



TECHNICAL PROPOSAL

Revision D

Hampstead Monitoring Scheme

Prepared For

WILLMOTT DIXON CONSTRUCTION

7th July 2016

Revision Table

Revision	Details	Date
A	Issued	23/05/2016
B	Access specifications added	26/05/2016
C	Fixing information added	27/06/2016
D	Access info updated	07/07/2016

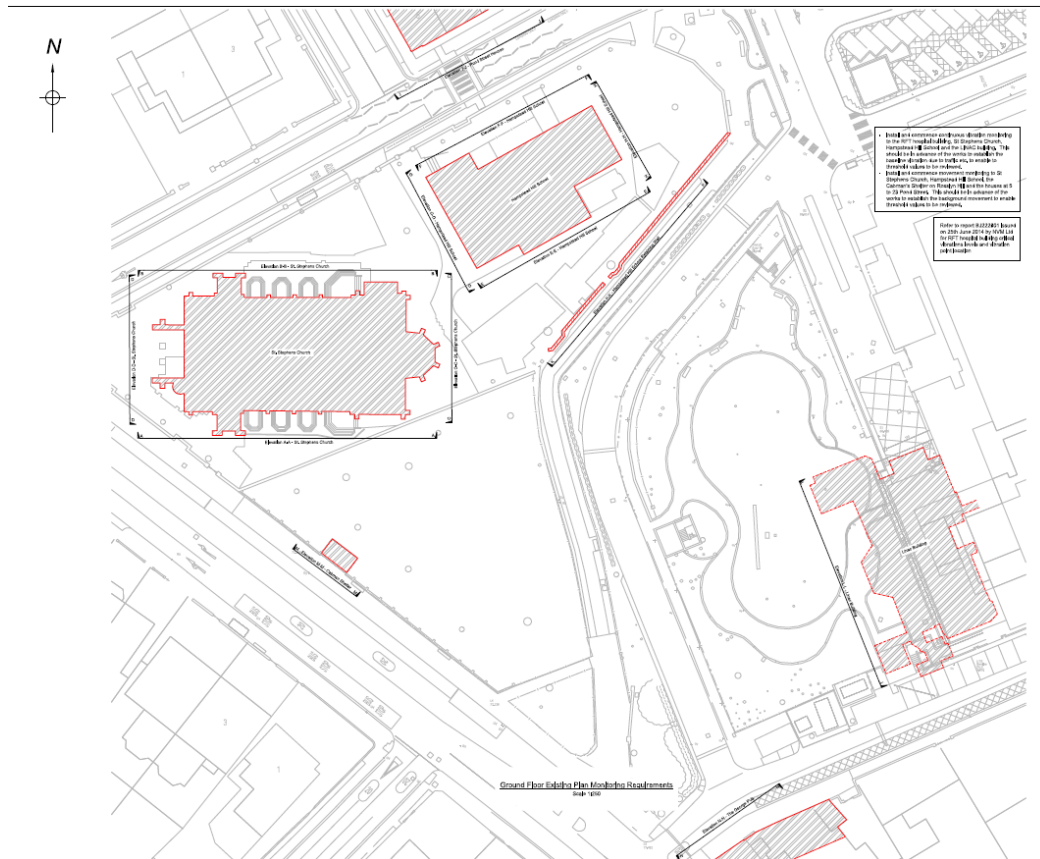
Table of Contents

Revision Table.....	2
Table of Contents.....	3
1 Introduction.....	5
2 System Description.....	6
3 Equipment Details.....	8
3.1 Data Acquisition – Wired Sensors.....	8
3.2 Data Acquisition – Wireless Tilt Sensors.....	9
3.3 Sensors.....	10
3.4 Automatic Total Station.....	12
4 System Technical Details.....	13
4.1 National Instruments cDAQ-9188.....	13
4.2 National Instruments cDAQ-9184.....	13
4.3 Inclination Module NI 9871.....	13
4.4 Vibration Module NI 9239.....	13
4.5 Wireless Transmitter.....	14
4.6 High Accuracy Tilt Sensor.....	14
4.7 Wireless Tilt Sensor.....	14
4.8 Vibration Sensor.....	14
4.9 Automatic Total Station.....	15
4.10 Enclosures.....	15
4.11 Data Connectivity.....	15
4.12 Connectors.....	15
4.13 Cable.....	15

