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 Drilling Applications
 7th November 2013
 Rotary Drilling Awareness
 for Engineers
 8th November 2013

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 Geotechnical Foundation
 Design - 11th December 2013
 Soil Description
 21st November 2013

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INTRODUCING KEYLOGBOOK VERSION 2.0



Also included:

- Terrain Motion Detection Design
- Priority Substances: An Update on Recent Changes
- Geotechnica ME 2013 : Managing Geotechnical Risk
- Feature: LANDPAC's Zone Load Test

Issue No.

25

October 2013



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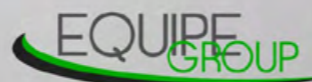
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22nd November 2013

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Contents

Cover Article:

[KeyLogbook v2: Welcoming Engineers to the 21st Century](#)

7

Version 2 of the software has many improvements and developments from the original release, in this month's issue of the Geotechnica KeyLogbook's product innovator, and Operations Director at the Equip Group, Keith Spires explains how the new release of KeyLogbook has developed.

[Terraforma Project: Terrain Motion Detection Services](#)

11

Writing for the Geotechnica this month is Professor David Norbury of David Norbury Limited and the European Federation of Geologists. Here he discusses terrain motion detection services.

[Priority Substances: An Update on Recent Changes](#)

17

Writing for the Geotechnica this month is highly valued and regular contributor Hazel Davidson of Derwentside Environmental Testing Services. This month, Hazel gives readers an update on priority substances and pollutants, and what has recently changed.

[Geotechnica ME 2013: Managing Geotechnical Risk](#)

21

Writing for the Geotechnica once more is Managing Director of the Equip Group, Julian Lovell. This month Julian proves readers with details of Geotechnica ME 2013, as well as outlining exactly what geotechnical challenges face Qatar and other Gulf States as the region continues to expand.

[Feature: LANDPAC's Zone Load Test](#)

27

In this month's issue of the Geotechnica, we have a spotlight feature on LANDPAC's Zone Load Test, detailing exactly what the test involves and what the test can produce in the way of retrievable data.

29

[Directory](#)



UPCOMING COURSES - 2013

GEOTECHNICAL FOUNDATION DESIGN: 11th December 2013

SOIL DESCRIPTION WORKSHOP: 21st November 2013

ROTARY DRILLING AWARENESS: 29th - 30th October 2013

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Welcome

Welcome to the 25th Edition of **theGeotechnica** - the UK's fastest growing online geotechnically focussed e-magazine.

The first article in this month's issue is also our cover article. This month see's the launch of the eagerly anticipated second version of Equipe Geosolutions' digital logging system, KeyLogbook. Developed in partnership with geotechnical technology specialists Keynetix, Version 2 of KeyLogbook boasts a number of new and improved features from the original release. In this article, Operations Director of the Equipe Group Keith Spire gives the run-down on Version 2's new features, as well as revealing details of the latest KeyLogbook and HoleBASE SI Webinar.

Following on from the reveal of KeyLogbook v2 is highly valuable entry from one of the UK's leading geotechnical experts, Professor David Norbury of David Norbury Limited and the European Federation of Geologists. In his first entry into **theGeotechnica**, Professor Norbury discusses the dangers of ground movement and what terrain motion detection services can do to aid the issue.

Returning to write to **theGeotechnica** is valued contributor Hazel Davidson of Derwentside Environmental Testing Services. In our third article of this issue, Hazel gives readers an update on priority substances and pollutants and what has recently changed - mainly regarding the EU's recent proposal to add a further 12 priority pollutants to the previous list of 33.

Article number four of this month's issue comes from another regular and valued contributor, Managing Director of the Equipe Group, Julian Lovell. This month Julian focuses on the massive developments happening in the Gulf Region, specifically the geotechnical risks that the many Gulf States are battling to manage. With Geotechnica ME 2013, the region's only geotechnically focussed conference and trade show fast approaching, the Region has never been in more need of expertise from specialist geotechnical companies from across the globe. In this article Julian outlines and defines the main geotechnical risks that need to be overcome, whilst also explaining the content of Geotechnica ME's

Technical Conference and how it aims to address and aid in the management of those risks.

Our final article this month is a spotlight feature on LANDPAC's Zone Load Test which utilises calibrated steel 'blocks' to determine the settlement characteristics of soil in-situ, immediately beneath the test pad.

This month we have a number of recruitment advertisements being placed throughout the magazine, notably from Soil Consultants, Geotechnical Engineering and the Equipe Group, who are in the lookout for experienced rotary drilling specialists.

As with every new edition of the magazine, the Editorial Team here at **theGeotechnica** will be on the lookout for even more new, original and interesting content from all corners of the sector, and would actively encourage all readers to come forward with even the slightest bit of appropriate and relevant content - whether it be a small news item or a detailed case study of works recently completed or being undertaken. If this content is media rich and interactive, then all the better. We are looking to increase the already large readership of the magazine through better social media integration and promotion, as well as improving content month on month.

Finally, for any content that is submitted we will ensure that advertising space, proportionate to the quality of content provided, is available for that single edition of the magazine. From then on, if you have submitted content, you will receive a discount on all further advertisements placed within **theGeotechnica**. We hope you enjoy this month's edition of the magazine and are inspired to contribute your own content for the coming editions of **theGeotechnica**.

**Editorial Team,
theGeotechnica**

The long awaited release of Version 2 of KeyLogbook, GE 2013's Product and Innovation Award winning site logging software, is now upon us. Version 2 of the software has many improvements and developments from the original release, in this month's issue of **theGeotechnica** KeyLogbook's product innovator, and Operations Director at the [Equipe Group](#), Keith Spires explains how the new release of KeyLogbook has developed.

The first release of the software was aimed squarely at the recording of the drilling data at source; this, coupled with the bar coded labelling system has proven to be a huge success with Drillers across the country, and has led to many Engineers becoming 'jealous' that the drillers have a better way of recording information than they do. Version 2 has hopefully addressed this, as **"Engineers and Drillers alike can now enjoy the benefits of KeyLogbook..."**

Engineers and Drillers alike can now enjoy the benefits of KeyLogbook which is now capable of recording trial and hand pits, in-situ tests such



GE Awards Product and Innovation Award Winner for 2013: KeyLogbook

as hand vane and pocket penetrometers, plus much, much more.

Version 2 still provides the user with the very popular instant thermally printed labelling **"This system is currently being looked at by a number of environmental laboratories up and down the country as a uniform way of providing a unique bar coded system that can be used throughout the samples life..."**

system. This system is currently being looked at by a number of environmental laboratories up and down the country as a uniform way of providing a unique bar coded system that can be used throughout the samples life, utilising the bar code for chain of custody and to track it throughout the laboratory.

KeyLogbook's development team at Keynetix have incorporated the ability to 'free hand draw' the trial pit face into v2 of the software, just as you would in your physical paperwork. However



"KeyLogbook grants you the ability to zoom in and out of the sketch to get of the smaller and finer details of the drawing right..."

