

theGeotechnica

equip^e

inside this edition...

tackling fallen leaves

the impossible task?

a frank assessment of industry attitude to health and safety

also included...

- the benefits of CLA in stability analysis
- information on free digital data
- the rising importance of Tachographs



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an introduction

Welcome to the September issue of **theGeotechnica**.

In this month's edition of **theGeotechnica** we thought that we would try to be a bit clever and have started to explore the philosophical side of geotechnics as well as the practical side. The articles in this month's issue provide some food for thought, as well as some very useful practical information to keep your projects on track and compliant.

Following on from his very well received presentation at this year's Geotechnica, we have an article from Professor Barry Clarke in which he questions if codes and standards will be the downfall of the industry. The article discusses the likely changes to geotechnical engineering which are being driven by government strategies and if the large number of codes and standards are sustainable.

The art of looking sideways is not only a good name for a band but is the theme to a philosophical article questioning our approach to safety. The article explores some philosophical aspects of safety management, exploring the value of schemes such as zero tolerance and behavioural approaches but throughout has a very clear and pragmatic message. It is compelling reading and well worth spending some time to read and digest.

As always, this edition of **theGeotechnica** provides articles which vary from 'useful to know' to 'I should have really known that!'. We have an article which provides an interesting insight into the problems of environmental sample prepping and pre-treatment and an article highlight the requirements of the use of Tachographs and what the law says. In addition, we look at a new software programme for checking working platform stability, the launch of RoGEP and what free digital data sets are available and how they can be used.

If you want to make a contribution of an article to **theGeotechnica** just send it to magazine@geotechnica.co.uk and provided it's content is applicable and not defamatory or blatant advertising we will publish your article.

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rapid stability analysis geotechnical



Colin Smith is a Director at engineering software house [LimitState Ltd](#) and also lectures at the University of Sheffield. Here, Colin writes for **theGeotechnica**, discussing the use of CLA in checking working platform stability.

The last few years have seen easy to use Computational Limit Analysis (CLA) software become readily available to practitioners. Used as part of a rapid design/analysis process, CLA is gaining significant popularity amongst contractors and offshore specialists who often have to find quick solutions for temporary works or rapid design solutions for unforeseen conditions.

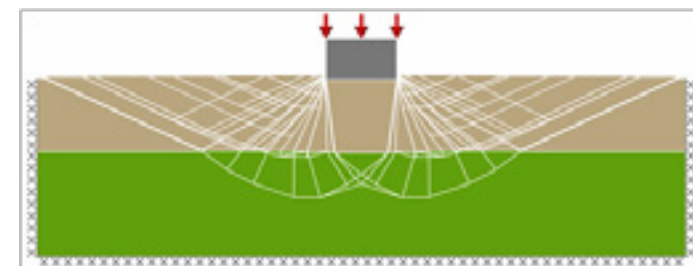


Figure 1: Computational Limit Analysis of working platform problem from BR470 clearly illustrating punching failure and also showing full extent of the failure mechanism (Example 1, Case 1). Predicted bearing pressure = 213 kPa, compared to 205 kPa from BR470.

Once the preserve of academic researchers (e.g. Smith and Gilbert, 2007), CLA uses state of the art optimization methods to rapidly determine the critical collapse mechanisms and loads for any problem geometry, without requiring the time and user expertise that comparable finite element based approaches demand. This article describes the use of CLA in checking working platform stability, in this case making use of the versatile LimitState:GEO CLA software application (LimitState, 2009).

Current industry guidance for working platforms is available, e.g. in the BRE good practice guide 'Working platforms for tracked plant', BR470 (Skinner, 2004). This provides a straightforward semi-empirical design method for determining platform strength and thickness.

As illustrated in Figure 1, CLA allows a quick check of any design to be performed. CLA software shows the extent of the failure mechanism and also frees users from many of the restrictions of semi-empirical methods, for example allowing the following to be considered:

- sloped platforms;
- platform edge stability;
- variable strength or multilayer subgrades;
- track interaction;

as well as providing scope for straightforward sensitivity studies.

Parameter	Example 1, soft clay subgrade		Example 2, firm clay subgrade	
Case	1	2	1	2
Track width (m)	0.7	0.7	0.7	0.7
Track length (m)	3.6	3.1	3.6	3.1
Design pressure from plant (kPa)	224	228	304	336
Working platform shear strength, ϕ'_{pd} (degrees)	40	40	40	40
Working platform unit weight, γ_d (kN/m ³)	20	20	20	20
Platform thickness (m)	0.72	0.71	0.5	0.63
Design subgrade undrained shear strength, c_u (kPa)	24	24	48	48
BRE (2004) computed design pressure (Plane Strain) ¹	205	203	286	309
Bearing pressure predicted by CLA ² (LimitState:GEO)	213	211	276	307

Table 1: Comparison of BR470 semi-analytical method and Computational Limit Analysis.

¹ Solution obtained with all shape factors set to 1.0.

