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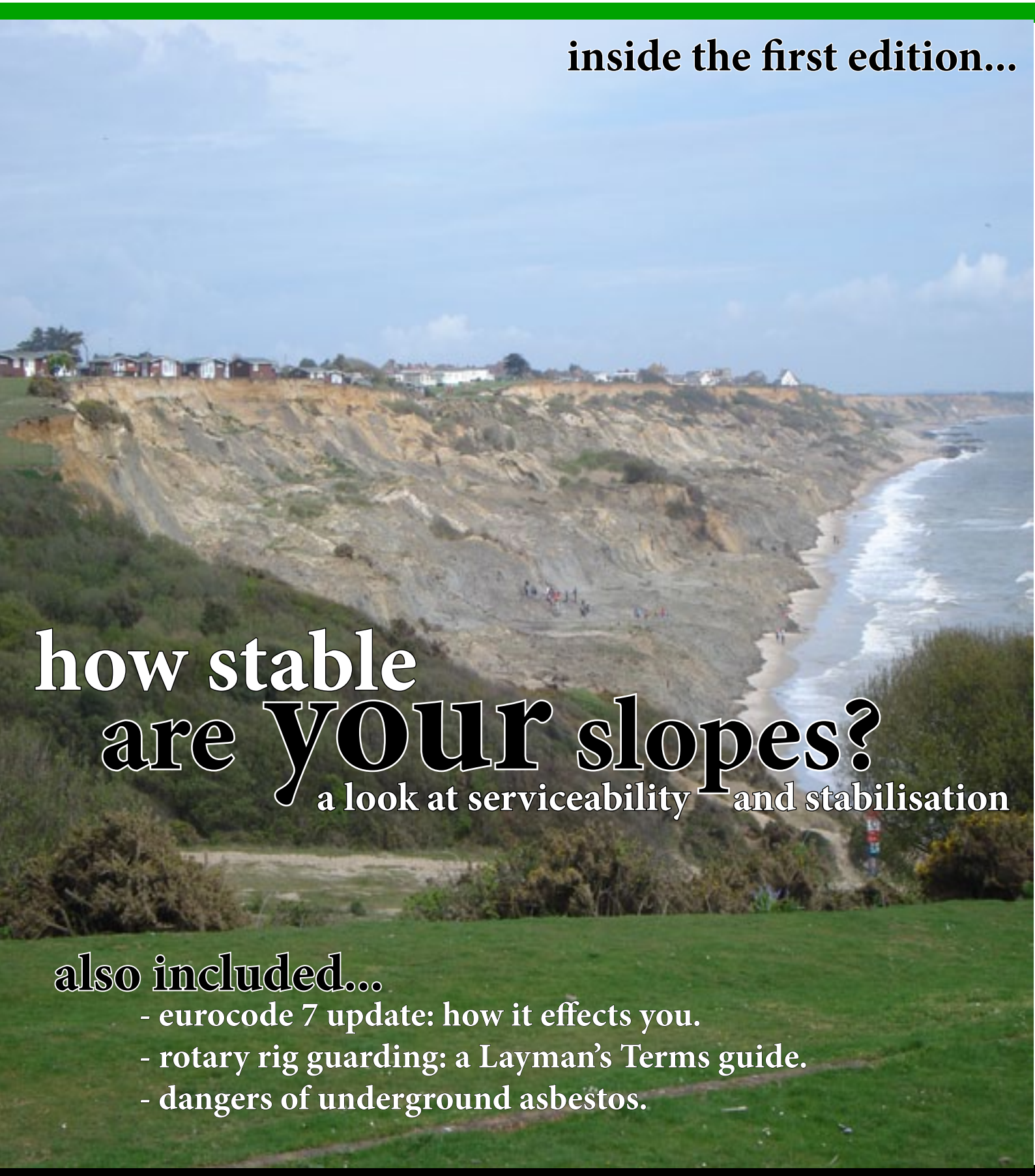
inside the first edition...



how stable are your slopes?

a look at serviceability and stabilisation

also included...

- eurocode 7 update: how it effects you.
- rotary rig guarding: a Layman's Terms guide.
- dangers of underground asbestos.

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an introduction

Welcome to **theGeotechnica**.

This is the first issue of a new concept aimed at the geotechnical, environmental and drilling industry. **theGeotechnica** is aimed at practitioners: whether you are a Geologist, Scientist or Geotechnical engineer; Designer or Consultant; driller or site operative; - **theGeotechnica** will have something to interest you. We will bring you news from all sectors of our community.

The most important thing about this magazine is that it aims to represent all sectors and people within our industry. **theGeotechnica** is free to all subscribers to allow invaluable content and important messages to be distributed more readily. Just sign up online and you will receive your copy every month absolutely free.

The content will be your news: If you have information or views that you wish to share, we will be pleased to hear from you. Every month there will be useful information and articles, aimed at aiding and dealing with the practical issues which affect our industry. These will include articles and news about geotechnical, environmental, drilling, training, safety issues as well as new products and innovation. There will also be editorial columns and articles from invited contributors. If you have something to say and want to voice your opinion, why not write to **theGeotechnica**? We promise to publish your letters, and let you have your say about the goings-on in the geotechnical industry (provided they are not defamatory).

theGeotechnica will carry advertisements at rates you can afford. You can advertise your services on a full, half or a quarter page or as part of the Services Directory. In addition **theGeotechnica** will carry advertisements for items that are for sale or hire and if you are looking for staff there will be a section for recruitment.

Editorial Board, theGeotechnica

Contents: What's in this issue?