KeyLogbook grants you the ability to zoom in and out of

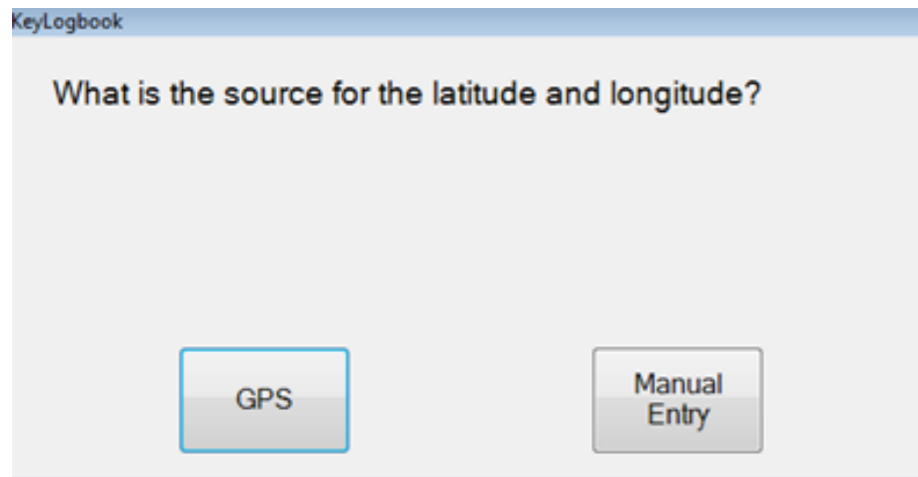
the sketch to get of the smaller and finer details of the drawing right: Erase the bits you get wrong without leaving untidy and grubby marks on the page; never worry about your pencil breaking with the ability to use the provided tablet pen or even the tip of your finger; option to 'log it as you go'; plus an ability to refer back to the sketch adding details as you discover them.

"All details such as excavator type, bucket size, driver, vane size, are all recorded..."

All details such as excavator type, bucket size, driver, vane size, are all recorded - KeyLogbook will even work out the mean values of the

vane and pocket penetrometer reading when you export them, saving vital time when the data is analysed back in the office.

Once you have completed the exploratory hole KeyLogbook can then record dimensions, final depth, stability etc. Version 2 of the software will now even allow you to use its own GPS positioning to locate the position of ►►



the hole using both Northing-Easting and Latitude-Longitude orientation - ground level can **“All of these developments allow you to have accurate positioning of the hole...”**

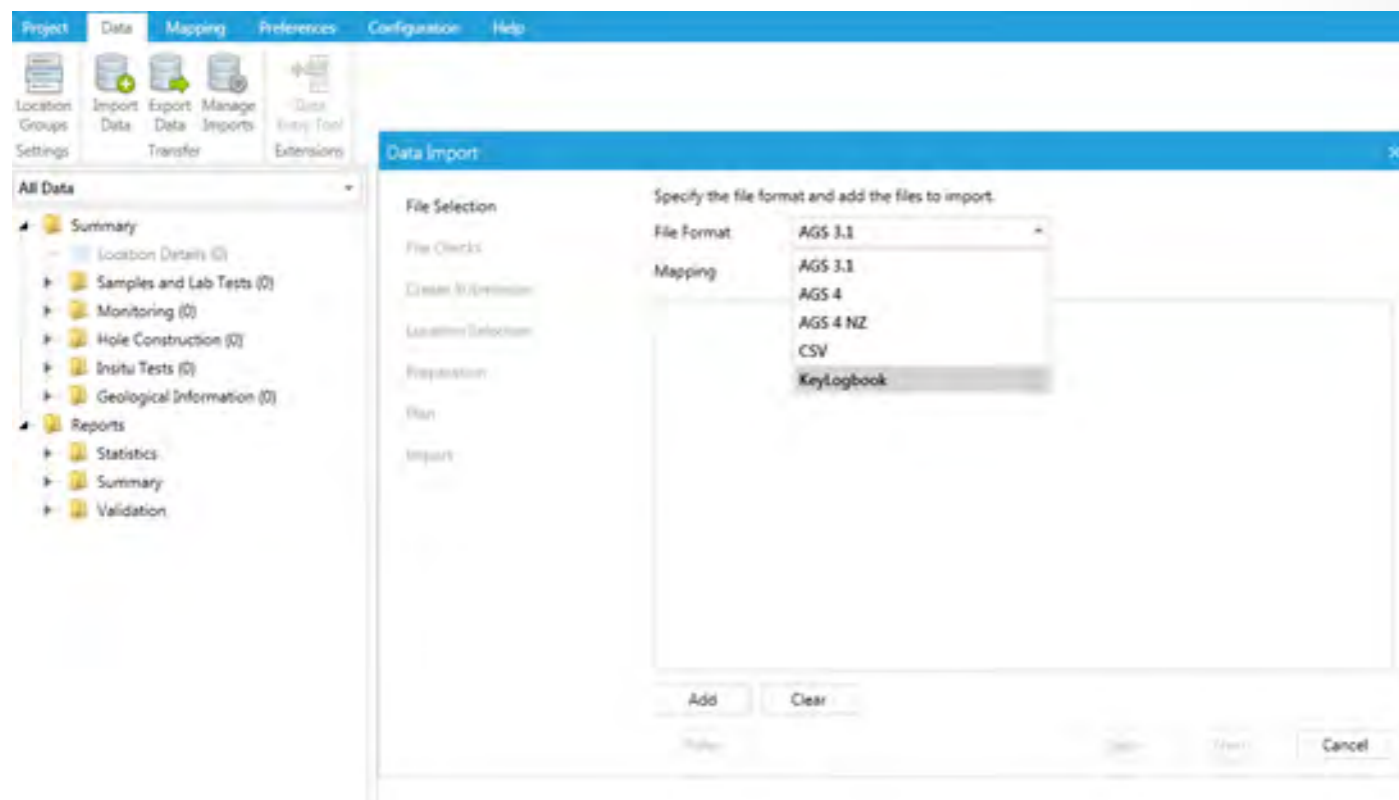
also be entered. All of these developments allow you to have accurate positioning of the hole within your geotechnical data management software instantly.

Importing data has also become even simpler. The export is now fully compatible with AGS 3.1 and 4 and some other forms of software, such as Keynetix' own new HoleBase SI, even have their own import option for the files direct from the exported KeyLogbook .zip file, allowing for the seamless import of data at the touch of a button.

Version 2 has moved on for the Drillers too. The development team have spent a great deal of time improving the smoothness

of how things work and operate in KeyLogbook – these small changes are not always easy to see, but the performance has been greatly increased across **“Following consumer feedback we have worked to resolve people’s teething issues with KeyLogbook...”**

the board. Following consumer feedback we have worked to resolve people’s teething issues with KeyLogbook; wording issues have been addressed along with more flexibility in how things can be recorded / edited. GPS has also been added to boreholes allowing instant plotting of the boreholes’ positions back at the office. Company details can now be imported and exported to different devices allowing easy setting up of either new devices or just swapping over,



KeyLogbook and HoleBASE SI Integration in action.

which has always been a time consuming operation.

“Many users are already reaping the rewards of KeyLogbook both in terms of time saved on site and monetary benefits, seeing savings of hundreds of hours and thousands of pounds...”

Many users are already reaping the rewards of KeyLogbook both in terms of time saved on site and monetary benefits, seeing savings of hundreds of hours and thousands of pounds even in the first few months of implementing the

system. Clients are also seeing the advantages to their own working programmes by having all of the site data available at the touch of a button within minutes of the hole being complete - thus making real-time decisions saving costly returns to positions and / or sites to fill in gaps where data received days later is either incomplete or inconclusive.

The KeyLogbook team have not been idle with regards to the system’s hardware either: The tablet is now lighter, faster, has a longer battery life and has a screen which is 50% brighter; new Bluetooth connections are more robust leading to a more enjoyable user experience.

The new build of KeyLogbook is once again pushing innovations in the geotechnical industry

even further into the 21st Century – and the good news is that the future of on-site logging has already arrived.

“KeyLogbook software is now available as a download for a free 14 day trial - available for you to use on your own device.”