4.14	Screw Bolts	16
4.15	Software.....	16
4.16	LIVEsite	16
4.17	Data Acquisition Frequencies.....	18
5	Equipment Quantities	19
6	Equipment Locations.....	19
7	Access Requirements.....	20
7.1	Access Methods.....	20
7.2	Location Requirements	20
7.3	Access Specifications	20
8	Environmental Monitoring.....	23
8.1	Enviroguard.....	23
8.2	Consultation	23
8.3	EnviroGuard Unit	24
8.4	Power Requirements.....	25
8.5	LIVE Site.....	25
9	Appendix.....	26

1 Introduction

Mabey Hire Instrumentation has been requested by Willmott Dixon Construction to propose a monitoring system that will be used to monitor displacement and vibration on properties in close proximity to the demolition and construction of the new Pears building at the Royal Free Hospital in Hampstead, London.



There are concerns that, due to demolition and construction works for the new Pears building, properties in close proximity to the site boundaries will be influenced. This technical proposal details the proposed solution which briefly consists of:

- Tilt Sensors (high accuracy and wireless types)
- Vibration Sensors
- Automatic Total Stations (ATS)
- Data acquisition/Distribution hardware
- Software (custom written)
- Data Presentation (Website)
- Manual Topographical Surveys

2 System Description

Mabey Instrumentation is proposing a bespoke monitoring scheme for Pears Building and properties within the zone of influence. The scheme has been designed using high accuracy sensors and bespoke data acquisition software to meet such a demanding and critical project. The scheme has been divided in to the following eight monitoring locations:

- St Stephens Church
- Hampstead Hill School
- Hampstead Hill School Retaining Wall
- The George Pub
- Pond Street Residential Properties
- Site Perimeter
- Hospital

A main data acquisition unit will be installed on each of the eight monitoring locations to offer high redundancy to the scheme. On each elevation of the monitoring locations a secondary data acquisition unit will be installed that will be used to monitor sensors on each particular elevation. A main data acquisition unit will be installed in a suitable location on each of the monitoring location above. The main data acquisition unit will be responsible for storing raw data as well as converting the raw data into engineering units. The data is then uploaded to our servers using the latest mobile communication technology, from where engineers will be able to review it when required.

High accuracy inclinometers are used to monitor movement (x & y plane). The proposed tilt sensors are accurate to 0.03mm per meter, making these suitable for this monitoring scheme. High accuracy tri-axial accelerometers (x, y and z plane) will be installed on ground level to monitor ground borne vibration levels from site activities. Moreover, four locations have been selected by the client to monitor vibration levels imposed by site activities, in the main hospital building. These will monitor potential disturbance to hospital activities due to site works. Finally, two Automatic Total Stations and target prisms will be utilised to monitor movement (x, y and z plane) over the residential properties on Pond Street and selected point targets within the site boundaries.

Each instrument will be supplied with a short cable length where at its end an IP67 connector will provide a secure long term connection. The technology implemented by the proposed inclinometers allows for daisy chaining as many as practically possible over a single cable. This allows for smaller installation time compared to the traditional installation method (individual cable line for each sensor).

Inclinometers and wireless tilt sensors will be fixed on the identified locations using M6 thunder bolts which allow for secure fixing as well as those can be removed without any part being left permanently to the structure. Accelerometers will be enclosed in IP66 housing for protection against environmental factors. These will be fixed in the identified locations using drop in anchor bolts (St Stephens Church & Hampstead Hill School) as well as appropriate adhesives (Hospital Building).

The Automatic Total Stations and Prisms (Survey and Monitoring) will be fixed in secure locations using M6 thunder bolts (Prisms) and recommended security enclosure (Automatic Total Stations). To enable slipping of St Stephens Church and Hampstead Hill School a number of prisms will be monitored on selected locations on those two properties. Back Sight prisms will need to be installed on a few properties to produce accurate readings.

An additional amount of target prisms will be installed on each of the eight monitoring locations and an initial manual survey will be carried out. Additional manual surveys will be conducted, in discretion of the client, based upon observation of measurements from the inclinometers.

3 Equipment Details

3.1 Data Acquisition – Wired Sensors

3.1.1 NI Master Logger Chassis

Bespoke monitoring systems will be implemented for this monitoring system. The data acquisition will be based on the NI cDAQ-9188 and NI cDAQ-9184. These are modular National Instruments Ethernet chassis designed for distributed or remote measurements in rugged environments.



With a temperature range of -40 to 70 °C, 50 g shock, 5 g vibration operating specifications, and Class 1 Division 2 and Ex hazardous location certifications, measurements are possible anywhere. Each chassis can measure up to 64 channels of electrical, physical, mechanical, or acoustic signals.