Dr Andrew Ridley is the Managing Director of Geotechnical Observations *and is a leading authority in geotechnical instumentation and monitoring. Here, he writes for* **theGeotechnica** *about the use of instrumentation for the assessment of serviceability and the stability of embankment and cut slopes.*

It is important to recognise that instrumentation, on its own, cannot and will not predict the onset of failure in a slope. However neither can analysis

"...instrumentation, on its own, cannot and will not predict the onset of failure in a slope."

(either simple or advanced) with a degree of accuracy that could be used in a practical sense to avoid the problem. The key to the effective assessment of slopes is the combination of analysis and monitoring (i.e. the observational approach).
In the short term significant savings could be made by slope monitoring as opposed to site investigation with immediate remediation in mind. Monitoring and analysis, done in the correct way, should relatively quickly identify those slopes that are most at risk of a failure occurring and should afford the opportunity to stagger investment in remediation, whilst providing the peace of mind that the problems are not being ignored.

Embankment slopes and fills:
All clay embankments begin life with negative pore water pressures. Empirical methods exist for estimating the likely magnitude of the initial suctions in clay fill materials (Ridley and Perez-Romero, 1998). The loss of this suction will, if the geometry of the embankment suits, lead to the devel-

opment of instability. In most cases such failures will occur shortly after construction. Longer term failures can occur in embankments that have an otherwise stable geometry, caused by progressive deformations induced by shrinkage and swelling. It is these that give most cause for concern.

"...identifying the presence of seasonal pore pressure changes is an important factor in assessing the need for further analyses."

Numerical analyses of idealised embankments have demonstrated (theoretically) the existence of failure mechanisms driven by shrinkage and swelling (Vaughan et. al, 2004). Therefore identifying the presence of seasonal pore pressure changes is an important factor in assessing the need for further analyses. Once identified the magnitude of the stress changes can be used in a finite element analysis of the slope to predict if a failure surface is likely to develop. However it is important to recognise that the analysis will be imprecise in its ability to predict the timing of a failure because the seasonal changes will not be consistent from year to year and the history of stress changes will be unknown. Vertical inclinometers can be used to detect acceleration in the movement along discontinuities near the toe of the embankment, but these measurements are out of necessity going to be long-term in nature.

Based on the above a recommended regime for the monitoring of embankments would be to place piezometers capable of monitoring both positive and negative pore water pressures throughout a cross-section of the embankment and into the underlying foundation. These should be set up to record continuously for two (possibly three) full seasons. Placing an inclinometer and a magnet extensometer close to the toe of the slope will detect swelling that could lead to softening and a slope failure. A magnet extensometer placed at the shoulder of the embankment will detect the shrinkage and swelling that causes serviceability problems. If there is concern about the shallow stability of the embankment's shoulder, inclinometers can be placed there but it is important that these penetrate a sufficient depth to ensure that the bottom of the inclinometer casing is not moving. Inclinometers and extensometers can be read manually at regular intervals to suit with the monitoring programme for the piezometers.

The data should be used in the first instance to make a judgment on the likelihood of a failure

surface developing and if necessary as the input to a numerical analysis of the embankment. Depending on the results of the latter, the monitoring of the inclinometer(s) can be continued at less frequent intervals beyond the initial period and used as (i) a means of recording the progress of any movements and (ii) feedback to refine the analyses.

Cut slopes and excavations in clay:
Cut slopes in clay will also begin life with an inherent suction that may penetrate to a considerable depth. Predicting the magnitude of the suction cannot be done empirically and requires numerical analysis of the excavation process. The

"Predicting the magnitude of the suction cannot be done empirically and requires numerical analysis of the excavation process."

delayed deep seated failure of cut slopes is a painfully slow process that is brought about by swelling. Numerical analysis of idealised cut slopes has shown that (theoretically) the pore pressures will have reached a value close to the value at collapse before a rupture surface begins to form near the toe of the slope (Vaughan et. al, 2004).

Therefore pore pressure measurements will be of no use for predicting when a cut slope will fail. However they will be of use in estimating if the pore pressures in the slope have increased to the value required for a failure to occur. To use them in this way it may be necessary to have performed a numerical analysis of the particular slope concerned, but it may equally be possible to make use of published parametric studies to make an engineering judgment of the problem. The longer-term monitoring of pore water pressures will be of benefit in identifying the likelihood of shallow slips occurring as a result of seasonal variations of pore water pressure.

If the potential for a deeper-seated failure exists, because the geometry, ground conditions

and pore pressures are appropriate, movements along a rupture surface may be detected with vertical inclinometers placed in the lower part of the slope. An early indication of the presence of a rupture surface may be obtained by careful measurements of water content from samples taken from the boreholes required to install the inclinometers and from boreholes required to install any piezometers that are seated below the elevation of the rupture surface. Significant movements along the rupture surface will only occur in the few years prior to a collapse, so one must prepare for a long-term monitoring programme.

Based on the above a recommended regime for the monitoring of cut slopes would be to place piezometers capable of measuring both positive and negative pore water pressures throughout a cross-section of the slope. It is not essential for these to penetrate to depths below the elevation of the bottom of the slope, but if one (positioned in the lower part of the slope) was to do so, samples taken from the borehole could be used to examine the water content profile. These piezometers should be set up to record continuously for as long as is required to establish the pore pressure regime and if there are any seasonal variations. If seasonal variations exist it may be necessary to record the pore water pressures for two (possibly three) full seasons. Inclinometers can be placed in the lower part of the slope and read initially at intervals to suit the programme of pore pressure monitoring and in the longer term perhaps only quarterly or bi-annually. It could be prudent to install the inclinometers at the same time as the piezometers are installed but this is not essential if logistical or financial constraints exist. The boreholes used to install the inclinometers can also be used to gather water content measurements. In summary, instrumentation on its own cannot predict the failure of embankments or cut slopes,