² Solution obtained assuming interface friction between track and working platform is 0.5 that of the platform material. In practice these solutions differ little from an assumption of full friction.

Comparison with BR470

Table 1 compares the results of CLA analysis with the examples given in BR470 for clay subgrade. It can be seen that a good match is obtained between the two approaches for plane strain (2D) analysis. (Application of shape factors typically increase the predicted **“Obtaining the results using LimitState:GEO requires only a few minutes to set up the model. Analyses typically solve in seconds or minutes.”**

bearing pressure slightly). Obtaining the results using LimitState:GEO requires only a few minutes to set up the model. Analyses typically solve in seconds or minutes.

Figure 2 shows further comparison of the loads predicted by BR470 and CLA for BR470 Examples 1 and 2, Case 1, for a range of subgrade strengths. Again a very good match is obtained.

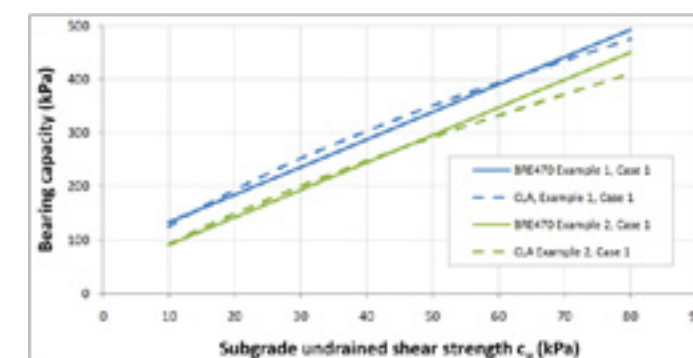


Figure 2: Comparison of BR470 and CLA plane strain results for a range of subgrade undrained shear strength (c_u) values.

“... CLA really comes into its own when non-standard design situations are involved...”

However, CLA really comes into its own when non-standard design situations are involved, e.g. when considering stability on a sloped platform (Figure 3), a multi-layered subgrade (Figure 4), or a subgrade with shear strength increasing with depth.

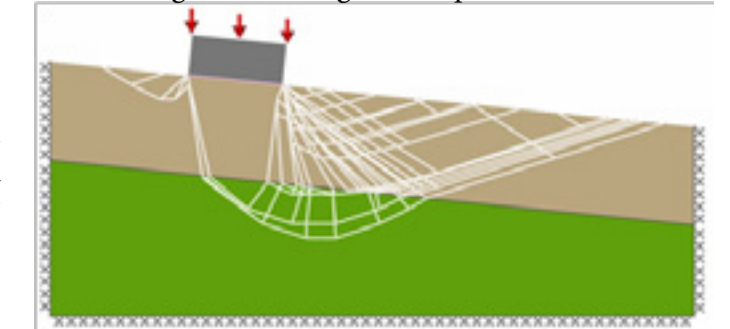


Figure 3: Sloped platform collapse mechanism.

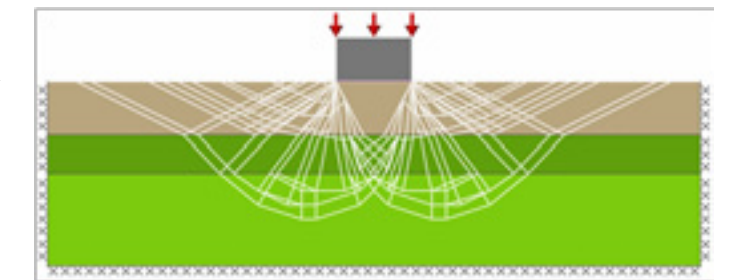


Figure 4: Multi-layered subgrade collapse mechanism.

Sometimes there is a need to check how close plant can be taken to a platform edge, as shown in Figure 5. Here the available bearing capacity was reduced by 26%, with the critical collapse mechanism involving translation of a block of soil near the platform edge. (In this case the same strength of platform material

“In practice reduced strength may be found at the edges, a situation which is easily modelled in CLA software.”

was assumed throughout. In practice reduced strength may be found at the edges, a situation which is easily

rapid stability analysis geotechnical



modelled in CLA software.)

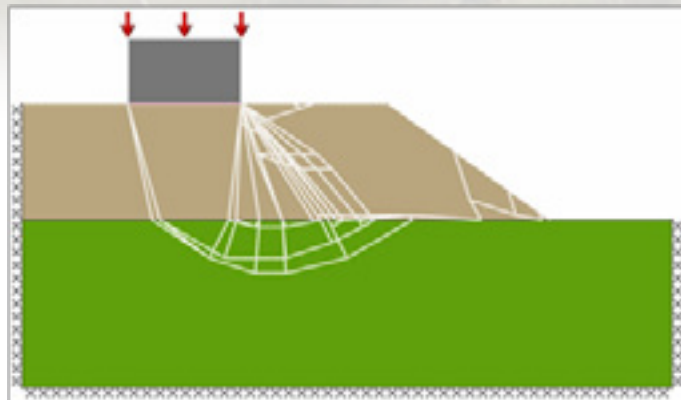


Figure 5: Collapse mechanism at platform edge (assuming same strength of platform material throughout). Bearing capacity reduced by 26% compared to full platform calculation.