With the cDAQ-9188 and cDAQ-9184, you can configure a watchdog timer for any of the output channels (analogue, digital, or counter) used on the chassis. This feature provides a fail-safe mechanism to adjust specified output channels to user-preconfigured voltage levels or logic states if the user does not reset the watchdog timer or if an undesired event occurs such as the Ethernet cable becoming disconnected.

National Instruments systems combine sensor measurements with voltage, current, and digital signals to create custom, mixed-measurement systems with a single Ethernet interface back to a main computational unit. Modules are available for a variety of sensor measurements including thermocouples, RTDs, strain gages, load and pressure transducers, torque cells, accelerometers, flow meters, and microphones.

3.1.2 NI Modules

In order to measure the sensors, NI modules are required. These modules connect to NI chassis and the sensors. Specific modules are required for specific sensors.

3.1.3 Inclination Modules NI 9871

Inclination instruments are selected on digital bus output basis. This minimises the risk of inaccurate measurements due to noise and voltage drops across lengthy cable installations. The selected module for these measurements is the National Instruments 9871 module with 4No. RS 485 input channels for high-performance control and monitoring applications.



3.1.4 Vibration Modules NI 9239

The NI 9239 module has been selected to measure vibration. The NI 9239 is an analogue input module for use in NI CompactDAQ or CompactRIO systems. Each channel provides a ± 10 V measurement range at a 24-bit resolution. The NI 9239 outputs 50 kS/s of data at the maximum sampling rate. Designed for both speed and accuracy, the NI 9239 is an effective general-purpose analogue module because of its resolution, sample rate, and input range. This module is a voltage type and measures volts.



3.2 Data Acquisition – Wireless Tilt Sensors

3.2.1 Wireless Transmitter

The Mabey Universal Wireless Transmitter is a unit that has been developed in such a way that can be utilised with a wide variety of sensors. The small size of the Mabey Universal Wireless Transmitter allows small installation times. Each unit is calibrated individually to a UKAS traceable level with each of our displacement measuring products. This allows higher accuracy readings to be obtained.

The transmitter utilises the IEEE 802.15.4 protocol which is used for high level communications. Each transmitter is installed in a safe and secure IP67 orange enclosure. This enclosure carries the Mabey Universal Wireless Transmitter which has a range of transmission that exceeds 500 meters (clear line of sight).

The design of the transmitter allows for high battery life times that can exceed 5 years maintenance free periods and at the same time small factor design (based on sampling rates of 30 seconds or higher). An internal Omni-directional antenna is used to transmit the signal back to our logging base station.

In challenging situations signal point-repeaters are strategically positioned to ensure that all measurements are safely transmitted back to our logging base station. This repeater utilises the same technology which allows for long maintenance free periods.

A threshold level can be programmed on the transmitter units, which allows the sampling intervals to become more frequent in the event of that threshold being exceeded. Nominal sampling intervals are restored once the measurements return to the area below the predefined threshold for a predefined period of time or a set number of consecutive number of samples is below the predefined threshold.

3.3 Sensors

3.3.1 High Accuracy Inclinometer Sensors

The RST in place inclinometer measures two axial planes perpendicular to the surface of the base plate. The electronics are housed in a NEMA 4X (IP-65) enclosure for environmental protection, and is typically bolted to the structure. For maximum resistance against water ingress, the cable is typically hard wired to the enclosure. The interconnecting cable is suitable for outdoor use. A digital bus signal output is selected, allowing several inclinometers to be daisy-chained on a single cable.



3.3.2 Wireless Tilt Sensors

The wireless tilt sensor proposed is a high performance inclination sensor designed for use in the toughest environments. The measurement range of the sensor is $\pm 15^\circ$. The sensor is enclosed in an IP66 orange enclosure which offers a high level of protection against environmental factors. The device has inherently good temperature stability, which is improved further by temperature compensation over a range of temperatures. The sensor outputs data via a wireless transmitter.



3.3.3 Vibration Sensors

The 4332M3 is 4-20mA output MEMS tri-axial accelerometer offering both static and dynamic response. The accelerometer is packaged in corrosion resistant stainless steel housing and has a $\pm 5g$ range. The model 4332M3 features an integral cable and is certified to IP68 protection up to 40m depth with an operating temperature range of -40°C to $+85^\circ\text{C}$.



3.3.4 Enclosures

The data acquisition systems used for the monitoring scheme will be installed in IP66 stainless steel enclosures that will be positioned strategically on each structure to allow minimal cable lengths and least invasion. Each one of these will house one NI chassis and the related modules.