"...together instrumentation ...and finite element analysis can be used to assess if the earthwork has the conditions required for a failure to occur. "

but neither for that matter can finite element analysis to any degree of accuracy that will be of practical use. However, together instrumentation (in the form of piezometers that can measure positive and negative pore water pressures) and finite element analysis can be used to assess if the earthwork has the conditions required for a failure to occur. Once this has been established the most effective method of detecting the failure as it occurs are inclinometers that have been correctly installed at the appropriate locations, but the programme of monitoring is likely to be long-term. ■

References:
Ridley A.M. and Perez-Romero J. Suction - water content relationships for a range of compacted clays. Proc. 2nd International Conference on Unsaturated Soils, Beijing, China, Vol.1. pp 114-118. International Academic Publishers, 1998.
Vaughan P.R., Kovacevic N. and Potts D.M. Then and now: some comments on the design and analysis of slopes and embankments. Advances in Geotechnical Engineering: The Skempton Conference 2004. Thomas Telford, London. pp 241-290.

eurocode: what is it?

eurocode

There is much confusion and rumour about what Eurocode actually means.

Eurocodes have been with us for some time but many have decided to do nothing with a 'wait and see' attitude. Now the much publicised transition has passed and there are still many questions which need to be answered regarding the implementation of the new Standards including: who will pay for the inevitable increase in costs?

Many of the Standards now include mandatory requirements which were previously recognised as best practice but often not followed by all. Will this outlaw some contractors or will consultants and clients be lenient to maintain cheaper contracts? There would also appear to be no place for the U100 if the consultants want to carry out triaxial or oedometer testing, but in the UK what will be expected for a Class A sample? The solution is not straight forward because thin wall samples and rotary cored samples are all too often cost prohibitive. Are clients prepared to pay for such samples to be obtained so that they can carry out what have been considered to be routine laboratory tests?

Eurocode also ventures into areas considered as taboo by BS and requires that Enterprises (the Companies) carry insurance and employ skilled and competent operators. Certainly there are very few skilled operators who can comply with all of the qualification requirements and presently there is no mechanism to provide the appropriate training and qualification to these individuals.

As an industry we need to decide where we want to take our trade. Do we embrace the philosophy and ethic which Eurocode provides? Or, do we bumble along in the same old way? At the end of the day looking to the future, there will be a cost. However for many years engineers have bemoaned the poor quality of investigation, knowing the industry should be of higher quality and cost to the client. Is this not the opportunity we have been waiting for?

Why not have your say send your article or letters to The Geotechnica and start the discussion… ■

John Powell is the Technical Director of Geolabs, as well as an Independant Consultant. Here, John writes for theGeotechnica for the first time, along with David Norbury - a fellow Independant Consultant, discussing the inpementation of Eurocode 7.

We trust that by now all readers are aware that, in addition to the two parts of Eurocode 7, there are a number of other Standards which are required to make up the complete set for use in ground investigations and geotechnical design practice. There are the National Annexes that go with the two parts, and then there are a number of attachments which are called up in Eurocode 7 Part 2. These are not all yet available, and this article provides an update on the current position in 2011.

"Clauses 3.2 and 3.3 of BS 1377 Part 9 no longer exist and should not be referred to in specification, practice or reporting..."

A number of the Standards have been published and implemented into UK practice, as listed in Table 1. At the same time as implementation, the corresponding parts of any conflicting BS have been withdrawn, hence Clauses 3.2 and 3.3 of BS 1377 Part 9 no longer exist and should not be referred to in specification, practice or reporting and BS5930 has undergone two sets of amendments as highlighted in Table 1.

However, the story does not end there as a number of other Standards listed in Table 2 have now been drafted, commented upon and have finalised text and are due to be published shortly, and possibly this year.

This list comprises a further 13 standards that will need to be implemented into national practice within 6 months of publication. That will require a major effort by industry at a time of difficult trading conditions. This is not a happy coincidence in timing.

There are also a number of other Standards, (20 or so) which are further from publication, but which are called up in EC7 Part 2. The date of publication of these Standards is not known, but is likely to be within two to three years.

Table 1: Standards published and implemented at the time of writing

Standard Number	Coverage of Standard	Comment
BS EN ISO 22475/1	Sampling and groundwater measurement	*Implemented. Changes incorporated in BS5930+A2*
BS 22475/2 BS 22475/3	Qualification of enterprises and personnel Conformity assessment of enterprises and personnel	*Now published as normative British Standards.*
BS EN ISO 22476/2 BS EN ISO 22476/3	Dynamic probing Standard Penetration test	*Implemented* *Clauses 3.2 and 3.3 of BS 1377 Part 9 withdrawn. Changes incorporated in BS5930+A2*
BS EN ISO 22476/10 (TS) BS EN ISO 22476/11 (TS)	Weight sounding test Flat dilatometer test	*Implemented; not widely used in UK*
BS EN ISO 22476/12	Mechanical CPT	*Implemented but no action as no precedent BS*
BS EN ISO 14688/1 BS EN ISO 14688/2 BS EN ISO 14689/1	Soil description Soil classification Rock description and classification	*Implemented. Changes incorporated in BS5930+A2*

Table 2: Standards that will shortly be pulished.

Standard Number	Coverage of Standard
22476 - Field Testing	1 Electrical Cone and piezocone penetration tests 2 Ménard Pressuremeter 3 Flexible dilatometer 4 Self boring p/meter 5 Borehole Jacking test 6 Full displacement p/meter 7 Field vane test
22282 - Geohydraulic Tests	1 General rules 2 Water permeability test in borehole without packer 3 Water pressure test in rock 4 Pumping tests 5 Infiltrometer tests 6 Closed packer systems

"Work has begun in other areas of investigation and testing on Standards which are not, at this stage, referred to in Eurocode Part 2..."

