire Piezometer
- Rain Gauge

II.C Structural Observation

- Strain Gauge
- Load Cell.
- Earth Pressure Cell
- Crack meter

II.D Monitoring Services for Construction / Environmental

- Vibration Monitoring
- Noise Monitoring
- Water Level Monitoring
- Dust Monitoring

II.E Data Management & Monitoring System

- Data automatic logging and Real Time Monitoring System
- Remote Monitoring System.

- Inspection and planning for Instrumentation

- Preparation for Monitoring

- Structural Instrumentation Works

Unique Image of Geomotion– Real Time Monitoring (RTM)

The Unique image of Geomotion (Singapore) is known for its "Real Time Monitoring Services Standards". Incorporating and utilizing the latest information technology and adopting "GeoMechanics Application". Geomotion (Singapore) fees for providing Real Time Monitoring services are reasonable but yet produces one of the more effective solutions for today's Singapore Geotechnical Field requirements.

Geomotion (Singapore)'s market niche is being competitive and providing the most effective solutions for "GeoMechanics Application", and this is due to its strength and dedication. Most of Geomotion (Singapore) Real Time services are NOT from off-the-shelf Supplier's ready-made design but tailored by Geomotion (Singapore) in accordance to our client's specifications and needs.

Today, Geomotion (Singapore) is one of the foremost for providing services on "Real Time Monitoring Systems" with no exception on the applications. Geomotion (Singapore)'s RTMS covers all available kinds of sensors from 3D Total Station (Survey), Vibration Monitoring, Tilting and Cracks Monitoring, Stress and Strain Monitoring to Piezometric Level Monitoring.

Geomotion (Singapore)'s approach is simple, effortless and with no limitation of locations, times and weather. All that is needed is only a Computer or Notebook, a server to act as a data-base with internet wifi technology and wireless telephone (GSM, GPRS or Fixed Lines besides Radio Frequency and or Blue Tooth communication mode).

Since the company incorporated in 2001, Geomotion's Real Time Monitoring, data management and software were internal and owned. The data management software is **"GeoMon"** and hosted and operated for various clients including Land Transport Authority and their civil contractors. Billions of vital information and billions of data were efficiently handled by Geomotion and utilized by the clients essentially in MRT Circle Line Construction and Kallang Paya Lebar Expressway Construction Phases.

Due to the merger and acquisition process in 2012, Geomotion Real Time system is continued however, the data management system is migrated to "**ARGUS"** database (UK) in which owned by "itmsoil" UK Holding which was major shareholder of Geomotion at time.

Moving forward and towards efficiency, Geomotion Real Time System provide the full spectrum of services utilizing "**Maxwell Geosystem**" Database and Real Time Monitoring System now.

Installation of Automatic Inclinometer in MRT's (Mass Rapid Transit) 1st reserved zone.

Geomotion (Singapore)'s 3D Automatic Station (RTM)

No compromising on safety in the MRT is essential. Any development near or at the proximity of MRT is required to access the MRT tracks are in line with safety levels.

Implementation of 3D total stations (robotic type) is so far the only solution to above matter.

3D total station services are one of major theme in the line of Geomotion (Singapore) services. Currently 4 numbers of total stations are safeguarding to our clients' construction development.

Preparation for Electro Level Sensors & Crack meter for sensitive building monitoring

Geomotion (Singapore)'s Automatic Inclinometer (IPI) - RTM

A series of Automatic Inclinometer (known as IPI) are in placed along the corridor of new development in order to ensure the safety of works and to public. (From Circle Line Stage-2, Contract 823)

Crucial and vital for accessing the deformation status while construction progresses and public transportation is concurrently taken place.

A total of 14 numbers of inclinometer are in progress for Geomotion (Singapore) RTM service. Having IPI is very uncommon service in Singapore Geotechnical field, yet Geomotion (Singapore) is the one of very few contractors that able to provide.

Automatic Type 3D Total Station in Monitoring

Geomotion (Singapore)'s Tilt and Crack meter (RTM)

Protecting the heritage buildings during the construction are the most headaches. Proper planning and choice of right instruments is the only solution to the problem.

Geomotion (Singapore)'s systems for such cases have never been made easy before. Systematic arrangement, planning and implementation of Geomotion (Singapore)'s tilt and crack real time monitoring will give a peace of mind and assessment for the construction planners and engineers.

Easy, effortless and efficient monitoring is the only solution to handle the construction problems associated with the heritage buildings.

Milestone Projects

Since the establishment of Geomotion (Singapore), we have carried out numerous projects using our services and specialties. This is a result of the confidence and trust that our customers have with Geomotion (Singapore). This is a testament to our high service standards.

The first milestone project was "Geotechnical Instrumentation Works for New M.R.T Circle Line 1 Contract 825". From the beginning of 2002, Geomotion (Singapore) had secured millions of dollars' worth of projects on Real Time Geotechnical Instrumentation Projects.

Past Projects

- **Circle Line Stage-1: Contract-825** (Fully completed)

  Client: Woh Hup-STEC-NCC Joint Venture.
  Contract value: S$ 2.3 million
  Scope of works: Geotechnical Instrumentation & Monitoring.
  Real Time Monitoring System implemented on 5 Stations and several heritage buildings. Numbers of geotechnical instrument involved are more than thousands and billion data were managed and handled over the period of 7 years

- **Kallang Paya Lebar Expressway (KPE) Contract: 421** (Fully completed)

  Client: SembCorp Engineers & Constructors Pte Ltd.
  Contract value: S$ 1.5 million
  Scope of works: Geotechnical Instrumentation & Monitoring.
  Real Time monitoring involved in full stretch of Cut and Cover tunnel along Expressway Construction Route over the period of 6 years

- **Kallang Paya Lebar Expressway (KPE) Contract: 422** (Fully completed)

  Client: SembCorp – Daewoo Joint Venture.
  Contract value: S$ S$1.25 million
  Scope of works: Geotechnical Instrumentation & Monitoring.
  Real Time monitoring involved in full stretch of Cut and Cover tunnel along Expressway Construction Route as well as MRT viaduct monitoring where construction went through underneath. Monitoring period is approximately 4 years.