3.3.5 Data Connectivity

3G Data connection will be provided by a Sierra Wireless modem which will be housed in an individual stainless steel enclosure. The AirLink® LS300 gateway has a small footprint for easy installation and a rugged, military spec design (MIL-STD 810) that enables it to withstand extreme temperature changes, humidity, shock, and vibration. This network link provides standard with Ethernet, serial, digital I/O, and USB interfaces, as well as GPS.



3.3.6 Connectors

Harting Han 3A connectors of the Han® Q series, e.g. the Han® Q3/0, Han Q4/0 and Han® QHD in particular require a wider cable entry, especially if they are to take full advantage of their strengths. The new hood is compatible with all existing Han® 3A contact inserts. As such, it meets the requirements for IP 65/67 and significantly expands the application options and potentials of the Han® 3A interface thanks to its wider cable entry.



3.3.7 Cable

The selected cable for this monitoring scheme is a twisted pair 24awg Overall Foil Screen PE. This cable is designed for outdoor use and is ideal for saline environments. The insulation of the cable is made from Polyethylene, where the twisted pair has an overall foil coverage. This cable is CE 450 / 750 V approved and its operating temperature is 80°C.

3.3.8 Fixing Details

Each sensor will be mounted on to brackets specifically designed for that sensor. The brackets will have fixing holes designed so that drilling in to the bricks should be avoided. Dependant on the condition of the mortar Mabey will endeavour fix the brackets in the mortar between the bricks. However if the mortar condition is not of good enough quality then the brackets will need to be fixed to the brick.



The brackets will be fixed to the wall using M6 x 50mm masonry screw bolts which will require a 5.5mm hole in the mortar/brick. By using screw bolts it means that removal is easier by not leaving a plastic plug or metal casing in the wall.

3.4 Automatic Total Station

The monitoring system will use Leica TM30's. The TM30 is a total station specially developed for monitoring and surveying sites. These motorized sensors ensure that measurements to prisms attached directly to the structure are taken and recorded around the clock. Meteorological sensors will be installed to correlate weather conditions and web cams can also be installed if required. The total station will need to be positioned in a settlement-free area and protected from the weather, vandalism, and theft by a specially manufactured housing.

The TM30 will be used in the ATS systems and for the topographical surveys.

3.4.1 Total Station TM30

A Leica TM30 Robotic total station will be employed:

- EDM Precise mode accuracy 0.6 mm + 1 ppm
- Angle measurement accuracy 0.5"
- Time of measurement 7 s
- Compensation Centralised quadruple axis compensation
- External supply voltage Nominal voltage 12.8 V DC
- Protection rate IP54



3.4.2 Leica GMP104 Prism

The TM30 will use GMP104 prisms to perform measurements. Each asset will have prisms fixed at key locations. The GMP104 prism is suitable for permanent installations even in extreme environments. The GMP104 Mini Prism is fixed in a metal housing, providing an extremely robust and precise monitoring target. Supplied with an L-bar for easy installation.

- Prism Constant: 8.92mm
- Range: 2000m



3.4.3 Leica GPR112 Monitoring-Mining Prism

The TM30 will use GPR112 prisms back-sights which will act as reference points for the ATS. See specification below:

- 60mm visible diameter for long range
- M8 Stud fixing
- In built filter to reduce condensation drying time
- For use in damp and wet conditions
- Rain shelter protects against rain and snow



4 System Technical Details

4.1 National Instruments cDAQ-9188

Number of Slots:	8
Temperature Range:	Standard: -40° to +70°C
Operating Relative Humidity:	10 % - 90 %
Power Requirements:	9 to 30 V dc
Operational Shock:	50 g
Random Vibration:	10 Hz - 500 Hz
Random Operating Frequency:	5 g

4.2 National Instruments cDAQ-9184

- Number of Slots: 4
- Temperature Range: Standard: -40° to +70°C
- Operating Relative Humidity: 10 % - 90 %
- Power Requirements: 9 to 30 V dc
- Operational Shock: 50 g
- Random Vibration: 10 Hz - 500 Hz
- Random Operating Frequency: 5 g

4.3 Inclination Module NI 9871

- 4 RS485/RS422 (TIA/EIA-485/422) ports for CompactRIO
- Baud rates from 14 baud to 3.684 Mbaud; -40 to 70 °C operating range
- Data bits: 5, 6, 7, 8; Stop bits: 1, 1.5, 2; Flow control: XON/OFF, RTS/CTS, None
- Individual 64 B UART FIFO buffers per port
- Transceiver modes: 4-wire, 2-wire DTR controlled, 2-wire DTR controlled with echo, 2-wire auto
- 8 to 28 VDC externally powered; PC-MF4-PT cable included