And that is still not the end of the story. Work has begun in other areas of investigation and testing on Standards which are not, at this stage, referred to in Eurocode Part 2; that omission will be corrected as the Standards are published.

The UK mirror committee (B/526/3) is charged with the implementation of all these Standards in a timely manner, but we cannot do this alone. We can publish news editorial as the above listed Standards come into circulation, but we need the help of industry. In particular, we aim to encourage volunteers to digest and publish critical but helpful summaries of the new Standards. This was carried out for those Standards already implemented (22476/2 and 22476/32, 14688/1, 14688/2 and 14689/1) and the relevant articles were published in Ground Engineering. The take up of these was still slow, and we will all need to do better in the years to come. The main reason for this is that if we do not implement smoothly and rapidly we will be operating parallel systems of old and new. This will be inefficient and cause errors and misunderstandings.

Finally, readers should note that there are maintenance and feedback systems in place for getting standards corrected and amended. This is not an easy or rapid process, but if you have any critical comments please submit these officially to BSI (cc to authors) and they will find their way to B/526/3 for action. It is not intended that the Eurocodes and the attachments will be fossilised as at the time of publication, and so UK industry can provide a positive lead in Europe to making these Standards better.

Note to readers - amendments to the DP and SPT EN ISO Standards are shortly to be published; whilst the changes in these align closer to UK practice, keep your eyes open for these and other changes. ■

For more information on the current position of publication and implimentation of the Eurocode Standards, please visit www.drnorbury.co.uk.

Chris Eccles (SiLC) and director at Terra-Consult Ltd, an environmental consultancy, writes for **theGeotechnica** *regarding the issue of asbestos contaminated land.*

Almost every practitioner in our industry is well aware that the presence of asbestos in the ground can be a significant risk which is required to be appropriately addressed as part of the development process. There have also been a number of recent court cases and High Court rulings regarding asbestos exposure and this has increased the concern over the potential risk of asbestos fibres in soil.

The management of asbestos in the work place, its assessment and removal are all highly regulated activities covered by the CAR regulations 2006 and a wealth of other HSE guidance. When assessing the presence of asbestos in the ground there is limited guidance in the UK. Some practitioners still apply former ICRCL guidance which is not risk based, others use better Dutch or US

"There is an urgent need to provide best practice guidance for use in the UK."

procedures but there are difficulties in applying these in the UK regulatory context. There is an urgent need to provide best practice guidance for use in the UK. For example the recently revised and much improved BS10175:2011 lacks advice on asbestos but does provide improved guidance on many other problematic contaminants.

Three of the key issues that urgently require addressing are:

- Analysis methods for asbestos in soil
- Sampling requirements and risk assessment
- Licensing of the remediation of asbestos in the soil

"It has become clear that many practitioners are not aware of the limitations of the various analytical techniques for testing asbestos in soil..."

It has become clear that many practitioners are not aware of the limitations of the various analytical techniques for testing asbestos in soil and are often under assessing the presence of asbestos fibres in soil and therefore incorrectly assessing the risk. Asbestos can be present in soil as fragments of bulk asbestos materials (e.g. asbestos cement sheeting) and also as discrete asbestos fibres within the soil matrix. Until recently many practitioners had soil samples analysed for the presence of bulk asbestos fragments but not for discrete asbestos fibres within the soil matrix. Discrete asbestos fibres potentially present a much greater risk to health from exposure than bulk fragments.

"Discrete asbestos fibres potentially present a much greater risk to health from exposure than bulk fragments."

When requesting asbestos analysis of soil samples note that many laboratories offer three different types of analysis:

1. Asbestos Screen of Soil Samples – method for screening for obvious signs of suspected asbestos containing materials; done by eye. If suspected asbestos containing materials are identified then the suspected material is generally analysed for Bulk Identification

2. Asbestos Bulk Identification – type of asbestos identified by using HSE approved methodology (polarised light microscopy)

3. Asbestos Quantification and Composition – positive or negative for presence of individual asbestos fibres in soil with a typical requirement for an accredited detection limit of less than 0.001 %. If positive presence of asbestos, then type of Asbestos then the percentage of asbestos in the material is determined.

One of the difficulties with asbestos in soils is how to determine whether soil is free of asbestos and at what percentage in soil asbestos constitutes a significant risk. Due to the health risks from asbestos fibres many practitioners use the typical laboratory limit of detection of 0.001% as the acceptable limit. At such low percentages, this presents difficulties for choosing an appropriate sampling frequency to validate that soil meets criteria for re-use or verifying that remediation targets have been met.

"With lack of specific guidance on asbestos in the ground from the regulators, the UK contaminated land industry is going to be producing its own best practice documents..."

With lack of specific guidance on asbestos in the ground from the regulators, the UK contaminated land industry is going to be producing its own best practice documents with current working groups being set up by the Environment Industries Commission and CIRIA. ■

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Keith Spires is veteran of the drilling industry. With 30 years experience within the field. Now a director at Equipe, Keith writes for **theGeotechnica** *about the need for improved guarding for rotary rigs.*

Guarding Rotary Rigs:

The guarding of Rotary rigs is still an issue throughout the drilling industry, in particular within smaller companies. The legislation which dates back to the PUWER regulations of the earlier nineties is now generally adhered to within the drilling world.

"...smaller companies still lack the understanding of the document and how it effects them..."

However the smaller companies still lack the understanding of the document and how it effects them, so lets try to explain it in Layman's terms.