KeyLogbook software is now available as a download for a free 14 day trial - available for you to use on your own device. For more information on free trial or the complete KeyLogbook package please use this [Enquiry Form](#), or alternatively contact Equipe Geosolutions directly on 01295 670990. ■

KeyLogbook v2 Introduction / HoleBASE SI Webinar

Friday 18th October 2013 - 15:00 to 15:30

PROVIDING DRILLING DATA FROM SITE TO DESIGN

This webinar is the second in a series provided by Equipe and Keynetix to provide an overview of the benefits of capturing drilling data at source and using this throughout the project process. This webinar will introduce Version 2 of KeyLogbook, outlining the developments and upgrades from the first edition of the digital logging system.

Content:

- Trial Pit Template Added
- GPS Location Tracking
- Improved AGS Output
- Improved Company Details Inport and Export
- Functionality improvements
- Greater integration with software such as HoleBASE SI



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TERRAFIRMA PROJECT: TERRAIN MOTION DETECTION SERVICES

Writing for *theGeotechnica* this month is Professor David Norbury of David Norbury Limited and the European Federation of Geologists. Here he discusses terrain motion detection services.

Ground movements are responsible for hundreds of deaths and billions of Euros annually, and the threat they pose is increasing due to urbanization and land use. ESA's GMES Service Element Programme has backed the Terrafirma project (2003-2013) to provide a new tool to help mitigate these risks.

"Gaining an accurate understanding of ground stability issues is not always easy without employing advanced and often expensive technologies."

Gaining an accurate understanding of ground stability issues is not always easy without employing advanced and often expensive technologies. As a result there has been a shift in recent times with more engineers and developers drawing on satellite technology to gain a greater insight into past and present ground stability.

New construction requires solid foundations to avoid costly planning mistakes, and underground works and metro-tunnelling have some

surface effect that needs remediation and monitoring.

"The Terrafirma services can provide information to locate low-risk foundation sites and help save money on the remediation of existing structures."

The Terrafirma services can provide information to locate low-risk foundation sites and help save money on the remediation of existing structures.

Terrafirma provides a Pan-European ground motion hazard information service to detect and monitor ground movements in relation to building stability, subsidence and ground heave, landslides, seismic activity and engineered excavations.

Since 1991, European Space Agency satellites (ERS-1, ERS-2 and Envisat) carrying synthetic aperture radar (SAR) instruments have been consistently acquiring data across the world, establishing an archive of over 1.5M images. SAR images contain information about the position of ground and

structures at the time of image acquisition. As subsequent images are acquired over the same location they can be compared and used to map relative terrain motion. This principal forms the basis of a remote sensing science known as interferometric synthetic aperture radar, or InSAR.

InSAR has been provides ground deformation data at millimetric precision using continually developing ways of processing the radar images. These "persistent scatterers", or "virtual GPS points", generally correspond to parts of man-made structures such as buildings, bridges and pylons, though they can also include rocks and outcrops.

"The exact location of persistent scatterers cannot, therefore, be accurately predicted in advance of processing..."

The exact location of persistent scatterers cannot, therefore, be accurately predicted in advance of processing, but over urban areas their densities are usually measured in the hundreds per square kilometre, although this has developed into thousands with latest high-resolution SAR systems.

The products derived from PSI

include average annual motion maps and the motion history of individual scatterers, both covering the time-span of the data set used.

"The technology has the ability to highlight a wide range of natural and anthropogenic motion phenomena..."

The technology has the ability to highlight a wide range of natural and anthropogenic motion phenomena such as those linked to subsidence, mining and mine water recharge, soil shrink/swell, oil and gas production and carbon storage, groundwater abstraction, flood susceptibility, geological activity and construction activities. Many of these phenomena are studied using conventional mapping and surveying techniques but these can be expensive, labour intensive and, in some instances, put life at risk.

Furthermore, some instability can remain undetected due to unsuitable survey conditions such as thick vegetation, adverse weather conditions or simply because motions are so subtle that they are difficult to detect and monitor.

At a time when there is more pressure than ever for new industrial development, construction and housing, the need for a cost and time effective method of assessing, monitoring and mitigating ground and structure motions has never been greater.

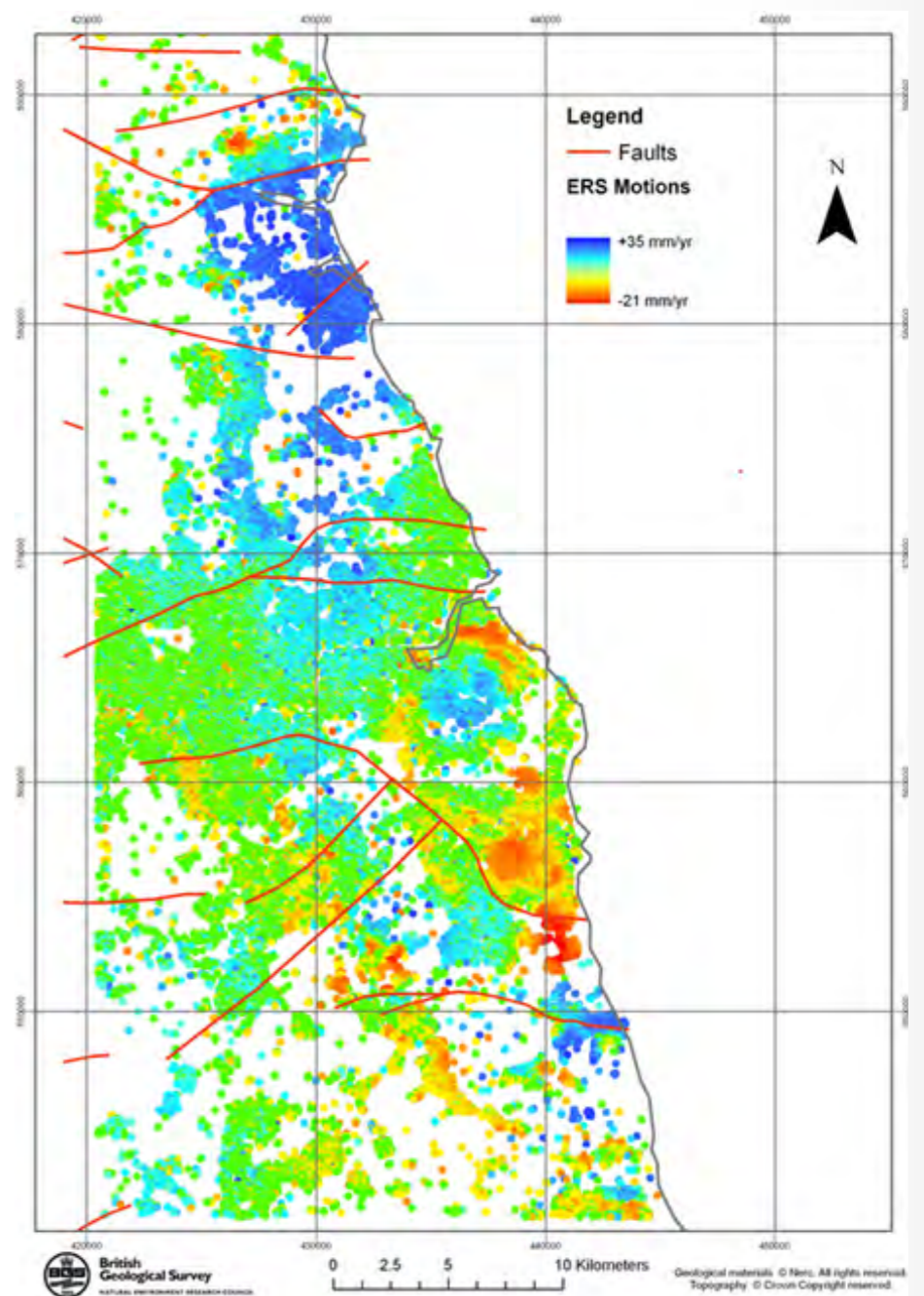


Figure 1: InSAR (1995 to 2000) derived motion for the Northumberland region.