- **Circle Line Stage-2: Contract-823** (Fully completed)

  Client: Lum Change Building Contractors Pte Ltd.
  Contract value: S$ 1.1 million
  Scope of works: Geotechnical Instrumentation & Monitoring.
  Comprehensive Real Time Monitoring covering full spectrum of instrument was provided for the period of 7 years as the construction was for a new interchange station to existing Paya Lebar MRT.

- **Geotechnical Instrumentation Works for Cable Tunnel (Jurong Island to Pioneer) (Fully Completed)**

  Client: Singapore Power Assets.
  Contract value: S$ 3.5 million
  Scope of works: Geotechnical Instrumentation.

GEOMOTION was awarded for procurement of all necessary instrumentation, hardware, accessory, software and the supply of labor and services for the installation and removal of monitoring instrument in accordance with the Contract requirement. Geomotion was responsible for supply of manpower, read-out units, equipment and services as necessary for the collection of monitoring data from instruments installed under the Contract or by others at the specified frequencies. At the beginning, GEOMOTION have carried out in collection, verification, compilation of instrumentation proposals and drawings and followed up for reproduction and submission to the SO for acceptance of the instrumentation plan(s) before installation.

In this Cable Tunnel Project, real time monitoring system (IDMS system) was to be implemented for continual up-to-date viewing of the monitored results by project personnel. To fulfill this requirement, GEOMOTION had worked to procure, install and maintain the system (including all necessary software and hardware) necessary for collection, and transmission of real-time monitoring instrumentation data. Monitored data were verified and uploaded on a daily basis into IDMS.

Before work start, we were responsible to apply and obtain permit, clearance from authorities such as LTA, SLA, NEA, NPark, PUB, SPPA etc. and private owners for the installation, monitoring, replacement, removal of instruments in/on their properties. Necessary NCD (Notification of Cable Detection) and NCE (Notification of Commencement of Excavation) application were made after sub-surface utilities detection was done by licensed cable detection workers. Those calibration certificates of instruments and monitoring devices were prepared and submitted to the clients and qualified persons of supervision, QP(S) team prior to ground boring work. During ground instrument installation works, environmental controls and measures such as prevention of mosquito breeding, etc. were paid attention and taken care of the area. After installation of instruments, we were to carry out inspection, testing and other incidentals necessary for the proper execution of the Works throughout the project

After installed/monitoring of instruments, GEOMOTION was responsible for collection, authentication, interpretation, compilation and submission of those data in a timely manner as specified to the acceptance of the SO, QP(D), and QP(S), and to compile the report separately for submission to the respective stakeholders. In the factual reports, GEOMOTION carried out for summarizing and presentation of monitoring data in tables, graphs, contours and specific structure or excavation reports, in combination with relevant construction activity as and when requested by the SO.

During the course of work, GEOMOTION was responsible for protection, maintenance and replacement of damaged, missing and malfunctioned instruments to ensure the continuity of monitoring data at all times throughout the period of the Contract. Thus we coordinated the installation, monitoring, maintenance and replacement of the instrumentation with the Main Contractor and QP(S) to make sure for no delay or lapse for the retrieval of data. We attended all meetings and inspections (daily, weekly or monthly) called by the SO, QP(D), QP(S) or the Main Contractors.

In this project, 3 main shafts, 2 temporary shafts were excavated to required depth where 5.2 km long cable tunnel was to be excavated by Tunnel Boring Machines. All the required

instruments were installed prior to the excavation. Around 40 industrial buildings and structures along the tunnel route were protected and monitored with relevant instruments. The followings instruments were installed in this project.

Structures to be monitored / protected	Types of Instruments installed
Main & temporary shafts	Inclinometers (in-wall & in-soil) Piezometers (Vibration wire type, water stand pipes) Settlement markers (ground and building types) Prisms (XYZ co-ordinates) Rod extensometers Strain gauges (steel struts in shafts)
Along Tunnel route	Inclinometers (in-soil) Piezometers (Vibration wire type, water stand pipes) Settlement markers (ground and building types) Rod extensometers (above tunnel crown)
Industrial buildings, structures, gas pipes, cables, drains, utilities etc.	Piezometers (Vibration wire type, water stand pipes) Settlement markers (ground and building types) Prisms (XYZ co-ordinates) Vibration meters Noise meters Crack meters Tilt plates

All other works and services necessary, ancillary or related to the completion of the Works in accordance with the Employer's Requirements were performed in the project.

- **Geotechnical Instrumentation Works for Changi East**

  Client: KTC Engineering & Construction Pte Ltd
  Contract value: S$ 22.13 million
  Scope of works: Geotechnical Instrumentation.

The civil contractor, KTC's work is for land preparation (ground improvement work) of existing hydraulic filled reclaimed land at Changi East. Geomotion was awarded for the planning, installation, maintenance, calibration, repair, re-instatement, removal, data acquisition, reporting of the instrumentation works.

Geomotion's scope of work included to install and monitoring of civil contractor's ground improvement working areas such as Prefabricated Vertical Drain (PVD) Installation Area, Cement treatment Work Area, Deep Compaction Work Area, Ground Improvement Area, Neighboring Areas, Existing Structures and Runways.