First: does it apply to you? Is the drill string a dangerous rotating part?

I think we can all answer a simple yes therefore the legislation applies and you must use one of the following provisions: Fixed Guard, Moveable Interlocked Guard, Other device.

"In Rotary Drilling, we need access to the drill string, and thus the Fixed Guard cannot be used."

In Rotary Drilling, we need access to the drill string, and thus the Fixed Guard cannot be used. With that in mind, we need to use the Moveable Interlocked Guard. This provision allows the guard to be moved away from the drill string, but when moved an interlocked electrical switch stops the rotation of the drill string instantly. The drill string cannot be restarted until the interlock is closed. This method has been proven within the drilling industry to work has generally been adopted across the board.
So what does the Moveable Interlock Guard have to do?

The Guard must fully enclose the rotating drill string on all sides – *Walk around the rig; can you touch the drill string? If so it does not fully enclose.*

Dimensions of any fencing or mesh must be of a suitable size and distance to prevent any part of the operator's body coming into contact with the dangerous components – *If the mesh is such that you can get your hand through then the mesh must be far enough away that you cannot reach the drill string with your hand.*

Fixed guards must be used where possible – *Fix the Guard where you don't need access. The back and sides don't generally need access so it is advisable that the Guard be fixed at these points.*

Example: Moveable Interlock Guard

A gap of 0.75m from the floor is acceptable and the guard must be at least 1.8m high – *Simple enough to measure, but this is at all times so think about where you mount the guard, dumps can be moved!*

"Where access is required, an Interlocked Guard should be fitted..."

Where access is required, an Interlocked Guard should be fitted – *We need access so fit the Interlock Guard. The Interlock Switch must protect the whole of any moveable part of the Guard and not just the gate.*

Where gaps are required, they must be of suitable size and distance in order to prevent any part of the operator's body coming into contact with the dangerous component – *If you have a gap, ensure you cannot touch the drill string from the gap.*

The Interlock must not be capable of being easily bypassed or disabled, so simple roller type micro switches are not acceptable – *If the driller can bypass the Interlock by any means (tape, cups, bags ties etc) it does not conform.*

The interlock must fail to safe – *If the Interlock is not working nor does the rig.*

"Closure of the Guard must not start motion on its own."

Closure of the Guard must not start motion on its own. Restart must require a positive restart from outside the danger zone – *You need a reset button on the control panel which is activated after the Interlock is reengaged.*

If motion of the drill string is required with Guards open, it must not be 'dangerous'. Therefore it must be slow and in low torque, so if entanglement occurs there will be no injury – This is all down to your hydraulics expert - it can be done. 15 RPM is the maximum as you often need some rotation for making and breaking the drill string.

"We should remember that we have a duty of care under the Health and Safety at Work Act..."

We should remember that we have a duty of care under the Health and Safety at Work Act to ensure we do everything practicable to ensure the H&S of both ourselves, and for the people who work both for and with us. Failure to implement the necessary control measures could result in enforcement action such as prohibition of activities or issue of notices requiring improvement or prosecution. Failure to ensure that the correct guarding is both fitted and working correctly has already resulted in Prohibition orders been served on companies. ■

Industry endorsed: coded magnet interlock-switch.

Energy Measurements:

The measurement of the energy ratio of SPT hammers is now becoming common place within the Site Investigation industry, but why do we need to measure it? Since some limited testing was carried out in the early nineties, it has always been assumed that the efficiency of the SPT hammer has been

"Data collected so far shows that hammer efficiency varies from a lowly 39% to high readings of around 90%."

60%. However with the introduction of the SPT Analyser into the UK, it has been shown that that the use of the 60% figure is flawed. Data collected so far shows that hammer efficiency varies from a lowly 39% to high readings of around 90%. This difference of up to 50% leads to confusion on sites where the N values would seem to be hugely varied, leading to doubts over the reliability of the results.

The main cause of the low energy ratios has almost solely been found to be due to poor maintenance of the standard type SPT hammers. This coupled with engineers and operators not understanding what causes poor SPT results, is leading to the mistrust of the results. The hammers are all too often dragged through the mud or dropped from the transport. Following this, they are then lifted from the mud and used to carry out a test of the strength of the ground with a series of often haphazard blows, where the hammer drops from too low, or has to be knocked off the sleeve by the action of the driller.

The test is designed for the hammer to be dropped vertically, so starting a borehole which is not vertical will immediately lead to poor, unreliable results from the outset. The standards state that the rods should remain central to the borehole – a case often over looked when carrying out the SPT test.

The drillers and engineers alike need to ensure the confidence in the test returns and we can go a long way to achieving this by adhering to 5 simple rules:

1. Know the energy efficiency of your hammer – *Without knowing the efficiency of your hammer, the actual N valve of the test is impossible to calculate accurately.*

2. Ensure all holes are drilled vertically – *Take the time at the outset to start vertically – the possible difference in energy ratio, if not vertical, can be up to 10%.*

3. Maintain your hammer: Keep it clean, don't drag it, ensure the dampening rubbers are in place, ensure it picks up and drops first time, every time – this is how they are supposed to work – *Nothing affects the hammer more than this. Poorly maintained hammers give the biggest variants in results, with results up to 20% either way.*

4. Ensure the rods are held secure in the hole and are vertical – *A simple rod guide placed in the casing head hugely improves the consistency of the test.*

Consistency: A simple rod guide.