MINING CASE STUDY: NORTHUMBERLAND AND DURHAM, UK

The productive Coal Measures form the bedrock for much of the Northumberland and Durham study area in the north east of England. The coalfield has a working history dating back to Roman times. Over twenty coal seams have been mined underground and the coalfield has been one of the major sources of opencast

(surface-mined) coal in Britain. The geological structure of the area determined the development of the coalfield with faults, in particular, serving to divide the area into zones of 'take'. The working of deeper and deeper coal seams, including those beneath the Permian, led to the need to pump mine water.

InSAR results show some areas of motion are bounded by the pattern of faulting. The underlying reason for



motion in several cases appears to be reactivation of faulting by factors such as ground water level change. Figure 1 shows the relationship between the regional motion and the regional pattern of faulting. Black circles outline areas where motion characteristics are seen to change over a fault at this scale. Figure 2 shows some of these relationships in more detail.

AREAS OF ABANDONED MINING

Ryhope colliery was closed in 1966 (figure 3), according to common opinion that subsidence relating to the extraction of coal using the long wall technique would take place within 5-7 years of extraction. The PSI data shows subsidence in this area occurring more

“It is not currently known if this subsidence is caused by coal extraction or if ground water levels have an effect.”

rapidly but with an especially rapid motion from 1997 – 1998. It is not currently known if this subsidence is caused by coal extraction or if ground water levels have an effect.

USER PERSPECTIVE

Following receipt of the data the UK Coal Authority is impressed with the apparent ability to use PSI to identify areas where groundwater levels are rising. PSI data therefore has the potential to save

money by reducing the need for unnecessary boreholes. Minewater monitoring boreholes can be cited in areas where PSI data has proven that minewater levels are rising via its ground motion signature, rather than employing an expensive ad hoc monitoring network of boreholes.

ACKNOWLEDGEMENTS

This work was carried out as part of Stage 3 of the European Space Agency funded Terrafirma project. Data analysis and geological interpretation were carried out by the British Geological Society and PSI analysis was carried out by FugroNPA under overall project management of Altamira Information (Terrafirma project prime). ■

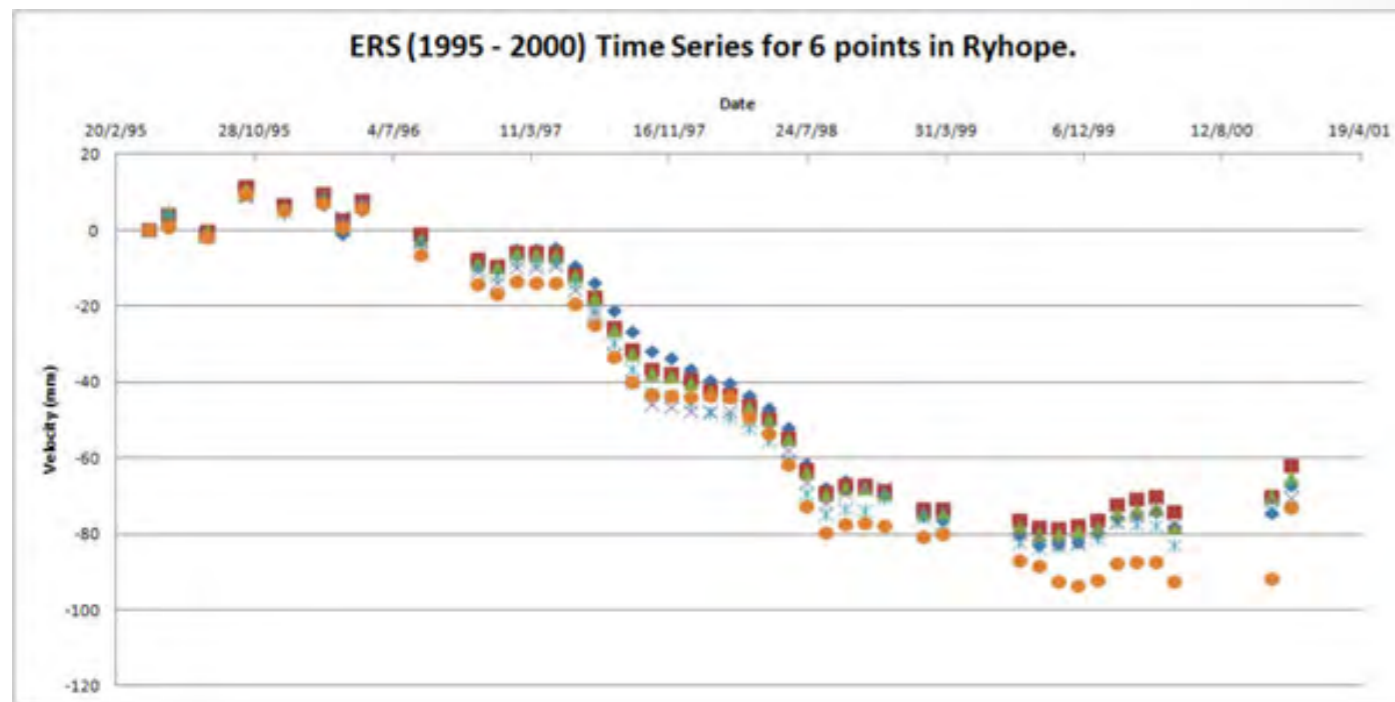


Figure 2: PSI result for the Ryhope area

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PRIORITY SUBSTANCES: AN UPDATE ON RECENT CHANGES

Writing for *theGeotechnica* this month is highly valued and regular contributor Hazel Davidson of [Derwentside Environmental Testing Services](#). This month, Hazel gives readers an update on priority substances and pollutants, and what has recently changed.

In association with the Water Framework Directive, a list of 33 priority pollutants was published some years ago, to assist in the monitoring of surface and other water bodies in order to ensure their compliance to 'good' status. Recently, the EU has proposed additions to this list, with a further twelve compounds added and some revisions to existing compounds.

Priority substances are subdivided into Priority Hazardous Substances (PHS), Priority Substances (PS), plus a further 19 Specific Pollutants (SP), and each compound is assigned an Environmental Quality Standard value (EQS). The table below shows all three categories of compounds, with colour coding to indicate additions and changes.

This table is included courtesy

of the Environment Agency, and is taken from a presentation given- on 15th July this year to the Priority Substances Stakeholder group - a forum of interested bodies from several sectors of the environmental industry.

“From the table, it can be seen that there are six additional PHS, and six additions to the PS column.”