For PVD working, the following instruments were installed and monitored to evaluate the progress of consolidation of underlying soft clays;

- Vibrating wire strain gauge piezometers – to evaluate the excess pore water pressure
- Casagrande type water standpipe – to assess ground water level
- Surface settlement plates – steel plates for measurement of ground settlement
- Deep settlement points – rod extensometers with anchors fixed in compressible soil layers to determine the settlement of each soil layer.
- Multi-level extensometer – to monitor the settlement of different layers after multiple spider magnets fixed in those layers.
- Earth pressure cells – to measure the stress imposed by the preload placed above
- Deep subsurface reference points – to serve as a stable survey level benchmark.
- Inclinometers – to monitor the tilt or horizontal deformation of the soil near to the preloading surcharge edge
- Survey stakes – to monitor the vertical deformation of embankment surfaceand ground surface.

For cement treated works, the following instruments were installed and monitored;

- Surface settlement plates / heave stakes
- Deep subsurface reference points
- Inclinometers

In deep compaction areas, the following are installed to monitor the progress of compaction;

- Surface settlement plates / heave stakes
- Deep subsurface reference points

- Vibration meter – to monitor the vibration magnitude of ground during the cement treatment works

Necessary instruments were installed to monitor any impact on the future runway, existing runway, taxiway, parking apron, drains, canals, Changi Water Reclamation Plant etc. by Civil Contractor's ground improvement works. In addition to the ground instruments, building settlement markers, crack meters, tilt-meters and 3D XYZ prisms were installed.

On top of conventional manual monitoring, the following instruments were set up with auto-real time monitoring;

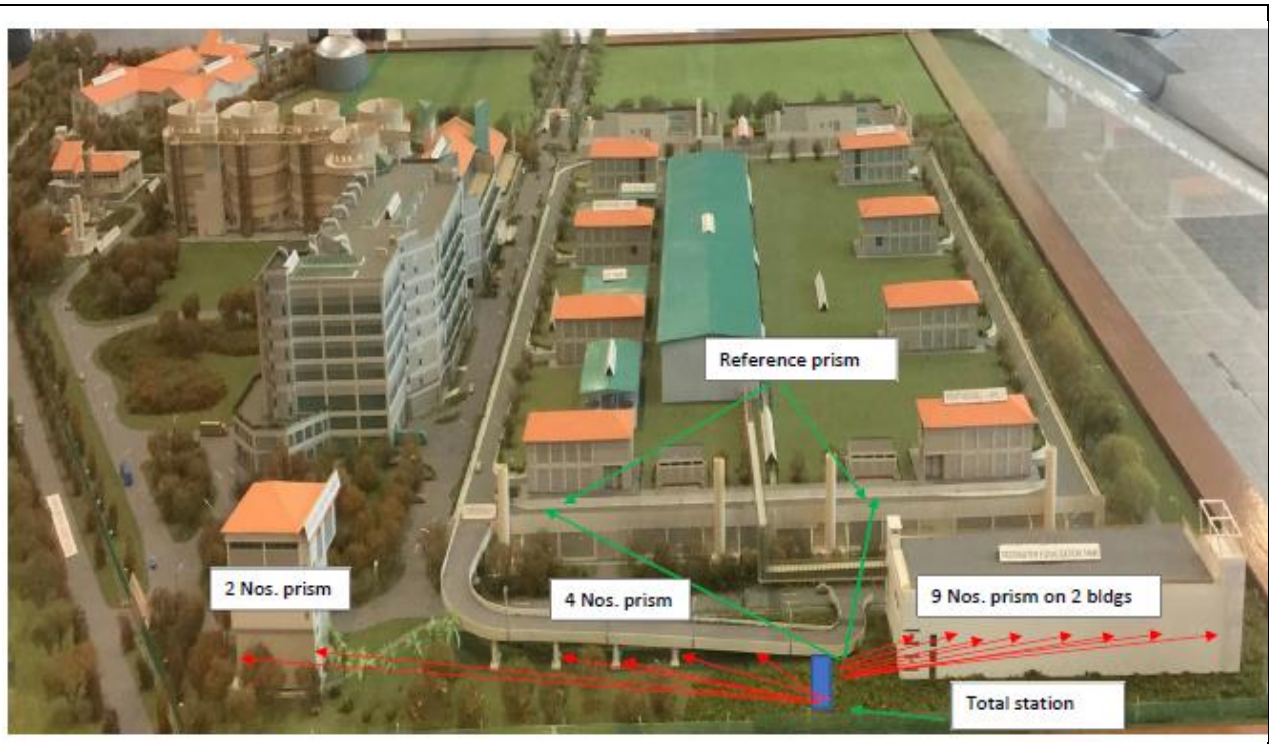
- Vibration wire strain gauge piezometers
- In-place inclinometer
- DEX system (multi-level settlement monitoring)
- Vibration meter
- 3D prisms (automated total station monitoring)

In this Project, MISSIONOS data management system was established for continual up-to-date viewing of the monitored results by project personnel. This system has been implemented on Asia and Australia's largest projects featuring tens of thousands of instruments, multiple data logged machines, video cameras and environmental monitoring. The system is a collaborative environment platform for sharing information such as monitoring data, technical data & process data, managing changes and monitoring risks. Monitored data were collected, verified and uploaded on a daily basis into the system.

Manual monitoring and real time monitoring were carried out according to the specified monitoring frequency. Hourly, daily, weekly and monthly monitoring reports were submitted in time as required. Different clearance for the related authorities were applied according to the site condition. All the requirements from the client / QPS/QPD were successfully fulfilled in time.