“Clearly engineering judgement must be applied when appraising results from CLA...”

Clearly engineering judgement must be applied when appraising results from CLA (and any other numerical analysis technique), but the fact that analyses are quick and easy to run allows the engineer to get a good feel for any given design situation, and its sensitivity to any of the parameters involved.

Analysis of problems is not just restricted to individual tracks; if required it is also possible to model full rigs as shown in Figure 6, although such models take longer to set up.

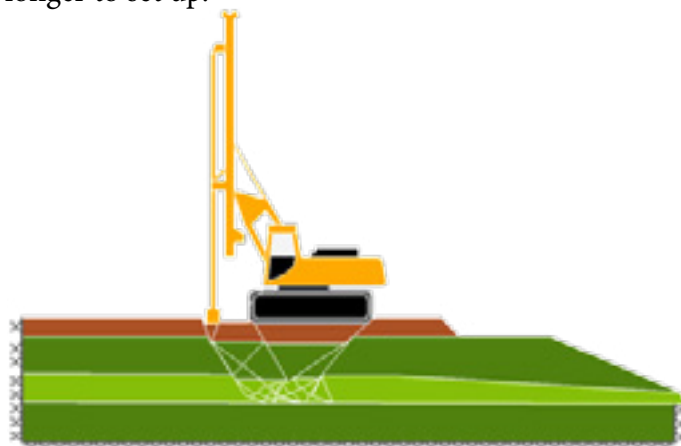


Figure 6: Piling rig near platform edge.

“In summary, the use of CLA helps engineers to rapidly assess non-standard situations.”

In summary, the use of CLA helps engineers to rapidly assess non-standard situations. This can be achieved without having to resort to complex hand calculations and/or semi-empirical correction factors, and consequently many CLA users are reporting dramatic workflow efficiencies. ■

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Skinner, H (2004) BR470: Working platforms for tracked plant: good practice guide to the design, installation, maintenance and repair of ground-supported working platforms, Building Research Establishment.

C. C. Smith, M. Gilbert (2007) Application of discontinuity layout optimization to plane plasticity problems, Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences 463 (2086), 2461–2484.

LimitState (2009) LimitState:GEO Manual VERSION 2.0, LimitState Ltd, September 2009 Edition.

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“To be quite honest, I can't see how we did geotechnical engineering before we had the software. It has really allowed us to take the guesswork out of engineering non-standard designs”
Geotechnical Engineer, Subsea 7

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Geophysics in Geotechnics

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Geophysics has often received bad press but through choosing the right techniques in the right environment it can be an invaluable tool to enhance any project.

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- Nick Russill**
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- Colin Tickle**
Managing Director, Drilline
- Dr Lucy Catt**
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- Dr Simon Hughes**
Operations Manager, TerraDat
- Ryan Temple**
Thames Tideway, Thames Water

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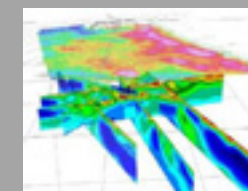
- Dr John Powell**
Technical Director, GEOLABS
- Peter Reading**
Technical Director, Equipe

Day 2 – Advanced Geotechnical Testing

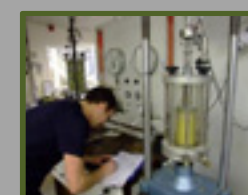
- Small strain and stress path
- Suction tests
- Cyclic loading and simple shear
- Resonant column
- CRS oedometer tests
- Hollow Cylinder

- Dr John Powell**
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Later the drill came into contact with the sewer, damaging the fabric.

Investigations showed that the drilling had veered less than 100mm from its intended path.

Our client had an obligation to indemnify the main contractor for damage to third party property. The main contractor received a claim for damage, passing it onto our client. The water utility claimed for a sewer section replacement costing £120,000.

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We helped our client show that as part of a stringent planning and risk assessment process, they had made appropriate enquiries prior to starting the drilling.

Liability was denied, on the basis that the information supplied by the water utility was incorrect.

The claim was successfully defended.”

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do codes and specifications hinder innovation?

eurocode

In the second of a series of articles inspired by and taken from talks held at Geotechnica 2011's Geotechnical Symposium, Barry Clarke - Vice President of the Institution of Civil Engineers and Professor of Geotechnical Engineering at University of Leeds - writes here for the Geotechnica about the connotations of new codes and specifications within the sector.

Eurocode 7 states that "knowledge of the ground conditions depends on the extent and quality of the geotechnical investigations. Such knowledge and the control of workmanship are usually more significant to fulfilling the fundamental requirements than is precision in the calculation models and partial factors". This could also apply to geotechnical structures because the lack of **"... the lack of knowledge of the performance of those structures results in excessive safety measures, leading to claims of overdesign and overuse of resources."**

knowledge of the performance of those structures results in excessive safety measures, leading to claims of overdesign and overuse of resources. This conservative approach is, in part, driven by the codes and specifications that take into account the natural variability of the ground and the limited knowledge of the behaviour of geotechnical structures as well as the need to design to thresholds.