From the table, it can be seen that there are six additional

Priority Hazardous Substances (GCS)	Priority Substances (GCS)	Specific pollutants (GES)
Anthracene	Alachlor	2,4-Dichlorophenol
Brominateddiphenylether (BDPE) (biota no AA)	Atrazine	2,4-D
Cadmium	Benzene	Ammonia
Chloroalkanes, C10-13	Chlorfenvinphos	Arsenic
Di(2-ethylhexyl)phthalate (DEHP)	Chlorpyrifos	Chlorine
Endosulfan	1,2-dichloroethane	Chromium (III)
Hexachlorobenzene (HCB) (biota no AA)	Dichloromethane	Chromium (VI)
Hexachlorobutadiene (HCBd) (biota no AA)	Diuron	Copper (bioavailable)
Hexachlorocyclohexane (HCH)	Fluoranthene (AA/biota)	Cyanide
Mercury (biota no AA)	Isoproturon	Cypermethrin
Nonylphenols	Lead (bioavailable)	Diazinon
Pentachlorobenzene	Naphthalene	Dimethoate
PAH: Benzo(a)pyrene (AA/biota)	Nickel (bioavailable)	Iron
PAH: Benzo(b)fluoranthene	Octylphenol	Linuron
PAH: Benzo(k)fluoranthene	Pentachlorophenol	Mecoprop
PAH: Benzo(g,h,i)perylene	Simazine	Permethrin
PAH: Indeno(1,2,3-cd)pyrene	Trichlorobenzenes	Phenol
Tributyl tin compounds (TBT)	Trichloromethane (chloroform)	Toluene
Trifluralin	Aclonifen	Zinc (bioavailable above background)
Dicofol (AA/biota)	Bifenox	3,4-dichloroaniline
PFOS (AA/biota)	Cybutryne (Irgarol®)	Benzyl butyl phthalate
Quinoxifen	Dichlorvos	Carbendazim
Dioxins & dioxin-like compounds (biota no AA)	Terbutryn	Chlorothalonil
Hexabromocyclododecane (AA/biota)	Cypermethrin	Glyphosate
Heptachlor/heptachlor epoxide (AA/biota)		Manganese
Revised EQS		Methiocarb
Change in chemical status - no change to EQS		Pendimethalin
Addition to EQS Directive		Tetrachloroethane
Proposed addition to Specific Pollutants		Triclosan

Table 1: Changes to priority substances

PHS, and six additions to the PS column. The three compounds shown in green were previously in the PS category, but have been reclassified as PHS. The compounds in red under the specific pollutants column are still under proposal.

This takes the sum total of PHS and PS to 49, and the SP to 28 compounds.

“Some of these EQS values are extremely low, and laboratories will face difficulties in achieving the requisite limits of detection...”

Some of these EQS values

are extremely low, and laboratories will face difficulties in achieving the requisite limits of detection (LoD), for example, cypermethrin has a specified annual average of 8 x 10⁻⁵ ug/l which is equivalent to 0.008 parts per trillion.

Most of the compounds require solvent extraction, as they are organic substances, and these extraction processes can be complex and time consuming. There will be difficulties for laboratories in achieving these levels with existing equipment, as there would be requirements for clean room operating conditions, solvents may not be of a high enough purity, and sample size may be up to 5 litres - there may also be issues in obtaining standards or finding proficiency testing

schemes which cover these compounds. This will obviously impact upon the cost.

“A further change to the list is the emphasis on monitoring biota for some compounds, rather than just the water itself...”

A further change to the list is the emphasis on monitoring biota for some compounds, rather than just the water itself, as measuring contaminants in plants or animals is thought to provide more robust data, due to bio-accumulative effects which concentrate the contaminant.

With the changes EQS ►►

Name of substance	EQS RBMPii - new standards (annual average) (ug/l)		Notes
	Inland surface waters	Other surface waters (TRaC)	
Priority Hazardous Substances			
Di(2-ethylhexyl)phthalate (DEHP)	1.3	1.3	* currently Priority Substance no change to EQS
Trifluralin	0.03	0.03	* currently Priority Substance no change to EQS
Dicofol	1.3*10 ⁻³	3.2*10 ⁻⁵	Biota: Fish 33 ug/kg (ww)
PFOS	6.5*10 ⁻⁴	1.3*10 ⁻⁴	u-PBT: Biota: Fish 9.1 ug/kg (ww)
Quinoxifen	0.15	0.015	
Dioxins & dioxin-like compounds	-	-	u-PBT: Biota (fish/crustaceans/molluscs): Sum of PCDD, PCDF, PCB-DL 0.0065ug/kg TEQ
Hexabromocyclododecane	0.0016	0.0008	u-PBT: Biota: Fish - 167µg/kg (ww)
Heptachlor/heptachlor epoxide	2*10 ⁻⁷	1*10 ⁻⁸	u-PBT: Biota: Fish - 6.7*10 ⁻³ /ug/lkg (ww)
Priority Substances			
Aclonifen	0.12	0.012	
Methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate (Bifenox)	0.012	0.0012	
Cybutryne (Irgarol®)	0.0025	0.0025	
Dichlorvos	6*10 ⁻⁴	6*10 ⁻⁵	
Terbutryn	0.065	0.0065	
Cypermethrin*	8*10 ⁻⁵	8*10 ⁻⁶	* currently UK Specific Pollutant (EQS 0.1ug/l)

Table 2 EQS Values for the new compounds (courtesy of the Environment Agency)



values for existing compounds, these are almost all lower than the previous levels.

Time Frames

- Transposition of revised directive within 2 years – August 2015
- Existing PHS, PS and SP compounds: revised EQS apply from 2015 (assuming analytical methods available by

Dec 2014), with compliance by Dec 2021

- New PHS and PS compounds: apply from Dec 2018, with compliance by 2024

There will also be the establishment of a 'watch list' to provide information across the EU on the occurrence of emerging pollutants, where there is currently a lack of

“The first list of 10 compounds will be identified by August 2014, and include estradiol (E2), ethinylestradiol (EE2) and diclofenac.”

monitoring data. The first list of 10 compounds will be identified

by August 2014, and include estradiol (E2), ethinylestradiol (EE2) and diclofenac. A need for pharmaceutical substances may also be required, but compounds will not be moved from the 'watch list' to the Priority Substances list unless they are considered to be problematic across the EU.

River Basin Management Plan 2 – consultation for this

“... consultation for this phase will take place in June 2014 and will look at the cost beneficial programme to reduce environmental levels of chemicals...”

phase will take place in June 2014 and will look at the cost beneficial programme to reduce environmental levels of chemicals, determine what improvements in status can be achieved, and will not include judgements on affordability.

Final Basin Plan – will be published in December 2015 with a programme of measures for implementation during 2015 - 2021

Costs

An estimate of possible costs was presented at the Priority Substances stakeholder meeting by the Risk and Policy Analysts (RPA) and this was extrapolated over the six year cycle of the River Basin

“The replacement of Cypermethrin to the agricultural industry could potentially cost €13 million.”

Management Plan. The replacement of Cypermethrin to the agricultural industry could potentially cost €13 million. In the UK, the monitoring costs over six years are estimated to lie between £15.9 - £26.5 million, split mostly between surveillance monitoring (fixed

network of sites for long term trending), and operational monitoring (focusing on the areas of pressure which may cause a water body to fail). These are risk based – if there is a risk of failure, then monitoring must be done. The overall figure includes some smaller estimated costs associated with investigative monitoring and the Watch List, although it is difficult to give accurate figures for these, particularly as the full list of substances on the 'watch list' is not yet known.

Summary

These changes to the Priority Substances list are likely to have a substantial impact on the UK environmental industry. Initially, it will be the EA laboratories involved with the WFD monitoring, but follow on requirements will be for effluents, ground water, and landfill monitoring at the very least, so different sectors will be

“For the laboratories, although a year seems a reasonable time to implement these methods, in reality, it is not...”

affected. For the laboratories, although a year seems a reasonable time to implement these methods, in reality, it is not, as method development and validation are very time consuming. Site investigation companies, landfill operators and drilling contractors all need to be aware of these potential costs, and risk assessments will always be required to identify substances of potential concern. ■



GEOTECHNICA ME 2013

MANAGING GEOTECHNICAL RISK

Writing for *theGeotechnica* once more is Managing Director of the [Equipe Group](#), Julian Lovell. This month Julian proves readers with details of *Geotechnica ME 2013*, as well as outlining exactly what geotechnical challenges face Qatar and other Gulf States as the region continues to expand.