	
Settlement markers and deep vibration meter at Vibro Floatation Treatment Area	Deep settlement plate at Surcharge Area

	
Real time In-place-inclinometer installation	In-place-inclinometer and data logger (Real time monitoring system)



Prism and Total Station Installation inside Industrial Building

Current Projects

- **Geotechnical Instrumentation Works for MRT Construction Contract T3122**

  Client: Land Transport Authority
  Contract value: S$ 5.36 million
  Scope of works: Geotechnical Instrumentation.

The civil contract T 312 is the excavation and construction of Sungei Bedok Station and cut and cover tunnel for LTA's Thomson-East Coast MRT Line.

GEOMOTION was awarded for procurement of instrumentation, hardware, software and the supply of labour and services for the installation of monitoring instruments. In hardware system, the work included to supply manpower, read-out units, equipment and services as necessary for collecting monitored data from installed instruments. Geomotion is responsible for collection, verification, compilation, interpretation and submission of monitoring data in a timely manner as specified to the acceptance of the Superintending Officer (SO). In field work, we are assigned to protect, maintain and replace of damaged, missing and malfunctioned instruments to ensure the continuity of monitoring data at all times throughout the period of the contract.

Two major scopes of instrumentation work to be installed and monitored were;

Building / structure instruments - Surrounded existing buildings, structures, roads, drains, underground services are to be monitored with instruments to observe any destructive impact due to the excavation of tunnel. It is for timely remedial action or protection to be placed on structures in case it is necessary.

Ground instruments – It is to monitor the response behaviour of the neighbouring ground due to the excavation of proposed cut and cover tunnel.

The existing buildings and structures were observed and monitored by installation of ground settlement markers, building settlement markers, crack meters, vibration meters, etc. It is to monitor any structural defect occurred on them due to deep excavation by civil contractor.

The behaviour of ground response after excavation was monitored by inclinometers, extensometers, vibration wire type piezometers, water standpipes, ground settlement markers, etc. Those were installed along the specified instrument array lines by consultants. In wall inclinometers were installed inside diaphragm walls constructed along the perimeters of excavation box to monitor the horizontal movement.

	
Water standpipe installation	Magnetic extensometer installation

Before work start, we were responsible to apply and obtain permit, clearance from authorities such as LTA, SLA, NEA, NPark, PUB, SPPA etc. and private owners for the installation, monitoring, replacement, removal of instruments in/on their properties. Necessary NCD (Notification of Cable Detection) and NCE (Notification of Commencement of Excavation) application were made after sub-surface utilities detection was done by licensed cable detection workers. Those calibration certificates of instruments and monitoring devices were prepared and submitted to the clients and qualified persons of supervision, QP(S) team prior to ground boring work. During ground instrument installation works, environmental controls and measures such as prevention of mosquito breeding, etc. were paid attention and taken care of the area. After installation of instruments, we were to carry out inspection, testing and other incidentals necessary for the proper execution of the Works throughout the project.

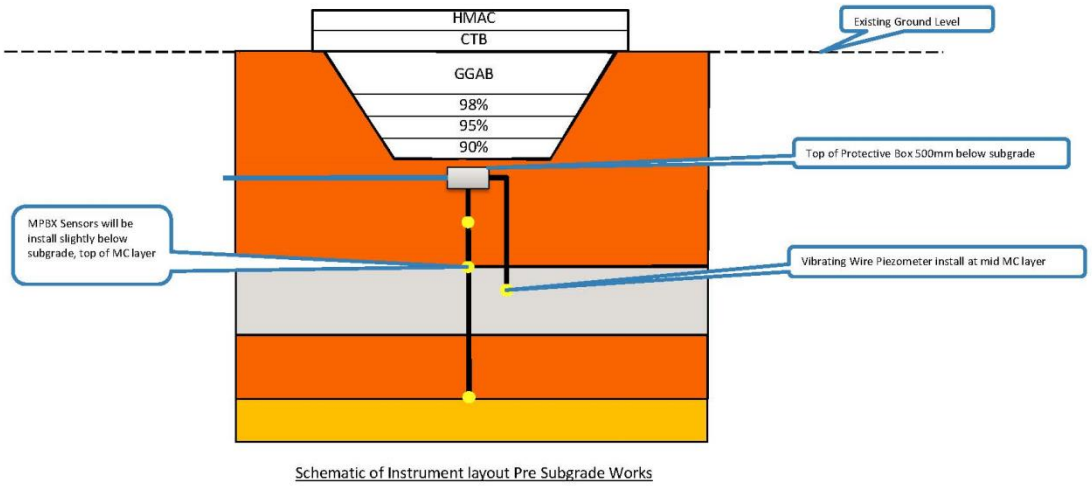
In this Project, MISSIONOS data management system was established for continual up-to-date viewing of the monitored results by project personnel. This system has been implemented on Asia and Australia's largest projects featuring tens of thousands of instruments, multiple data logged machines, video cameras and environmental monitoring. The system is a collaborative environment platform for sharing information such as monitoring data, technical data & process data, managing changes and monitoring risks. Monitored data were collected, verified and uploaded on a daily basis into the system.

- **Geotechnical Instrumentation Works for Changi Package-1**

  Client: Samsung-Koh Brother Joint Venture
  Contract value: S$ 1.27 million
  Scope of works: Geotechnical Instrumentation.

SSKBJV scope of works is to carry out compaction works for the top 2 m at the respective work areas. The objective of the instrumentation work is to determine whether there is any residual long term settlement in the Marine Clay layers that has been treated and if there are any significant pore pressure changes.