4.4 Vibration Module NI 9239

- 4 differential channels, 50 kS/s per channel sample rate
- ±10 V measurement range, 24-bit resolution
- Antialias filter
- 250 Vrms ch-ch, CAT II (screw terminal), or 60 VDC ch-ch, CAT I (BNC) isolation
- Screw-terminal or BNC connectivity
- -40 °C to 70 °C operating, 5 g vibration, 50 g shock

4.5 Wireless Transmitter

- Sampling Rate: 1 sample/10 seconds to 1 sample/1 hour
- Upload Rate: Sampling Rate Dependant
- Measurement Storage: No Local Memory
- Connectivity: Zigbee Protocol (IEEE 802.15.4-based)
- Power Supply: 3.6V DC
- Power Autonomy: 30 Days (upload rate dependant)
- Enclosure: Polyoxymethelene- IP67

4.6 High Accuracy Tilt Sensor

- Range: $\pm 15^\circ$
- Resolution: $\pm 0.0006^\circ$
- Operating temperature: -40°C to $+85^\circ\text{C}$
- Storage temperature: -55°C to $+85^\circ\text{C}$
- Protection: IP 65
- Non linearity error: $\pm 0.0125\%$ F.S. ($\pm 0.002^\circ$) (0.03 mm/m)
- Repeatability: $\pm 0.0125\%$ F.S. ($\pm 0.002^\circ$) (0.03 mm/m)
- Sensor Sensitivity: $\pm 0.013\%$ of reading/deg. C
- Sensor Offset: ± 0.002 arc deg./deg. C

4.7 Wireless Tilt Sensor

- Range: $\pm 15^\circ$
- Resolution: $\pm 0.001^\circ$
- Accuracy: $\pm 0.02^\circ$

4.8 Vibration Sensor

- Range: ± 5 g
- Sensitivity: 1.6 mA/g
- Frequency Response: 0-300 Hz
- Natural Frequency: 800 Hz
- Non-Linearity & Hysteresis: $\pm 0.5\%$ FSO
- Transverse Sensitivity: $< 3\%$ FSO
- Shock Limit: 5000
- Residual Noise: 50 μg RMS
- Thermal Zero Shift: $\pm 0.04\%$ FSO/ $^\circ\text{C}$ (0 to $+65^\circ\text{C}$)
- Thermal Sensitivity Shift: $\pm 0.04\%$ FSO/ $^\circ\text{C}$ (0 to $+65^\circ\text{C}$)
- Operating Temperature: -40 to 85°C
- Compensated Temperature: 0 to 65°C
- Storage Temperature: -40 to 85°C

4.9 Automatic Total Station

- Accuracy: 0.5" Angular Accuracy
- Operating Temperature: -20°C to 50°C
- Protection: IP 65

4.10 Enclosures

- Material: Stainless Steel AISI 304
- IP rating: IP66
- Door Lock Type: Double Bar
- Door Type: Plain

4.11 Data Connectivity

- Network Technologies: 800/850/1900/2100 MHz HSPA+
- Peak HSPA data rates: Download: 14.4Mbps, Upload: 5.76Mbps
- Network: TCP/IP, UDP/IP, DNS
- Routing: NAT, Host Port Routing, DHCP, PPPoE, VLAN,
- Operating Temperature: -30°C to +70°C
- Humidity: 90% RH @ 60 °C
- Durability: Military Spec MIL-STD-810, conformance to thermal, mechanical, shock and humidity

4.12 Connectors

- Housing Material: steel, zinc-plated
- Body Orientation: Straight
- Current Rating: 3A
- Voltage Rating: 250 V Ac/Dc
- Operating Temperature: -40°C to +125°C
- Mounting Type: Cable Mount
- IP Rating: IP65/67

4.13 Cable

- Conductor: 24(7) AWG Tinned Copper Conductor
- Insulation: Polyethylene
- Screen: Overall Aluminium Foil 100% Coverage
- Drain Wire: 24awg Tinned Copper
- Inner Sheath: Polyvinyl Chloride
- Outer Sheath: Low Density Polyethylene
- Voltage Rating: 300v, CE 450/750V
- Nominal O/D: 8.3 mm +/- 0.2mm

4.14 Screw Bolts

- Type: Hex Flange
- Size: M6x50
- Drill Bit Diameter: 5.5mm
- Maximum Fixture Thickness: 20mm
- Maximum Tightening Torque: 25Nm

4.15 Software

Bespoke software will be created in accordance with the requirements which will be defined in the agreed Specification. The selection of the proposed logger was made to provide a high reliability data logging system well known on the industry for its robustness, accuracy and durability. All measurements will be date and time stamped prior to uploading to our servers

Moreover the system will be remotely accessible and programmable to accommodate potential changes based on Engineer discretion.