Geotechnica ME will be held in Qatar for the second year running at the Grand Hyatt, Doha on 4th & 5th December 2013. As the only dedicated technical conference and trade show representing the geotechnical industry and built environment sector, it is an important opportunity for stakeholders to discuss current issues and challenges. This year the conference will

deal with the key hot topic of managing geotechnical risk. Qatar and the other GCC member states share many similarities with the rest of the world when it comes to structural design and construction but they have their own unique geotechnical challenges. How does the local geology affect construction? Can voiding affect our tunnels

or buildings? Where are we going to source our drinking water from?

The conference will bring together key stakeholders as well as regional and UK based technical experts to discuss these challenges including;

- Infrastructure construction and managing risk in an arid environment;

- Geotechnical solutions to tunnelling and deep excavations in potentially voided or saturated ground;
- Dealing with the risk posed by dissolution features and cavities in a karstic environment and
- Water engineering to deliver sustainable growth.

Mr Andrew Slate, General Manager of Qatar based Gulf Laboratories told us that "Geotechnical engineering is often undervalued by project clients but is undoubtedly

an integral part of the entire construction and plays a significant part in highways, tunnelling, water and sewerage projects."

"As the region's economies continue to grow, so do the social, logistical and technical challenges..."

As the region's economies continue to grow, so do the social, logistical and technical challenges and these challenges must be met to sustain this growth. Projects key to meeting these challenges include; improvements to the infrastructure - building highways, railways, metros, airports and ports; building new real estate developments, hospitals and schools and improving water and sewerage

"All of these projects will have their own geotechnical challenges which can range from poor ground conditions to major water filled cavities."

services. All of these projects will have their own geotechnical challenges which can range from poor ground conditions to major water filled cavities. These geotechnical challenges will also carry a risk to their successful completion.

The headlines always involve the major projects;

KSA has recently awarded a \$17 billion Makkah public transport project which includes major metro and highways construction and has awarded a \$22 billion Riyadh Metro project and construction is now well under way on the new terminals at King Abdulaziz International Airport (KAIA) which is reported to be the region's largest construction project in the GCC.

UAE has seen a steady stream of major construction and infrastructure projects such as the Burg Khalifa and currently includes the \$653 million Louvre Abu Dhabi development.

"Qatar is reported to have already awarded a total of 35 mega contracts in 2013 worth in excess of \$25 billion and has at least another \$25 billion worth of projects still to be awarded."

Qatar is reported to have already awarded a total of 35 mega contracts in 2013 worth in excess of \$25 billion and has at least another \$25 billion worth of projects still to be awarded. These include the Doha Metro packages, Bahrain causeway as well as the infrastructure improvements and construction projects required to meet their 2022 objectives.

The projects discussed

above and all projects which interact with the ground will have geotechnical risk but the key is to be able to identify and manage it.

Understanding Geotechnical Risk

So what do we mean by geotechnical risk and why must ministries, developers and designers consider it?

“Geotechnical risk has been defined as ‘the risk to building and construction work created by the site ground conditions’.”

Geotechnical risk has been defined as ‘the risk to building and construction work created by the site ground conditions’. Geotechnical risk

“Geotechnical risk should therefore be treated no differently to health and safety risk: Risk=Hazard x Consequence.”

should therefore be treated no differently to health and safety risk: Risk = Hazard x Consequence.

As with health and safety risks the consequence may be personal (injury), structural (damage) or financial and therefore must be fully assessed and control measures put in place. Therefore, geotechnical risk can affect all of the stakeholders and can have a significant impact on project delays and the financial outcome. Geotechnical risk can also affect the wider

environment and even those not directly involved with the projects and these aspects can sometimes outweigh the project risks.

As the table to the right indicates, geotechnical risk can be split into two categories; technical and contractual. Is the risk created by the site ground conditions or by the work practices permitted by people?

“Geotechnica will discuss geotechnical risk from a theoretical position...”

Geotechnica will discuss geotechnical risk from a theoretical position but more importantly will relate this to real projects and real challenges affecting the Gulf

Types of Geotechnical Risk		Hazard
Contractual	Project Management	Poor management of entire geo-engineering process
	Site Management	Poor management of site investigation and contract documentation
Technical	Analytical	Unreasonable analytical model chosen
	Properties	Unreasonable design values chosen
	Geological	Unforeseeable geological conditions
		Inherently hazardous conditions
		Unforeseen ground conditions

States and how they can be investigated and managed.

“The conference will also tackle some of the key issues facing construction in Qatar and the GCC member states and will showcase methods used in the region and the UK to manage geotechnical risk.”

The conference will also tackle some of the key issues facing construction in Qatar and the GCC member states and will showcase methods used in the region and the UK to manage geotechnical risk. The emphasis will be that risks have to be identified at an early stage so that their full impact can be properly assessed and measures put in place to mitigate them. This has to involve the right approach, the right people and the right budget.

What lies beneath our feet?

As with all projects interacting with the ground, understanding the underlying geology is key. The conference will highlight some excellent projects which are using innovative

techniques to provide a deeper understanding of the geology in the region and how this needs to be addressed to ensure risk free foundation design and subsequent construction. Reducing geotechnical risk starts with the identification of the strata and analysing their geotechnical properties. Identification and recording these accurately are crucial to assessing the risks to any construction project particularly deep basements and tunnels. A good example of this in Qatar is the Rus Formation which is a mixture of limestone, clay and gypsum.

“This formation is particularly prone to voids often of significant size and these can be fully saturated with saline ground water. Innovative methods of locating and investigating these voids will be discussed.”

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ground water. Innovative methods of locating and investigating these voids will be discussed.

Collaboration

With so much construction taking place in the region it is important that there is continuity in the planning and integration of the works.

“Tunnelling projects have increased significantly due to the growth of our major cities and requirement to minimise surface impact.”

Tunnelling projects have increased significantly due to the growth of our major cities and requirement to minimise surface impact. In Doha, tunnelling is due to take place at two levels; a relatively shallow tunnel for the new sewer system (the Idris project); and the deeper and larger bore system for the Metro Rail. In addition, there are major excavations for the station boxes. Similar projects are programmed across the region and they will all require a sound understanding of the geology and the



soil structure interaction. Solutions such as the use of stabilisation techniques to ensure ground movements are kept to a minimum can be transferred between projects and therefore collaboration and knowledge sharing should be actively encouraged. The conference will use case histories to demonstrate how specific tunnelling methods and deep excavation techniques have been used to ensure ground movements are within acceptable limits.

Many of the future construction developments and infrastructure projects will carry the same geotechnical risks and some such as the GCC Railway and Qatar-Bahrain Causeway will affect neighbouring states and therefore share geotechnical risks. Challenges such as shifting sand,

voiding, earthwork collapse, water supply are common throughout this arid region and the control measures are often engineering solutions which can be used whichever State

“The conference will look at how other GCC States have overcome the challenges and how similar experiences in other countries such as the UK can be adapted or adopted to provide a suitable solution.”

you are in. The conference will look at how other GCC States have overcome the challenges and how similar experiences in

other countries such as the UK can be adapted or adopted to provide a suitable solution.

Julian Lovell, Event Director for Geotechnica ME explains that “Unlike many other conferences, Geotechnica will encourage open discussion sessions to enable attendees to develop an understanding of how geotechnical risks can be controlled from start to completion of a project to provide confidence to all stakeholders. Through an open exchange of views, methods and techniques can be reviewed and the right techniques adopted to fulfil the project aims.” Geotechnica will not provide all of the answers but will provide a platform for those to play their part in managing the geotechnical risk. ■

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4th - 5th December 2013
Grand Hyatt Hotel - Doha, Qatar

CONFERENCE TOPICS INCLUDE:

Infrastructure Construction and Managing Risk in an Arid Environment

With an ambitious regional program of construction, managing the geotechnical and construction risks are paramount to successful and sustainable projects. Learn about how these challenges can be met technically and how initiatives such as collaboration can reduce your exposure.