To achieve this objective, GEOMOTION was awarded for installation of 73 locations with MPBX (Multipoint Borehole Extensometers) together with Vibrating Wire Piezometers (VWP) in a Cluster as a pair. The MPBX will consist of 2 Sensors + 1 Datum and VWP will be a single tip as shown in Fig. 1. All MPBX and VWP will be cabled to a termination location and connected to a wireless node for data transmission to a gateway as shown in below figure.



Schematic diagram for installation of MPBX and GWP

	
Cable detection before installation work	Installation of MPBX (Multi point borehole extensometer)

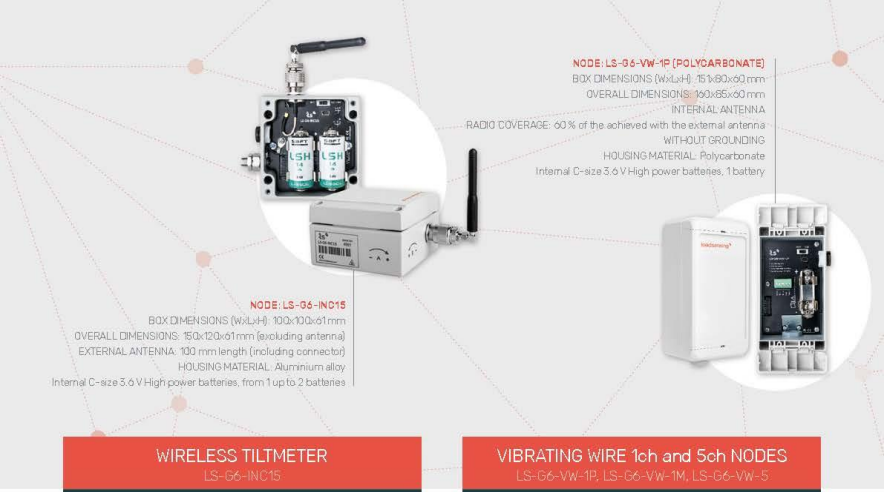
From the gateway, the data is further transmitted to our server for data processing and interpretation.

The data logger was mounted on the drain wall and that there will not be any interference with the Airside operation. Generally the gateway must be placed at high. The greater the high there will be better the reception. Since the coverage distance of the gateway is more than 5 kilometer, finding a suitable high location may not be a difficult matter. At this project, the gateway was mounted at the client project office. In the event the gateway needs to be move at a later stage, this can be accommodated.

The IT servers are located in Singapore, Australia & Italy. As for the display for reporting of monitoring results, we provided the client with the necessary log-in password to access our web server from their own personal or dedicated computer or computers.

The monitoring system including software's, hardware's, dataloggers, gateways, etc., is maintained 24/7.

Data logger (Node) for wireless monitoring system



WIRELESS TILTMETER
LS-G6-INC15

APPLICATIONS
Remote tilt monitoring from retaining and building walls
Landslide monitoring
Bridge pier monitoring
Structural load monitoring
Ground subsidence

SPECIFICATIONS	
Type:	MEMS (Micro-Electro-Mechanical) Inclinometer
Range:	± 15º
Accuracy (± 5º):	0.03% FS / 0.004º
Accuracy full range:	0.17% FS / 0.025º
Resolution:	0.001º
Repeatability:	0.005º
Axes:	Two (biaxial)
Temperature sensor resolution:	0.1 ºC
Temperature sensor accuracy:	±0.5 ºC

BATTERY LIFE ESTIMATION Wireless tiltmeter

SAMPLING RATE	Barcelona temperature profile*	Singapore temperature profile*
5 min	1.2 years	1.1 years
1 h	5.8 years	4.7 years
6 h	8.3 years	6.4 years

* Estimations for 2 x saft LSH 14 batteries

VIBRATING WIRE 1ch and 5ch NODES
LS-G6-VW-1P, LS-G6-VW-1M, LS-G6-VW-5

VIBRATING WIRE NODE 1ch and 5ch	
VIBRATING WIRE	
Measurement method: Embedded algorithms increasing immunity to noise	
Excitation wave:	+/- 5 V
Measurement range:	300 to 7,000 Hz
Resolution (-40 to +85ºC):	0.12 Hz
Accuracy (-40 to +85ºC):	0.018 % FS
THERMISTOR	
Measurement range:	0 ohm to 4 Mohm
Resolution:	1 ohm
Accuracy (20ºC):	0.05ºC (0.04 % FS)
BAROMETER	
Pressure Range:	300 to 1,100 hPa
Relative Accuracy (950 to 1,050 hPa at 25ºC):	±0.12 hPa

BATTERY LIFE ESTIMATION Vibrating wire nodes

CHANNELS & SAMPLING	BATTERIES*	BATTERY LIFE ESTIMATION*
1 CH 5 min	1 cell	3 years
1 CH 30 min	1 cell	7 years
5 CH 5 min	1 cell	1,5 years
5 CH 5 min	4 cell	5 years
5 CH 30 min	1 cell	4 years
5 CH 30 min	4 cell	>10 years