It has been the practice in geotechnical engineering



A thing of the past? - Didcot Power Station.

to develop codes over a number of years so that sufficient data can be accumulated and consensus reached. This was acceptable until recently because the pace of change was slow enough to allow this process to happen.

In 1941, Sir Charles Inglis, President of the Institution of Civil Engineers wrote: "Engineering is now shaping the destiny of civilization; it has vast potentialities for both good and evil and, side by side with his scientific training, a student should have his interest stimulated towards the humanitarian, the economic, and even the ethical responsibilities of the profession he is about to enter"- thus highlighting the start of the rate of increase in population which led to an increase in the need for social, domestic and economic infrastructure and the increase in construction activity.

There has been a further step change due to climate change, which led Keith Clarke, past Chief Executive of Atkins, to state in 2009 that "Our sector (construction) is facing the most complex challenge it has ever dealt with. Changing the way we design the built environment is a phenomenal challenge, both technically, organisationally and culturally." One implication of this challenge is the rate of change means that developing codes through long term observations and reaching a consensus may no longer be feasible.

While the pace of change has been accelerating there has also been government recognition of the importance of the construction industry not only in employing people, but in providing the infrastructure

"While the pace of change has been accelerating there has also been government recognition of the importance of the construction industry..."

that underpins the economy. This has led to a number of government papers in the last two years including:

- National Infrastructure Plan 2010 (Oct 2010)
- IGT Low Carbon Construction (Nov 2010)
- Infrastructure Cost Review: Main Report (Dec 2010)
- Government Construction Strategy (May 2011)

The reports on the low carbon economy and the cost of construction which refer to over-specification and the tendency, more prevalent in some sectors than others, to apply unnecessary standards, and the use of bespoke solutions when off-the-shelf designs would suffice, have led to a construction strategy that:

- Challenges current processes
- Creates new procurement models
- Tackles governance and client skills
- Provides co-ordination and leadership
- Develops forward programmes of construction
- Develops client relationship management
- Develops supplier relationship management
- Creates efficiency and elimination of waste
- Makes Building Information Modelling ("BIM") the standard for all government projects
- Realises value for money, raises standards and introduces benchmarking
- Introduces competitiveness and reduces duplication across the whole public sector
- Aligns design/construction with operation and asset management
- Implements Government policy in relation to sustainability and carbon

Therefore, adapting the built environment to cope with climate change, operating in a low carbon economy and reducing the cost of construction are also drivers to change the way the construction industry operates. This means that it may no longer be feasible to develop codes over a number of years because these changes are happening now.

Currently, the BSI have 31000 current standards (including 7000 in review and 2000 under development) covering eight sectors with 8500 volunteers from 1800 organisations providing technical expertise. Construction, the largest sector, has 75 technical committees,

"... a recent review of sustainability identified thirteen areas of that would change codes..."

300 subcommittees and 3250 standards. This is not sustainable. Furthermore, a recent review of sustainability identified thirteen areas of that would change codes: coastal erosion, non-tidal floods, storm return period, greater driving of rain, changes to storm patterns, lower summer flow, drought frequency/length, increased risk of subsidence, soils shrinkage, water table variations, great UV exposure, and changes to seasons - warmer winters, cooler summers. These require new approaches to design, construction and operation which could mean new or modified codes.

Thus, there is likely to be a reduction in the number of standards because currently they prevent incremental change which will be necessary as the pace of change increases; and prevent a risk based approach to design and construction which can stifle innovation. Further, there will be a move to standardisation rather than bespoke solutions with a reduction in remedial activity, development of optimal design and enhancement of solutions through feedback.

Our current approach to design is based on the scientific method, i.e.

- Investigation (e.g. ground investigation, desk



do codes and specifications hinder innovation? eurocode

study)

- Characterisation (e.g. creating the ground model based on the geological profile and geotechnical properties)
- Options (e.g. geotechnical solutions based on client requirements and geotechnical and geological hazards)
- Predictions (design calculations based on codes, numerical studies and experience)
- Applications (geotechnical structures)

“... from 2016 all government procured projects will be subject to BIM...”

However, with the announcement that from 2016 all government procured projects will be subject to BIM, there is the opportunity to incorporate feedback loops into the design process by instrumenting geotechnical structures. Thus there will be an observational system in place to allow progressive learning to happen reducing the need for standards and allowing innovation to prosper.

This raises a number of questions:

- Can we use the observational technique to

advance geotechnical design and construction when dealing with the uncertainty found in the ground?

- Should we be moving to outcomes rather than process?
- Can we reduce the risk associated with the ground by better engineering?
- Should we be using baseline reporting to apportion risk?
- Standards and codes are developed by the scientific method and rely on a degree of consensus. Is this process compatible with the rate of change in the built environment?
- If all government projects from 2016 are going to be using BIM, can we take advantage of this opportunity to shorten and enhance the feedback loop?