Geotechnical Solutions to Tunnelling and Deep Excavations in Potentially Voided or Saturated Ground

As the region's major cities continue to grow and the availability of un-developed land in the urban environment diminishes, the requirement for tunnelling and deep basements will increase. Listen to experts involved in major developments, metro, water and sewerage projects in the region.

Dealing with the Risk Posed by Dissolution Features and Cavities in a Karstic Environment

Dissolution and karstic features are often an unavoidable risk due to the unique geology of the region. However, the difficulties with identifying these at planning and even construction phase means quantifying that risk is challenging. Recent advances in investigation techniques and innovative engineering solutions will be discussed which can be adopted to better define the risk.

Water Engineering to deliver Sustainable Growth

Water supply and management is essential to enable sustainable growth and in an arid environment, this presents its own unique challenges. This session will help you understand the regional problems and how they may be overcome.

Discussion: Can Geotechnical Risk be Easily Identified and Managed?

Construction projects are many and varied and understanding the risk both below and above ground allows the key stakeholder to have confidence in obtaining a successful technical and financial outcome. Often the most significant unknowns are ground conditions and this open session will discuss the significance of quality, completeness and cost to obtain the data required to assess and manage the risk.

CONFERENCE SPEAKERS INCLUDE:

- Chairman of the Qatar Soc. of Engineers - Eng. Ahmad Jassim Al-Jolo
- Leeds University and President of ICE - Prof. Barry Clarke
- Director, Arup - Asim Gaba
- Mott MacDonald - Peter Sharp
- Lead Engineering Geologist, CH2M - Sallie Vest
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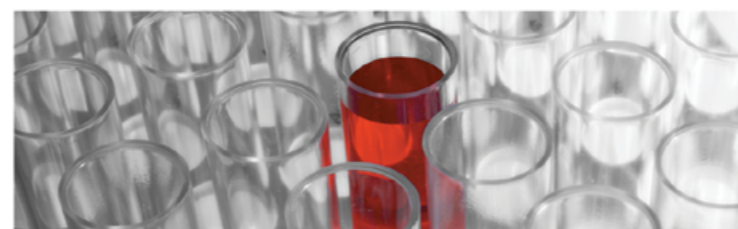
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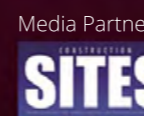
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FEATURE: LANDPAC'S ZONE LOAD TEST



Zone Load Test (ZLT) loading and unloading is carried out in general, accordance with BS1377: Part 9, Section 4.2, "Methods of test for Soils for Civil Engineering purposes – In-situ Tests".

The ZLT load is applied through the use of calibrated steel "blocks" of known weight. The "blocks" are lifted into place using certified chains and certified lifting lugs attached to the "blocks. The load/"blocks" are applied to the plate in a symmetrical fashion to ensure an even application. The most appropriate combination of "blocks" is used to match the required load increment.

The maximum ZLT load that can be applied safely is 120kN/m², on a 2m x 2m base plate

The general loading criterion is defined below.

Before HEIC: Settlement for a 120kN/m² load on unimproved soils (2m x 2m base plate) was typically measured as 26mm over a 15 day period.

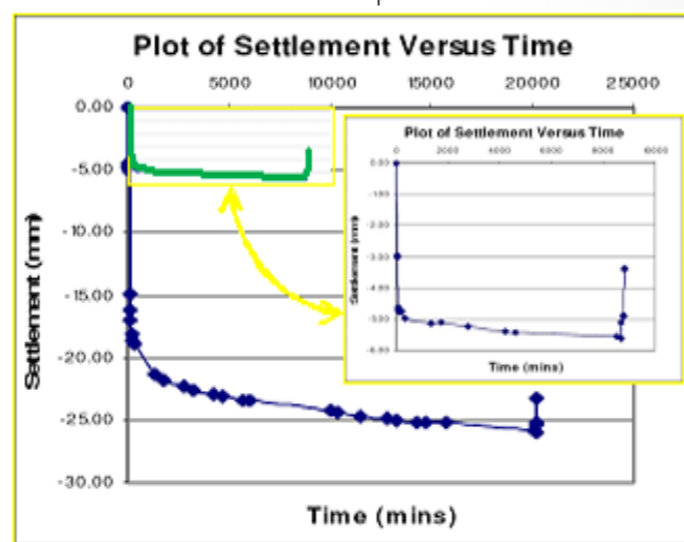
After HEIC: Settlement for a 120kN/m² load on HEIC improved soil (2m x 2m base plate) was typically measured as 5.5mm over a 6 day period (i.e. < 0.1mm for last 24 hours), confirming that the drained stiffness modulus specification

had been met for that project.

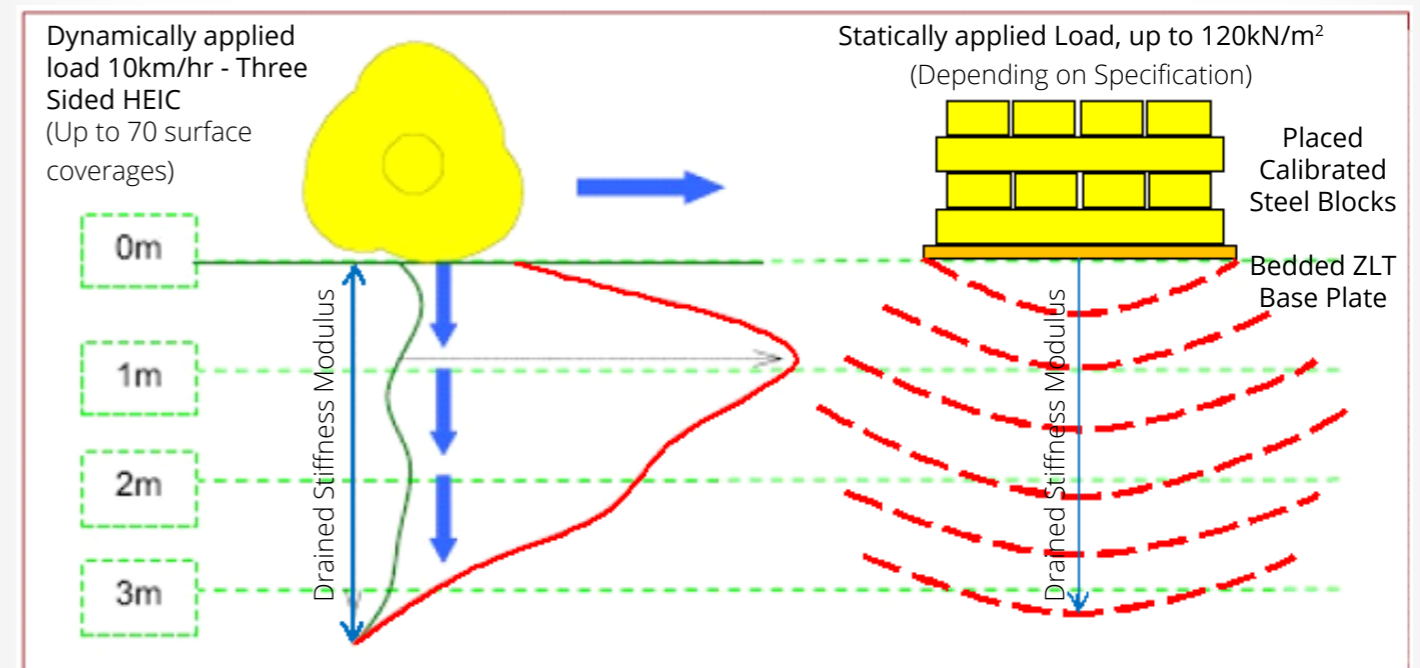
This ZLT method covers the determination of the settlement characteristics of soil in-situ by a test in which a constant load is applied to the ground for a period of several days through a steel pad placed on the surface. The ZLT is suitable for estimating the settlement caused by loads placed on filled ground. The ZLT makes it possible to estimate the settlement that will occur due to an applied load. The ZLT is solely confined to providing an indication of the magnitude of settlement of the ground immediately beneath the test pad.