The master logger and computer will accommodate a local area network, and the latest mobile network technology (4G, 3G and GPRS) modem for data transmission. The remote data server stores all data for easy access and download as required.

4.16 LIVEsite

Mabey LIVEsite (www.mabeylivesite.co.uk) is the all new web portal and software package developed by Mabey. It is unique to Mabey and within the monitoring sector. LIVEsite has been designed to be very easy for the end user to navigate, configure and personalise.

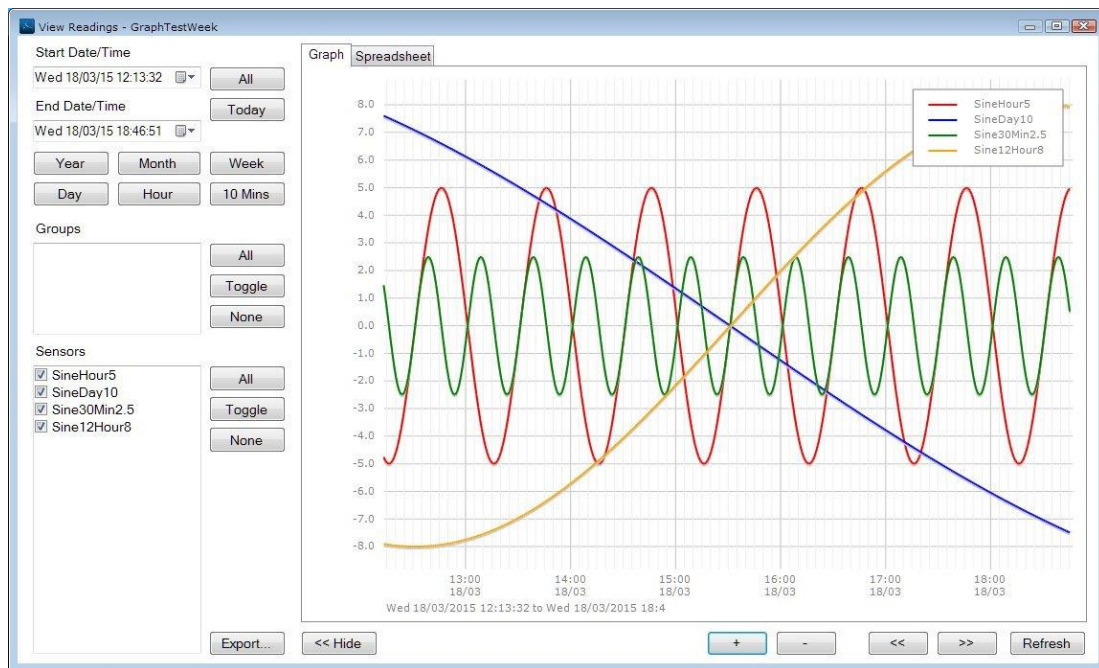
Mabey engineers will preconfigure your LIVEsite portal as part of the system setup process. You can specify how you would like to see the data presented and what parameters need to be set. Three stage trigger levels can be added with set value thresholds. Once these thresholds are breached an email is automatically generated to nominated users. These alert emails are also sent to Mabey engineers who can also interrogate the data and react accordingly.

Each nominated user is given their own password to LIVEsite and can customise their own view and functionality with ease

Users can see data from each individual sensor or data from any amount of sensors in each view. They can also select the time frame of the data they wish to view, whether that is minutes, hours, days, weeks or months.

Viewing of certain sensors combined with others allows for direct comparison mapping such as seeing dust levels alongside wind direction or seeing displacement in correlation to temperature it provides engineers a real time insight into what is happening.