5. Don't use grease of any sort on the hammer – *The simplest thing, but the biggest difference. Grease can reduce the efficiency of the hammer by up to 20%. Do not grease your hammer!*

It's not all bad news either: an efficient hammer uses less blows to complete the test and speeds up the whole process! ■

avoiding danger from underground services

safety issues

Writing for **theGeotechnica** *for the first time,* Tom Phillips*, an independant chartered occupational safety professional from* RPA Safety Services*, voices his concerns about the industry's failure to address adequate training in underground service avoidance.*

Many leading voices within the geotechnical and drilling industry would suggest that one of the most significant hazard for our site staff is underground service strikes yet statistics do not bear this out. Figures provided by the Health and Safety Executive

"...11 major injuries within the construction sector in 2008/9, caused through contact with underground electrical cables."

(HSE) record 11 major injuries within the construction sector in 2008/9, caused through contact with underground electrical cables. One of these involved a driller working in London in 2008 which came as a sobering reminder, if it were needed, about the risk faced by employees within the industry.

To help companies discharge their legal obligations in relation to underground services, the HSE provides guidance in their publication 'HSG47 - Avoiding Danger from Underground Services' . A HSG document is issued by the HSE to outline the suggested best practices – but, following it is not compulsory. Companies are free to take other action, but if they do follow the guidance they will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice, so understanding and applying it is important in preventing injuries and protecting against any potential prosecution.

HSG47 outlines the requirements for any company involved with work where there is a risk of contacting underground services. They need to have a safe system of work which includes: planning, maps and plans, cable and pipe locating devices and safe digging practices. A safe system of work recognises it is impossible to eliminate all risk, but rather relies on people for it to be effective. Therefore staff must be trained to follow it and understand any limitations. It is this area which is currently of concern to

"Engineers, drillers, consultants and directors are too often unaware of the risks they face..."

industry safety professionals. Engineers, drillers, consultants and directors are too often unaware of the risks they face and are often unsure how to apply the requirements of HSG47. The safe system of work will only be effective if everyone involved is trained in all aspects and able to apply the correct controls. This is an area of weakness in the geotechnical sector as few in the industry receive training beyond how to use a Cable Avoidance Tool (CAT). Many of the working practices being used expose staff to an unacceptable level of risk and to a large extent, everyone turns a blind eye. It is these factors and the levels of training for operatives, consultants and engineers which need to be addressed so that working practices can be improved.

Problem: a typical buried service.

Planning the work is the initial stage outlined in HSG47. Understanding the site, its history and the nature and location of any services, will initially determine the costs of the work and should form part of the pre-tender process. Determining the extent of hand digging or selecting the appropriate detection technology can only be done if the utility plans have been consulted, and failure to do this means the contractor or client will not be discharging their duty of care. This could result in prosecution under the Construction Design and Management Regulations 2007. The second stage of HSG47, maps and plans, are

"...maps and plans are only useful to those who understand their limitations."

only useful to those who understand their limitations. Utility providers acknowledge their services rarely run in straight lines and that surface depths may have changed. Datums such as kerb lines may have been moved and plans may only run to site boundaries. They all carry disclaimers to this extent and as a result their omission is often condoned, but they still provide valuable information for those on site in locating services in the area.

Maps and plans are then best supplemented through the use of appropriate cable and pipe locating technologies. In most instances the appropriate cable locating technology will be a basic CAT to verify the accuracy of utility plans or detect the presence of services not indicated. However CATs will not detect plastic or earthenware pipes, they may struggle to detect cables with no load, and in some cases three phase cables where the load is well balanced such as high voltage feeds to substations.

This is where Signal Generators are vital but it is disturbing how few people are comfortable with using them. They are taken to site but rarely used and in many cases, the accessories have never been unwrapped. This can be overcome with simple practical and theory training and dramatically extends the number of services a CAT can detect.

Mandatory: CAT Scan.

At the other end of the scale there is Ground Probing Radar. Often advertised as the answer to all service location problems, they are expensive; may not detect all ground anomalies; are sensitive to ground conditions and struggle to detect small diameter utilities. They must not be used to replace utility plans or CATs and those specifying and operating them must understand how

"HSG47 places great emphasis on the importance of finding services before mechanical work commences..."

they work, whilst also being able to interpret the results and understand their limitations. HSG47 places great emphasis on the importance of finding services before mechanical work commences and this is currently the greatest area of weakness within drilling and geotechnical work. The predominant practice within the geotechnical and drilling industry is to scan the area for services and then dig a pit to 1.2m before drilling. When drillers and engineers attend training courses they all report striking services below 1.2m, caused by a common misconception regarding the maximum depth of services in the ground. HSG47 states mechanical equipment must not be used until services have been located, so if the service on a plan has not been found, the utility provider should be contacted and it must be assumed to be underneath

safety issues

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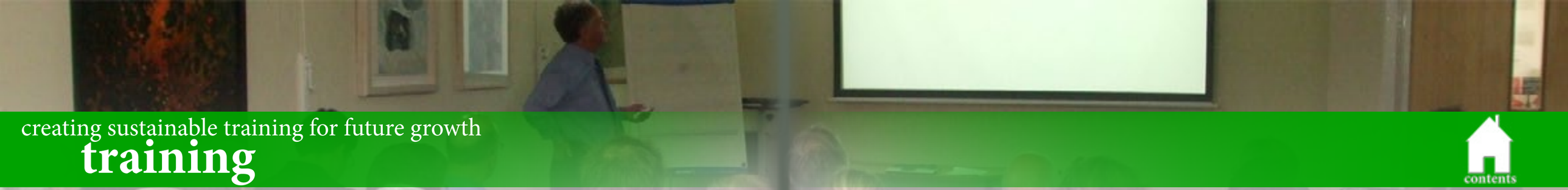
the area planned for work. Therefore more emphasis needs to be placed on finding services rather than checking that the area planned for work is clear. Additionally safe digging relies on the careful use

"Hand digging must not be abandoned, but should be used to positively identify services..."

of tools, using pins and bars only to free rocks and other debris, rather than the current practice of driving tools into the ground to achieve a 1.2m depth. Hand digging must not be abandoned, but should be used to positively identify services in the area and to confirm changes in geology or fill which may indicate utility presence.