Apparatus: Rigid square steel base plate of suitable dimensions and known mass. The larger dimension (B1) and the smaller dimension (B2) of the square pad shall be such that B2/B1 = 1. B1 or B2 shall be not smaller than 2m. The pad shall be fitted with four leveling stations at its periphery equidistant from the centre of the pad and from each other. The leveling stations shall be accessible when the pad is loaded. In general the ground to a depth of not more than

Load (% of Maximum Load)	Minimum Time Interval (minute unless noted)
50	5
50	10 (or <0.1 mm movement since previous interval)
50	30 or <0.1 mm movement since previous interval)
100	5
100	10
100	30
100	1 hr
100	2 hr
100	5 hr
100	10 hr*
100	1 Days
100	2 Days
100	Daily * or until or <0.1 mm movement per day
50	5
50	10 (or <0.1 mm movement since previous interval)
50	30 or <0.1 mm movement since previous interval)
0	5
0	10 (or <0.1 mm movement since previous interval)
0	30 or <0.1 mm movement since previous interval)
0	1 hr



ZLT data "before" and "after" full HEIC application



Typical HEIC depth of influence down to 3m bgl - Typical ZLT bulb of pressure down 3m bgl

1.5B1 or 1.5B2 will be affected by the loading test and the properties of the ground at greater depths will have little influence on the test results.

Kentledge, in the form of calibrated steel "blocks", of known mass sufficient to provide the required bearing pressure.

Leveling equipment: Surveyor's level with tripod and staff capable of measuring to a resolution of at least 0.1mm. The leveling equipment shall be maintained in adjustment according to the manufacturer's instructions.

Leveling datum stations which shall not move more than 0.5mm during the course of the ZLT.

Procedure; Leveling datum stations. Establish two leveling datum stations for the load test at a distance from each other of at least 3B1 or 3B2. Locate the leveling datum stations at a distance of at least 3B1 or 3B2 from the centre of the load test.

Preparation of test area: Excavate the area of the load test to remove obvious surface soft materials and prepare a level surface. The prepared area shall be sufficiently large to make possible the installation of the loading pad but no larger.

Installation of pad: The pad shall be prefabricated, in the form of a 2m x 2m square steel base plate 100mm thick. Place a layer of sand, nowhere exceeding 100mm in thickness, and with a level surface, on the prepared soil surface. Bed the prefabricated steel base plate onto the sand.

Loading sequence: Apply the load so that it is evenly distributed over the pad. Where the load is mobilised above the pad, and prior to its application, ensure that it is kept stable sufficiently far from the test position so as to reduce the influence on the results to a tolerable level. Apply the load in a number of equal increments. Measure the settlement of

the pad immediately following the application of each load increment. Record the time at which each load increment is applied and each set of levels is taken. Intermediate increments of load need be maintained only for the period corresponding to the immediate settlement.

Maintained load test: When the final load increment has been applied and the immediate settlement has been measured, take further measurements of settlement at suitable intervals of time, or until <0.1mm settlement is recorded for last 24 hours.

Unloading: Remove the load in equal decrements corresponding to the incremental application of load. Immediately following each load decrement measure the vertical movement of the pad. Apply data through relevant calculations. ■

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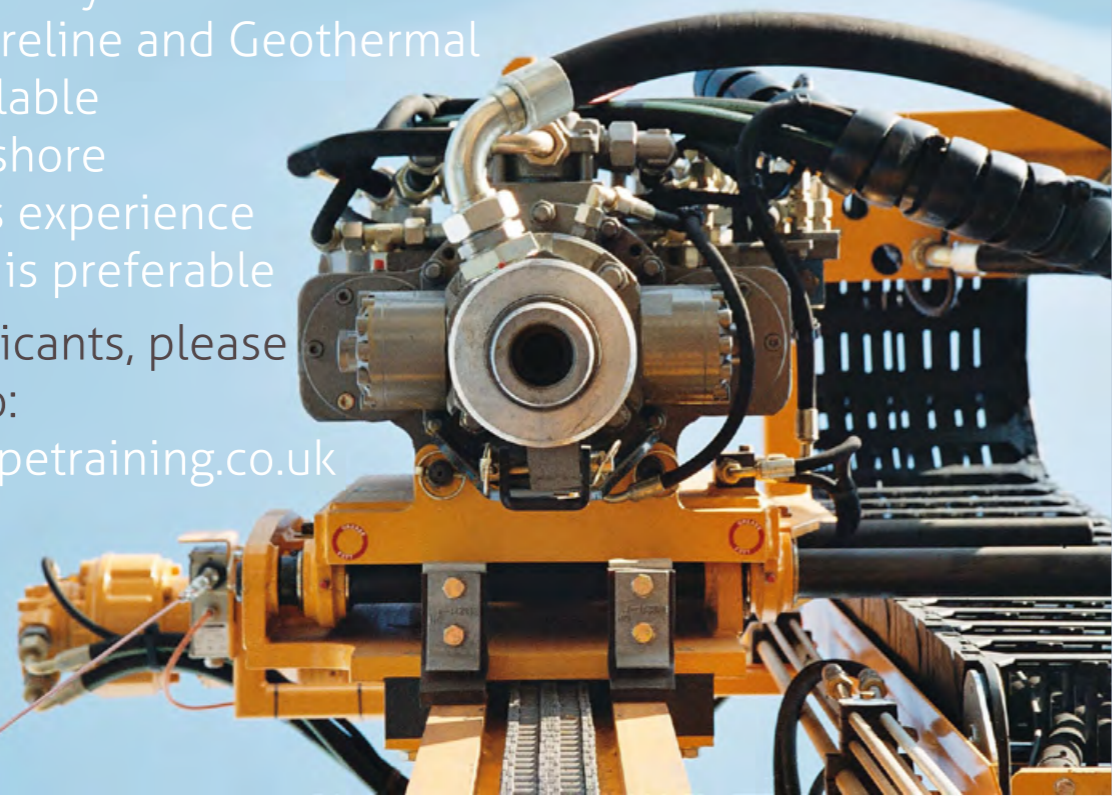
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Gardline Geosciences performs marine rotary drilling with wireline tools and seabed CPT's from its own in house fleet of vessels as well as vessels of opportunity in water depths that range from the nearshore to 2000 metres. Our operations are worldwide, with prestigious projects for major oil and gas clients having recently been completed in the Antarctic; South America; off the Grand Banks of Canada as well as the North Sea.

Due to our increasing workloads we are currently seeking to recruit engineering geologists / geotechnical engineers at all levels to help plan; specify and supervise marine seabed investigations. Core skills required include logging of soil and rock to British and European Standards; a working knowledge of cone penetration testing; laboratory strength and classification testing and the preparation of factual/interpretative reports.

Salary is negotiable depending on experience and all positions carry an attractive offshore allowance.

Reply with a CV to:
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