All data can be printed into reports that are acceptable with most local authority environmental officers. Data can also be exported into databases that compatible with csv format such as MS Excel and historical data is readily available. All data from completed projects is held on secure Mabey servers for 3 months should you need to reference it at a later date



4.17 Data Acquisition Frequencies

Location	Tilt		ATS		Vibration		Survey	
	Measurement Frequency	Upload Frequency	Measurement Frequency	Upload Frequency	Measurement Frequency	Upload Frequency	Measurement Frequency	Upload Frequency
St Stephens Church	1 Sample per second	Mean value every 15 minutes	1 sample per hour	Set of readings every hour	1000 samples per second	Mean value every 1 minute	Baseline measurement & readings taken when required	Within 7 days of measurements
Hampstead Hill School	1 Sample per second	Mean value every 15 minutes	NA	NA	1000 samples per second	Mean value every 1 minute	Baseline measurement & readings taken as and when required	Within 7 days of measurements
Retaining Wall	1 sample per hour	Mean value every 15 minutes	NA	NA	NA	NA	Baseline measurement & readings taken as and when required	Within 7 days of measurements
Pond Street	NA	NA	1 sample per hour	Set of readings every hour	NA	NA	NA	NA
Cabman Shelter	1 Sample per second	Mean value every 15 minutes	NA	NA	NA	NA	Baseline measurement & readings taken as and when required	Within 7 days of measurements
The George Pub	1 sample per hour	Mean value every 15 minutes	NA	NA	NA	NA	Baseline measurement & readings taken as and when required	Within 7 days of measurements
Site Perimeter	NA	NA	1 sample per hour	Set of readings every hour	NA	NA	NA	NA
Hospital	NA	NA	NA	NA	1000 samples per second	Mean value every 1 minute	Baseline measurement & readings taken as and when required	Within 7 days of measurements
Environmental	Yet to be specified							

5 Equipment Quantities

Location	High Accuracy Tilt Sensor	Wireless Tilt Sensor	Vibration Sensor	GMP 104 Prism	GPR 112 Prism	ATS
St Stephens Church	63	0	4	20	0	0
Hampstead Hill School	32	0	4	20	0	0
Retaining Wall	0	5	0	5	0	0
Pond Street	0	0	0	12	6	1
Cabman Shelter	2	0	0	4	0	0
The George Pub	0	11	0	5	0	0
Site Perimeter	0	0	0	27	6	1
Hospital	0	0	4	0	0	0
Environmental	4					

6 Equipment Locations

The proposed locations for the sensors, wiring, data loggers and environmental monitoring are detailed in the following drawings:

- GA-770882-101
- GA-770882-102
- GA-770882-103
- GA-770882-104
- GA-770882-105
- GA-770882-106

7 Access Requirements

7.1 Access Methods

To access the sensor locations Mabey Hire will use 5 methods of access depending on suitability and permission:

1. Foot access, where equipment can be installed at ground level or without a mechanical aid.
2. Mobile access tower which can be altered to different heights with the correct out-rigging.
3. Step ladder which will be used for access and not as a working platform.
4. Podium with full guard protection.
5. Spider platform, this will be used where height and location restricts the use of a mobile access tower.

7.2 Location Requirements

Location	Access Requirements
St Stephens Church	Methods 1 - 5
Hampstead Hill School	Methods 1 - 5
Retaining Wall	Method 1
Pond Street	Method 1
Cabman Shelter	Methods 1 - 2
The George Pub	Methods 1 - 5
Site Perimeter	Method 1
Hospital	Method 1
Environmental	Method 1

7.3 Access Plan

Upon acceptance of the proposed access methods and completion of a full site survey including internal and external areas Mabey will issue a site access plan detailing the locations required for access.

7.4 Access Specifications

7.4.1 Method 1 – On Foot

Providing the equipment location is below head height and the ground is suitable then Mabey will endeavour to install as much equipment as possible using this method.

7.4.2 Method 2 - Mobile Access Tower

- Max S.W.L. 225kg per deck, 950kg per tower
- Platform (LxW) 2.5x1.45m



7.4.3 Method 3 – Step Ladder

- Closed Length 3.6m
- Extended Length 9.1m
- Weight 22kg



7.4.4 Method 4 – Podium with Guard

- Platform Height 1.52m
- S.W.L. 150kg
- Weight 30kg



7.4.5 Method 5 – Self Propelled Spider Lift

- Maximum Platform Height 11.64m (38.2ft)
- Maximum Working Height 14.00m (45.9ft)
- Maximum Outreach 6.80m (22.3ft)
- Width (with cage attached) 1455mm (4.8ft)
- Weight 1700kg
- Maximum Load 200kg @ 12.00m
- Bi-Power Diesel/Electric



8 Environmental Monitoring

8.1 Enviroguard

The Mabey EnviroGuard has been developed as a direct result of customer enquiries and feedback. Being at the forefront of environmental monitoring, it was clear to Mabey there was a need for an environmental monitoring station that could be easily tailored to a client's requirements



The EnviroGuard has been developed to be a modular and scale-able environmental monitoring station to meet the requirements of any client. All data is streamed wirelessly to Mabey LIVEsite giving clients up to the minute continuous information. The standard EnviroGuard comes complete with a dust monitor, noise monitor, wind speed and direction sensor. However, due to the unique 'menu' system available which tailors the system to your requirements, Mabey will build each EnviroGuard to your specification.