* Nominal capacity of each battery: 5.8 Ah. Considering laboratory conditions

Specifications are subject to review and change without notice

Gateway for wireless monitoring system

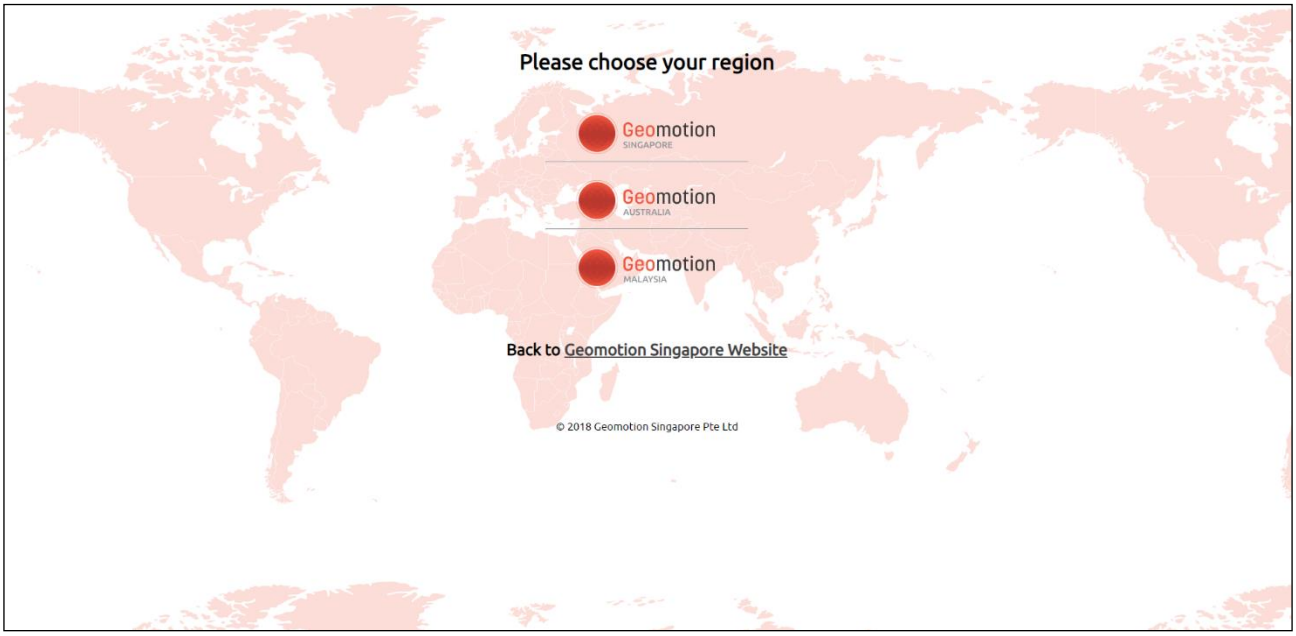
ATHENA – Real Time and On-line Data Reporting Application

ATHENA is an in-house web and mobile application that allows customers and engineers monitor the latest technical data and progress of on-going projects, developed by Geomotion (Singapore) Pte Ltd. Such web and mobile application enhance the competitiveness of Geomotion and productivity of engineers.

Software Features

The following are the features are being made available for the application:

- User access control management
- Project management, Data polling, Data processing
- Manual data input by engineers for geotechnical instrumentation results.
- Display of project and instruments' geo-location on live maps
- Web interface for administrators/ end users that are using a computer.
- Mobile app for users that are on mobile devices (TBA)
- Data replication feature to synchronize processed data among multiple database servers to allow scaling of operation size and to enhance reliability of the whole solution.
- Plotting and reporting feature to generate PDF reports required by customers and engineers.
- Notifications to relevant parties via SMS, e-mails, and push-notification on mobile devices