Codes and standards do not hinder growth if they are used correctly; they do not prevent innovation as they set the thresholds; and the development of new codes is feasible if we adopt a risk based approach to construction. However, there may not be enough time. ■



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Writing for **theGeotechnica** for the second time, Hazel Davidson, Technical Marketing Manager of [ALcontrol Laboratories](#). Here, Hazel talks about the issues surrounding soil analysis.

Environmental laboratories receive tens of thousands of soil samples each year, and consultants/contractors/developers schedule specific contaminants on these samples, but it is rare for a client to specify the type of pre-treatment a soil should undergo prior to the analytical testing. This is unfortunate, as laboratories use different procedures, and these can significantly affect the result, as the following data* for arsenic demonstrates:

1. Sieving and analysing the < 2 mm fraction
66.6 mg/kg
2. Sieving and analysing the < 10 mm fraction
30.6 mg/kg
3. Analysing the whole sample
20.0 mg/kg

This soil consisted of 70% of material > 2 mm and 30% of material > 10 mm.

*data provided by Professor Clive Thompson, ALcontrol Laboratories

If we use the Environment Agency Soil Guideline Value (SGV) for arsenic for residential land of 32 mg/kg,



A working crusher.

then protocol 1 would consign this soil for hazardous disposal, and protocol 3 as non-hazardous. Protocol 2 is borderline, and would need further analysis on additional samples.

“The risk of future potential litigation should not be underestimated.”

This can obviously affect whether a site is determined as contaminated under Part IIA, can cost thousands in possibly unnecessary remediation or waste disposal work, can blight a site entirely, or a site can potentially remain toxic to future users if the contamination is not removed/treated. The risk of future potential litigation should not be underestimated.

Current protocols

The following are examples of common protocols found in laboratories:

- The sample is dried at ambient temperatures, 35 or 40oC, and 105oC
- The sample is tested as wet, as received soil
- The sample is not mixed
- The sample is mixed by manual stirring or mechanical methods
- The sample is crushed to anything from <200 microns to <10 mm
- The sample is analysed without removing anything
- The sample has large stones picked out by hand, and the residue analysed
- The sample is sieved and the <10mm fraction is analysed
- The sample is sieved and the <2mm fraction is analysed

So when should these different protocols be used?

If the soil is for waste disposal or leachate analysis, then it is more appropriate to analyse the whole soil without removing anything. If the soil is being assessed for human health risk, then it is more appropri-

ate to sieve the soil and analyse the < 2 mm fraction, as the dust generated is considered to be the hazardous fraction. Both these protocols therefore can be logically defended for the appropriate purpose.

“But what of the other protocols? What exactly is being measured here, and how is it reported?”

But what of the other protocols? What exactly is being measured here, and how is it reported? One important point to consider is whether the contamination is likely to be concentrated in the fines fraction, in which case a sieved sample will give higher concentrations of contaminants. If the contamination is associated with the chunkier particles (concrete lumps, oil soaked gravel, tar, etc), then sieving the sample will give a lower result.

There are no clearly defined standards to follow – MCERTS states that if anything is removed, it must be recorded and included within the report. An Environment Agency Blue Book publication states that the protocols may vary depending upon how the data will be used. It is therefore critical for the consultant/contractor to ensure the laboratory is prepping the samples in accordance with the requirements of the site.

Homogenisation

It is extremely difficult to mix a wet soil successfully, in order to provide a suitably homogenised sample. If



Mixed soil.

the sample can be dried and crushed (e.g. for metals analysis), then this can be achieved more easily. If the testing has to be performed on a wet, as received soil (the majority of tests), then this process is more prone to error.

In the laboratory, the soil sample is tipped into a tray, and mixed, either by coning and quartering (BS 1377 technique), or by other means more suitable to the sample matrix. Gravel samples or concrete lumps can be broken down using a jaw crusher, which reduces the particle size to < 10 mm. Clay samples can be mixed with a paddle mixer, or kneaded similar to dough. Samples containing chunks of fibrous material may require cutting or shredding to provide more manageable pieces. When mixed, the sample is usually split into quarters, one of which is used for the wet tests, and one of which is sent for drying and crushing. At ALcontrol, the remaining quarters are returned to their original container for cold storage.

The above is recommended procedure, but some laboratories assume the site staff have mixed the sample already, and perform no further homogenisation.

Drying temperature

“For soil tests where the sample can be dried, there is significant variation in the temperature used for drying.”

For soil tests where the sample can be dried, there is significant variation in the temperature used for drying. Most laboratories will use ovens set at 30oC, 35oC or 40oC. For correcting analyses performed on wet samples, then the recorded weight loss will be used as a moisture content. However, if a true moisture content is required, then the sample should be dried at 105oC.

MCERTS requires that all results are reported on a dry weight basis, so even if tests are performed on a wet, as received soil, then a separate aliquot of soil must be

soil analysis - the problems of prepping or pre-treatment
environmental

dried to determine the water content, and the original result corrected accordingly.