8.2 Consultation

The first stage of the process is to speak with the Mabey Instrumentation team to discuss your requirements. Once we know what you would like to monitor or measure we can advise on what sensors would be beneficial. The amount of sensors required will often determine which enclosure can be used from the menu available.

Mabey will then liaise with you on how you would like to see your data presented. LIVEsite is unique to Mabey and again has been developed with the customer in mind. Mabey engineers will preconfigure your required set up prior to dispatch but there are still many features which are totally configurable by each end user.

The final stage of consultation will be regarding any site specific requirements. Enviroguard enclosures have industry standard mounting facilities but sensor mounting often needs to be bespoke to the site or project. Mabey have full fabrication facilities in house so are able to react to virtually any requirement, immediately

8.3 EnviroGuard Unit

The EnviroGuard unit comes 'as standard' with three different sensors

Dust and airborne particulates

Noise levels

Wind speed & direction

This configuration will require enclosure dimensions of approximately H650mm x W450mm x D250mm. This standard configuration has been chosen as it offers the most common requirements of environmental monitoring with scope to expand easily.

If however you require less sensors than standard and perhaps a smaller enclosure, this can easily be achieved from our menu of options

The standard enclosure can accommodate additional sensors and indeed some sensors are external to the enclosure but should the need arise larger volume enclosures are available along with the ability to daisy chain enclosures

Sensors

Mabey currently offer a range of sensors for environmental monitoring applications. We are continually expanding our portfolio and are happy to investigate the integration of any specific sensor you require.

The Mabey sensor range currently offers

- Dust and airborne particulates (light scatter, cyclonic or non-cyclonic, PM10 or PM2.5)
- Noise levels (class 1)
- Wind speed & direction
- Barometric pressure
- Rainfall (tipping bucket)
- Temperature (internal, external, structural, concrete curing)
- PH levels
- Flow rate
- Water pressures
- Water level
- Vibration

- VOC's (volatile organic compounds)
- Gasses
- Thermal effect
- Enclosures

More often than not, the type and quantity of sensors required will dictate the enclosure required.

Some sensors are installed within the enclosures and some are external. All enclosures offered by Mabey will come with a minimum of IP65 rating and all will come as standard with a wall or pole fixing option. The Standard EnviroGuard comes in a lockable, rugged composite enclosure which, is available in 3 sizes. Mabey can however, accommodate any specification of enclosure such as higher IP rating, metallic, stainless steel, ATEX or additional security

Standard sizes (All dimensions are approximate)

Small – H400mm x W300mm x D200mm, More often used for single sensor applications or units with mainly external sensors

Medium – H650mm x W450mm x D300mm. The standard EnviroGuard enclosure. Allows the use of several internal sensors and many external

Large – H750mm x W650mm x D300mm. Allows for a vast array of sensors, internal & external along with additional logging ability

8.4 Power Requirements

The EnviroGuard comes complete with a 5m, site standard 110vac input. Alternative power requirements can be specified if required. The EnviroGuard contains a small UPS (uninterruptable power supply) back up system that will give 30 minutes of service should the mains power connection be lost. If the mains power is lost, an email alert will immediately be sent to site managers or system managers indicating that the power has been disconnected.

Mabey have developed a range of low voltage DC power sources that can be used in remote locations or where complete portability is required*. These include UPS and battery power, solar power, wind turbine & water turbine. Whatever your requirements, Mabey have a solution.

* Not available for all sensors

8.5 LIVE Site

All data will presented on Mabey Hire's LIVE Site.

9 Appendix

In reference to sensor locations, cable routing and data logger locations please see drawing numbers:

- GA-770882-101
- GA-770882-102
- GA-770882-103
- GA-770882-104
- GA-770882-105
- GA-770882-106

For additional info on sensors please see spreadsheet:

770882_Equipment Details

For work schedule of planned works please see spreadsheet:

770882_Program of Works