All of these subjects are discussed in depth, on the IOSH accredited Avoiding Danger from Underground Services, a one day training course delivered in conjunction with Equipe Training. The course addresses the short comings of existing CAT and Genny courses and for this reason, it has been adopted by many organisations as their default training course. It was described by one candidate thus:

'This was the best underground services course I haever attended. All the other courses focus solely on how to use a CAT and Genny, but this one looked at all aspects of managing risk in relation to underground services.' ■



creating sustainable training for future growth

training

contents

With over 35 years experience as a chartered geologist, Pete Reading now finds himself a technical director of Equipe Training. *Here Pete writes for* **theGeotechnica** *about the need to provide training in order to enable future growth within the industry.*

In December 2010, NERC issued a letter announcing that it was to withdraw all financial support for students on MSc programmes. This is in line with the EPSRC, who also withdrew such support some while ago. The announcement has sent waves of dismay through the civil engineering community and has increased the serious concern that the UK graduate and postgraduate course structure will not be able to supply sufficient suitably trained and qualified people into the sector. So what options are available to the industry to bridge this inevitable skills gap?

In the past, the majority of companies relied on the university course structure to provide sufficiently rounded individuals who could, with some minor specialist in-house or external training, be moulded into staff providing real value to their organisations. Some of the larger companies also developed graduate training schemes with courses specifically developed to enhance and build on the knowledge and skills obtained from the university courses. The industry courses also included essential training in industry specific areas which the universities are often somewhat divorced from, such as health and safety. So it has, for some time, been a partnership between universities and industry to supply courses to create the engineers/geologists/scientists of the future.

"...in addition to the seeming demise of the university courses, the civil engineering industry is now in the grip of a prolonged and significant economic downturn in the market. "

However, in addition to the seeming demise of the university courses, the civil engineering industry is now in the grip of a prolonged and significant economic downturn in the market. With the current economic climate and companies struggling to survive, training has been hit hard because the returns are difficult to quantify. The training budget has been an easy target when companies are looking for cuts and the cost for attendance on courses is often the first to disappear. However, this attitude is short-sighted and will make the climb out of recession even harder and longer. The most valuable resource of any company are its staff, and they are essential to its growth, development and ultimate survival.

"The benefits of properly trained staff are clear to see... All of which can give the company the edge over its competitors."

The benefits of properly trained staff are clear to see; improved accuracy and efficiency; increased quality and flexibility of a company's services; improved customer satisfaction and greater productivity and responsiveness. All of which can give the company the edge over its competitors, whilst making its employees feel motivated and improving morale.

So how is this skills gap going to be bridged and how will existing and future courses provide this

On site: Apprentice training.

essential sustainable training? As with the nuclear industry, the answer is that industry training organisations, whether in-house or independent, must work more closely with the universities to bridge the gap. Some companies and independent training providers, such as Equipe, who provide training courses for the geotechnical industry, have already created strong links with universities and are able to provide focused training both in the form of formal courses and also as seminars and symposiums.

Training in progress: an Equipe Open Day.

Equipe courses regularly feature University Professors and Lecturers and in return offer free places to undergraduate and postgraduate students. Equipe also provide lectures and site visits to their facilities at The Drilling Academy™ where students can obtain an industry perspective to their learning and even see plant and equipment in action. Many

"Many of these courses combine practical demonstrations with technical and contractual training..."

of these courses combine practical demonstrations with technical and contractual training, as well as all courses being designed with Eurocodes as standard. In addition to technical courses, Equipe is also best placed to offer practical training, such as health and safety, and this can be provided at a company level or using specifically designed industry focused courses such as IOSH Safe Supervision of Geotechnical Sites, IOSH Avoiding danger from underground services, SMSTS, SSSTS etc.

"...within industry bodies... there is a real concern that the knowledge base is being reduced and the skills gap being increased."

It is clear from discussions currently being held within industry bodies, trade associations, learned societies and the civil engineering industry as a whole, that there is a real concern that the knowledge base is being reduced and the skills gap being increased. It is also clear that with the issue of government funds being withdrawn or reduced from university courses, that more stress and pressure is being placed on individuals and companies to make up the shortfall. This will not change in the foreseeable future and so it is now time for the industry to fully assess the courses available, and to promote better communications and relationships between all organisations involved, whether that be academic, industry or independent. Whichever way the industry assesses the situation, it will be the industry itself which will have to pick up the cost of the training and development of the courses which will add the real value and create the growth required to move forward. If it fails to do so then it will ultimately pay the price. ■

Training in progress: an Equipe Open Day.

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borehole logging the smarter way

products and innovations

contents

The Drilling Industry has recently been given a long overdue IT overhaul in the shape of KeyLogbook®. With clients demanding more accurate and quicker data and companies requiring to be more lean and efficient, the solution could not come at a more appropriate time.

KeyLogbook® is a simple robust digital logging system which has been developed by Equipe, a leading geotechnical solutions provider in partnership with Keynetix, the leading geotechnical software specialist. The traditional method of a driller writing his log into his site notebook, then transferring the data onto daily record sheets and writing endless labels is time consuming. When coupled with engineers spending vast amounts of time re-entering the data into computer databases it is simply wasting huge amounts of both time and money. The introduction of KeyLogbook® will condemn these processes to being a thing of the past.