“It is also a requirement of MCERTS that the temperature utilised for drying is included in the final report...”

It is also a requirement of MCERTS that the temperature utilised for drying is included in the final report, and that whether the test is performed on a wet or dry sample is also clearly defined.



Crushed soil.

Crushing
 The dried subsample can be crushed, and there are a number of systems used for this, ranging from rough crushing by hand, using a pestle and mortar, to heavy-weight mill crushers, which can deal with much larger samples, and produce a fine homogenised powder down to a particle size of < 200 microns.

Summary
 This issue has occupied the contaminated land industry for more than twenty years, but has still not reached resolution. The Environmental Industries Commission contaminated land working group has now set up a subgroup to discuss the problems and try to provide a way forward. They have produced a survey, and the results are currently being analysed, and will be released to EIC members, but it is apparent that many operators in the industry are unaware of these issues.

In the interim, it is crucial that any consultant or contractor specifies the sample preparation protocol when submitting samples to a laboratory, to avoid potential expensive repercussions, and this should be discussed at the contract review stage of a tender or quotation. ■



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Tachographs are becoming increasingly important to our industry. Considering this, the Geotechnica invited Keith Spires, a veteran of the drilling industry and a director at the Equipe Group, to update our readers on the legislation behind Tachographs, and the importance they have.

The Tachograph legislation has been around for many years and has to a certain extent been ignored by the majority of the industry and in particular the smaller operations. For a long time questions have been asked regarding the need to fit Tachographs within the drilling industry, and by looking closely at the legislation, companies can be given clear guidance on the subject.

If we start with the basic elements, the legislation asks:

Does the maximum permissible weight of the vehicle/vehicle combination exceed 3.5 tonnes?

For vehicle and trailer combinations, this means the maximum gross weight of the vehicle and trailer added together, or the towing vehicle's maximum train weight, whichever is the smaller.

“... all too often we tow trailers, compressors, rigs (etc.) which almost always push the train weight over the 3.5 tonnes limit.”

Within the industry we use many vehicles which, on their own, do not have the capability of carrying in



A basic Tachograph.

excess of the 3.5tonne limit. However, all too often we tow trailers, compressors, rigs (etc.) which almost always push the train weight (the weight of everything added together) over the 3.5 tonnes limit. This is simple to measure and it is often the case that the train weight fails to fall under the 3.5 tonne limit, and so we regularly fall foul of this piece of legislation.



Compressor: Requires a Tachograph.

Are the vehicles exempt?

Again this is quite clear: The vehicles are used to carry goods, with things such as samples or Bentonite being regarded as goods. As we carry these goods, we do so for gain - there can be little doubt that we get paid for the work. Some may argue that we tow a rig or compressor - not a trailer. However, this question has been posed in a court of law where the judge ruled that anything which it trailed is a trailer, thus we are not exempt.

How do we comply?

Firstly you must ensure that a digital Tachograph is fitted, these cost around £1000 to £1200 and can be fitted to all modern vehicles without exception. They can also be moved from vehicle to vehicle, so there is only need to purchase one.

Secondly, get some training on how to use the Tachograph: What needs to be recorded? How do I do this? When do I need to use it? Can I ever turn it off? If so when? It is not a simple as plug it in and go you

have to ensure that the correct records are kept. This record keeping and logging is now often handled by independent companies who specialise in keeping the records for you removing the need for small inde-

“People should not be put off getting Tachographs fitted they are, if used correctly, simple to use...”

pendents to do so. People should not be put off getting Tachographs fitted they are, if used correctly, simple to use and as an industry many companies have already shown that we can work with them. Increasing numbers of firms within the industry are working with them and they also cost very little to run – some as little as £3.00 per week, per vehicle.

By fitting a Tachograph you will also have to ensure

that a rigorous vehicle inspection is in place. Every time the vehicle and trailer are taken onto the public highway they must

be fit to do so and you must have a record of inspection should you be stopped. This does not mean that the vehicles have to be in any better condition than non-Tachograph vehicles, just that the inspection has taken place. Without doubt VOSA are far more aware of our industry and are looking at our vehicles more closely. ■



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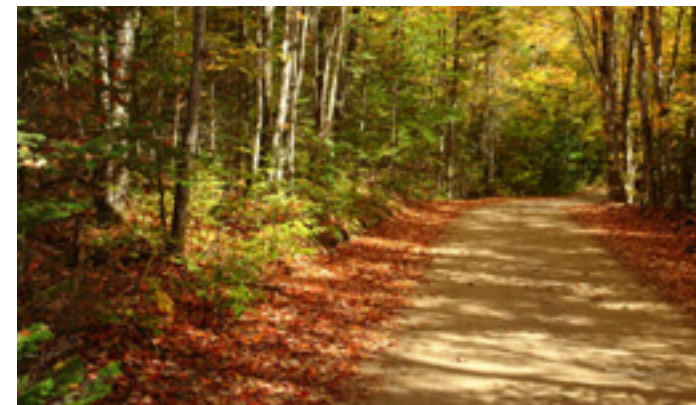
beyond zero and the art of looking sideways safety issues



Pushing forward and raising health and safety standards is one of theGeotechnica's main aims. With this in mind, Peter Turner, National Safety, Health and Environment Advisor for ncpms, gives his frank assessment of industry attitudes towards health and safety.