Software Features Shown in Graphical Diagram

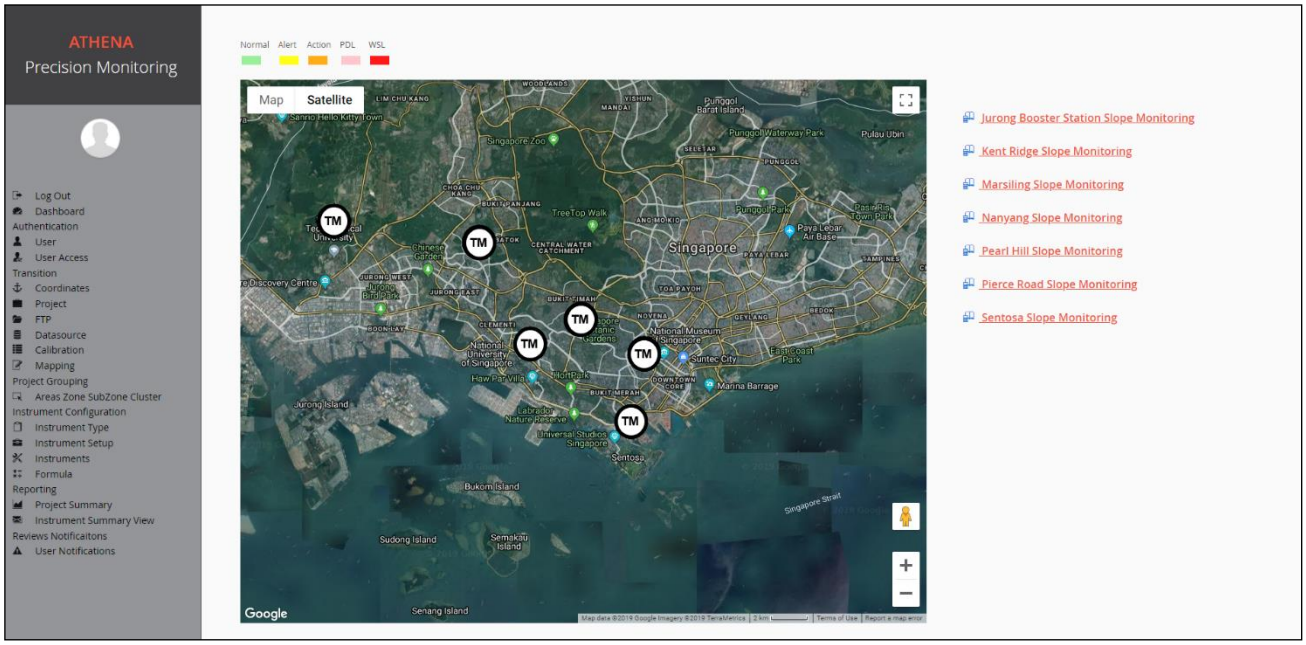
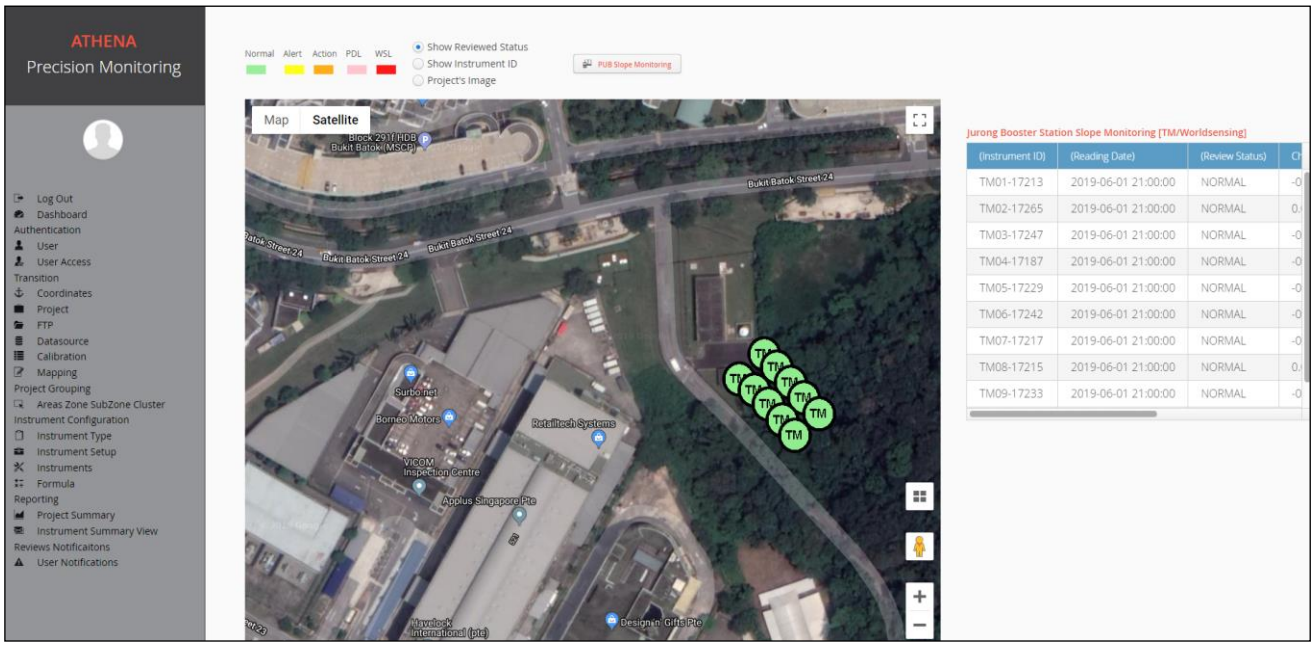


Fig: Project location in the live map



Figures: Instrument location and brief summary of instruments in the dashboard

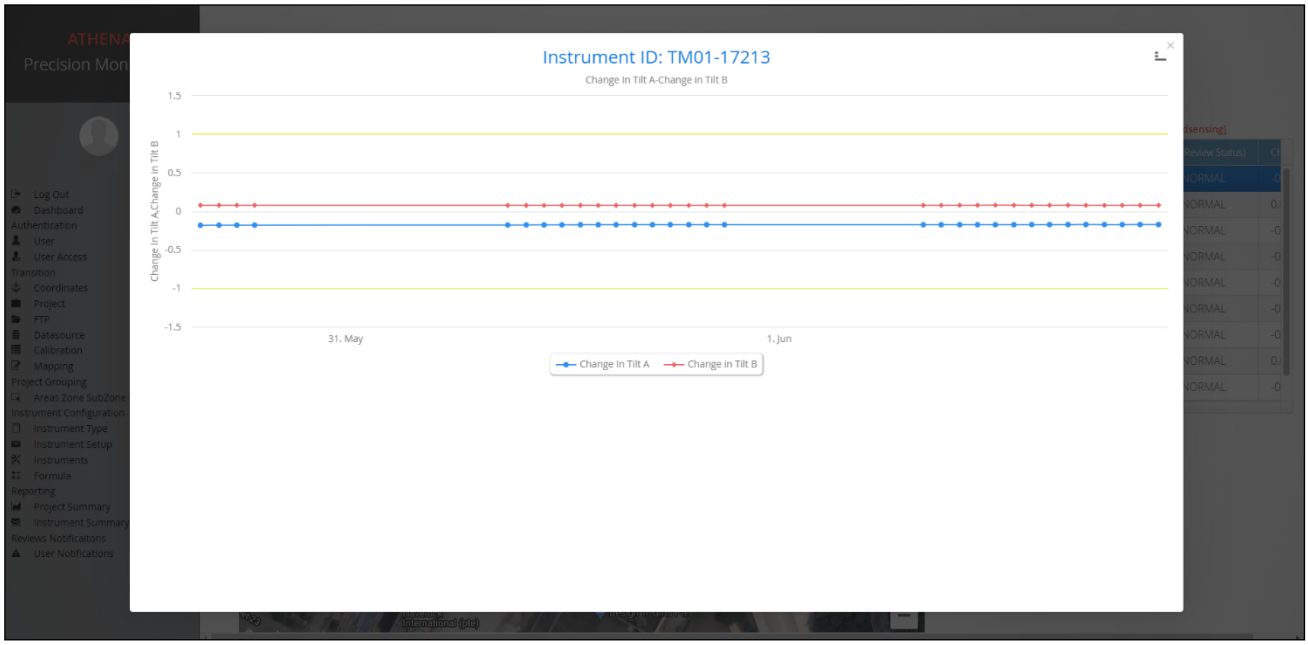
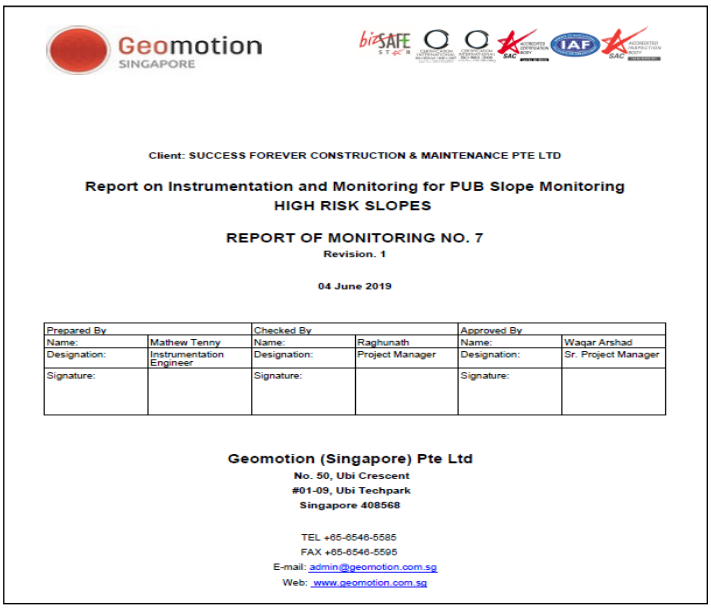