KeyLogbook® boasts an ultra rugged tablet which can be mounted directly onto the drilling rig or in the support vehicle. Data is entered via a simple touch screen operation requiring minimal typing and no computer skills. The KeyLogbook® programme can import the drilling instructions directly via the 3G connection, and transfers all of the data by a simple touch of the screen as the borehole or shift is completed. The data is sent in PDF and AGS format and includes a full measure and invoice of the job as well as test results.

"KeyLogbook® cuts out up to two hours of work a day."

Keylogbook® has undergone a trial period with companies such as Vinci Soil Engineering, ESG, Glovers, and Bam Ritchies. These field trials have provided feedback which has been overwhelmingly positive. Reaction from drillers on the ground suggests that KeyLogbook® cuts out up to two hours of work a day. As a result, production is higher and drillers present a more professional image because the records are clean, complete, clear and accurate. Digby Harman, Regional Manager of Vinci Soil Engineering, says: "We've been evaluating its use on a number of internal projects, mainly cable percussion and rotary routine ground investigations, and we've found that it is robust and meets all the standards of the industry. Digby added: "The company has been involved with KeyLogbook® for the past year and has provided feedback for both Keynetix and Equipe. Our role in trialling the Key Logbook is to ensure that it is easily usable for the people who need to use it most - i.e. the drillers." KeyLogbook® has been produced to take the drudge away from the driller's day as it now writes the daily record sheets as well as producing legible thermally printed labels. As the data is then transferred digitally in AGS format to the office there is no longer a requirement for that someone to transcribe it. Digby also adds: "This long-winded process has now disappeared at a stroke. From the feedback I've had from drillers, I'd say they really like the product."

Julian Lovell, Equipe's Managing Director states: "The ability to capture essential drilling information at source and to then transfer this data to all interested parties at the push of a button is truly revolutionary. The ability alone to produce bar coded sample labels from the bluetooth label printer removes issues of legibility and transposition errors which cause so many problems". This barcode system can be easily used for sample chain of custody and laboratory storage systems, making sample tracking and retrieval simpler.

Keylogbook® has been developed to improve not only the drillers life but to give engineers unambiguous up to date information from the field to enable quicker and smarter decisions on sampling, borehole depth, insitu testing and installations, thus improving the focus of the project and delivery of the design. The drillers on the ground, the contractors, designers and clients all benefit from the use of KeyLogbook® and will all truly reap the rewards from this new technology. ■

KeyLogbook®

State of the art digital logging system for drilling professionals

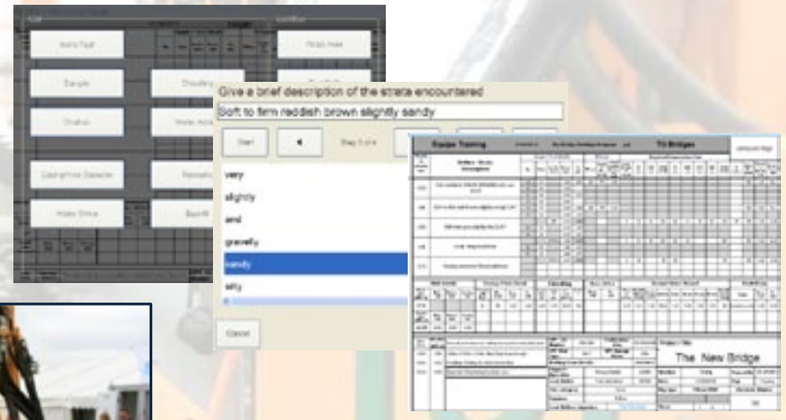
Keylogbook® revolutionises the way site data is captured, recorded and transmitted. Drillers and engineers no longer need to keep re-entering the same data over and over again thus reducing errors and making the whole process simpler, faster, smarter, greener and more efficient.

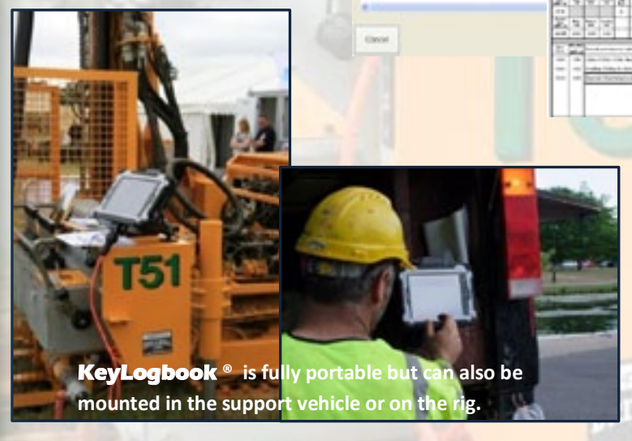
Benefits – The Driller

- **No re-writing anywhere - imports project details directly from office/client**
- **No computer training required – just switch on and follow the instructions**
- **No typing skills required - simple single entry of data directly on to screen**
- **No pen required - uses latest touch screen technology**
- **No writing of labels – prints thermal sticky labels from the bluetooth printer**
- **No writing up of logs after shift - logs sent directly to office/client immediately**
- **No scrabbling around for old note books – all projects are stored on the machine**
- **No arguing over the final price – invoice is produced directly from the logs**

Also produces:

- **Accurate Invoices and Measures**
- **Installation Drawing**





KeyLogbook® is fully portable but can also be mounted in the support vehicle or on the rig.

KeyLogbook® records all site data at source and transmits it direct from site saving time and money from the outset.

Specification

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Microsoft Office 2007

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KeyLogbook®: 3yr support and free version upgrades
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KeyLogbook® is developed in partnership with Keynetix Limited

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For more information visit www.keylogbook.co.uk

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