As a young engineer in a steel works, I was seconded during my training to the company safety department. Whilst there, the safety manager, a man with **“...safety was like picking up leaves in a forest, the same issues constantly reappearing and requiring attention.”**

many years' experience, commented that safety was like picking up leaves in a forest, the same issues constantly reappearing and requiring attention.



Accidents, like leaves falling from trees...

He meant it, I think, positively - a job with security. But it has always troubled me and I have struggled with it ever since.

By a curious turn of circumstances I found myself in a safety role; first in steel, then consultancy and for the past 10 years in civil engineering. This provided ample opportunity to explore a variety of ways tackling the safety problem. I have tried good cop, bad cop, friend, manager, doer, lawyer, and hands off consultant. I have tried technical solutions, systems and a whole bag load of behavioural approaches. Sometimes they worked, sometimes they didn't, but always I had the sense that I was still just collecting leaves.

I suspect that I am not alone in having felt like this, but if that's unsettling for a safety man how much worse must it be for everyone else? The fact is that for many people, perhaps most, the perceived risk of an accident is theoretical and low, whilst the aggravation of “doing safety” is very real, very apparent and often unwelcome.



In this uncomfortable situation organisations all too often find themselves manoeuvred into justifying their safety arrangements as a necessary evil. There are a few variations on the theme, but a common argument is that “we”, the majority, have to do these things in order to protect “them”, a small foolish minority who might otherwise be injured.

“...there is very little sympathy with those who, by error, disregard or through plain bad luck become injured.”

It's hardly a P.C view, but I suspect that there is very little sympathy with those who, by error, disregard or through plain bad luck become injured. It might even be argued that those foolish few deserve what they get.

If I'm correct, it's a huge problem, because the fewer accidents we have, the greater the number of people who are required to do more, and put up with more, for those viewed as being undeserving of their effort.

In short, safety just isn't worth it. It might even be seen as unjust, punishing the ordinary responsible employee for the negligence of the irresponsible minority.

I want to state clearly here that I don't believe that safety is an inconvenience. It has been a huge social good, but what people tend to remember are the aggravating factors, whilst taking the gains as a natural **“Moreover, I do not believe that there is a distinction between them and us, but rather a mindset of “it will never happen to me”...”**

right. Moreover, I do not believe that there is a distinction between them and us, but rather a mindset of “it will never happen to me”. This view is repeatedly reinforced by everyday experience at a time where accident rates are mercifully low, driving the belief that that the rewards of safety are negligible.

As a consequence, it is hardly a surprise that people tend to resist, or at least become disengaged with safety. Nor is it surprising that organisations feel obliged constantly to address the same issues, and learn, or not, the same lessons. It's easy to see how frustrating this can be, and why organisations often resort to a shrill, zero tolerance stance, just to maintain let alone advance standards. The result however is a vicious cycle which distracts us from the objective.

In my opinion, one factor more than any other has led to this impasse: an unhealthy fascination with accidents as a measure of safety. We are constantly striving to prevent things which have already happened. Our key measures look back to a past we cannot change, not forward to the things we can.

“Ask someone what we are trying to achieve in safety, and the chances are they will say “zero accidents”. Ask them if they believe it can be done, and overwhelmingly they will say “no”...”

Ask someone what we are trying to achieve in safety, and the chances are they will say “zero accidents”. Ask them if they believe it can be done, and overwhelmingly they will say “no”. Ask them what a zero accident organisation would look like, and you will probably be met with sarcasm or silence. We might call it cynical, but given our accident data and experience it is an entirely logical position.

It is also a dead end in which we spend huge amounts of time and resource to understand in forensic detail the circumstances of past accidents, but almost no time imagining the kind of organisation we would need where accidents would not happen. Because we can't imagine that better place, we can't build it. Instead we feel compelled to support a continuous series of safety initiatives, which so often miss the point entirely.

I recently spoke to a company who were about to launch a behavioural safety scheme. Although they were enthusiastic about the possibility of reducing accidents, it was obvious that they were unclear how this would actually be achieved. As we talked, it emerged that the focus, and the biggest cost of the project, had been a new computer system and associated software. That computer is to be used to count, and give a more detailed analysis of accidents and near misses.

A new way of picking up leaves is still just picking up leaves.

It is argued that by understanding the causes of accidents we can better safeguard the future, and there is of course some truth to this, but, the fact remains that there is a huge chasm between “accident performance”



Warning signs: Constant safety reminders.

and “safety performance”. Some of the projects which have given me the most cause for concern have nevertheless been completed without apparent incident. Others, with which I have been proud to be associated, have experienced injuries, even serious ones. That there might have been more, or worse, had it not been for the excellence of the project team, is incapable of measurement, and consequently we discount “safety performance” in favour of “accident counting” and in doing so, miss the point.