Fig: Graphical display of an instrument data



Geomotion SINGAPORE

Client: SUCCESS FOREVER CONSTRUCTION & MAINTENANCE PTE LTD

Report on Instrumentation and Monitoring for PUB Slope Monitoring
HIGH RISK SLOPES

REPORT OF MONITORING NO. 7
Revision. 1

04 June 2019

Prepared By		Checked By		Approved By	
Name:	Mathew Tenny	Name:	Raghunath	Name:	Wagar Arshad
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Fig: User can generate PDF report via the web application

3. Current Status of Installation and Monitoring

Location	Instrument Type	Qty To Be Installed	Installed Qty	Monitroing Qty	Remark
Pierce Road Slope Monitoring	TM	6	6	6	Within the review level of ±1 degree
Jurong Booster Station Slope Monitoring	TM	10	10	10	Within the review level of ±1 degree
Pearl Hill Slope Monitoring	TM	15	15	15	Within the review level of ±1 degree
Nanyang Slope Monitoring	TM	4	4	4	Within the review level of ±1 degree
Marsiling Slope Monitoring	TM	10	10	10	Within the review level of ±1 degree
Sentosa Slope Monitoring	TM	4	4	4	Within the review level of ±1 degree
Kent Ridge Slope	TM	4	4	4	Within the review

Summary of Monitoring Results

Instrument Details			Initial Reading Date	Last Reading Date	Current Reading		Maximum Reading	
Instrument No.	Location	Installed Date						
TM-2-RT	TM-2-RT	01-04-2018	01-04-2018	03-06-2019	Change In Tilt A	-0.0657	2019-05-06 14:00:00	-0.0446
					Change in Tilt B	-1.0889	2019-05-13 20:00:00	-1.0864
					Temperature	26.4000	2019-05-06 14:00:00	34.9000
TM-3-RT	TM-3-RT	01-04-2018	01-04-2018	03-06-2019	Change In Tilt A	-0.0288	2019-05-05 08:00:00	0.0071
					Change in Tilt B	0.8560	2019-05-05 08:00:00	0.8733
					Temperature	26.2000	2019-05-29 14:00:00	32.0000
TM-4-RT	TM-4-RT	01-04-2018	01-04-2018	03-06-2019	Change In Tilt A	0.2346	2019-05-29 14:00:00	0.2592
					Change in Tilt B	0.2033	2019-05-09 14:00:00	0.2152
					Temperature	26.1000	2019-05-29 14:00:00	32.7000
TM-5-RT	TM-5-RT	01-04-2018	01-04-2018	03-06-2019	Change In Tilt A	-0.0601	2019-05-29 14:00:00	-0.0403
					Change in Tilt B	-0.1623	2019-05-31 14:00:00	-0.1496
					Temperature	25.8000	2019-05-29 14:00:00	33.3000
TM-7-RT	TM-7-RT	01-04-2018	01-04-2018	03-06-2019	Change In Tilt A	0.0378	2019-05-29 20:00:00	0.0504
					Change in Tilt B	0.9386	2019-05-26 14:00:00	0.9807
					Temperature	26.4000	2019-05-26 14:00:00	35.4000
TM-8-RT	TM-8-RT	01-04-2018	01-04-2018	03-06-2019	Change In Tilt A	-0.0416	2019-05-24 20:00:00	-0.0262
					Change in Tilt B	-0.2320	2019-05-24 20:00:00	-0.2047
					Temperature	26.3000	2019-05-29 14:00:00	35.6000

Fig: Summary status of the instruments in the report

Today changes in the "Singapore Construction Environment" are like never before, with a highly competitive and aggressive market. Having the right specialist contractor is one of the assurances for managing the construction smoothly and effectively – thus saving construction costs.

The efficient and full range coverage of services at reasonable price by "Geomotion (Singapore)" is the solution for Today's Singapore Geotechnical Engineering field.