Root cause analysis gets closer, but it doesn't go far enough. Often this is because no matter what the outcomes of such an analysis, which may call for specific organisational changes, we insist on measuring success only in terms of accident numbers, rather than on the steps taken towards building a better place.

“It is as if we feel compelled always to look backwards, instead of sideways to our partners and forwards to a new place...”

It is as if we feel compelled always to look backwards, instead of sideways to our partners and forwards to a new place, a place so organised that there are simply more opportunities to excel and less for things to go awry. This isn't a vision of a Nanny State, but of something really good, even dare I say it in an article about safety, fun!

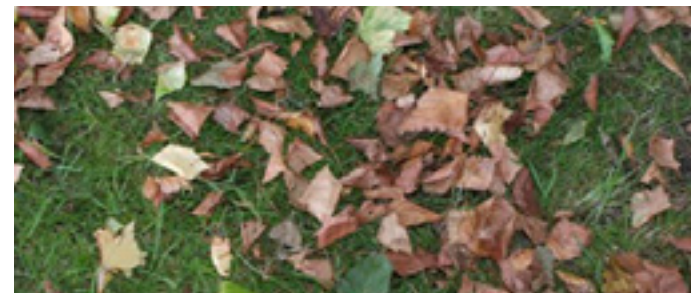
That is not to say that there is a complete disconnect between safety and accidents, but at best accidents are a symptom of poor safety performance, they are not themselves the issue. They should not be the focus of our attention. Safety is more than that narrow view. Moreover it's a practical necessity, because however much we can learn from accidents, the price of that learning is just too high.

I still love saying this - accidents don't matter. That's a pretty strange position for a safety man, but it opens a whole new vista of opportunities.

What do I mean? Well returning to my original forest image, no matter how carefully I count, or what statistics I apply, I cannot predict which leaf will fall next, when or where - hence I can't stop the leaves from falling. Indeed the only certain conclusion from such an analysis is that leaves will fall; accidents will happen.

Of course this is a very limited view of a forest, which is a grand and beautiful place. But if I stare only at the ground, all I will ever see is dead leaves, just as in safety if we focus only on accidents we will only ever see old problems, and the safety professional will always be required to pick them up.

If we truly want to deal with the leaves, we have to tackle the trees, or move to a different place, beyond



Fallen leaves: Accidents that have already happened.

the wood. Then the picture becomes fundamentally different. It doesn't mean that a leaf will never come our way, but it will be so unusual an event that it will no longer have any real impact, and will no longer define the “place” we find ourselves in.

In the same way, instead of looking at accidents, we should start to ask the far more important, interesting and above all, practical questions: What would we need to do, and what we need to stop doing, in order to change our organisation to one beyond the stats, “beyond zero”, to a place which is great to work in? The organisation would be genuinely safe, not just accident free and each individual valued and encouraged to excel. Instead of a majority working ever harder for the benefit of a (perceived) undeserving few, the majority work for the benefit of the whole. As one consequence, accidents and ill health are simply no longer part of what we do.

What would that look like ?

The Environment Agency's national capital project management service (ncpms), together with its design, construction and site investigation framework partners, have started to look seriously at this question, and it is transforming and redefining our relationships and practice.



Needs updating? Health and Safety Law.

We haven't got there yet, but together we are working out the “place” we want to be and how we will get there. All the tools we have at our disposal, even the most basic such as risk assessments and method statements, are being re-evaluated in light of the destination we have set for ourselves. They are becoming fresh and relevant, and where they are not we are learning to let them go.

“We have developed new ideas, and looked sideways to borrow from framework partners or beyond...”

We have developed new ideas, and looked sideways to borrow from framework partners or beyond, changing our contracts where necessary so that good ideas become common practice. We are building great frameworks, not just great projects, so that lessons learnt today are learnt forever, and all these things are no longer just discrete safety initiatives but a part of coherent forward strategy.

We have fewer discussions about a particular accident or the latest accident stats, and more and more which start with, “In a beyond zero frame we would do this”, or, “We wouldn't do that”, and armed with a vision of

the future which such discussions create, we are working out what is needed to achieve real and lasting improvements.

The conversations aren't always comfortable. We are questioning things which have long been held immutable, but these different questions are leading us to different answers and yes, the accident figures on our typical £200M pa spend are going down. Indeed at the time of writing, (July 2011), our AFR was, until last month - zero. Unfortunately, last month a 2nd tier supplier had an accident, but that accident no longer defines who we are, it is merely another marker on the way.

“...would you rather spend the rest of your career agonising about accident rates? Or, would you rather be part of an organisation set on building a practical vision for a better future...”

Maybe you're thinking it all sounds too good to be true, but honestly, given the choice, would you rather spend the rest of your career agonising about accident rates - Do they have the power to engage you, or your workforce ? Or, would you rather be part of an organisation set on building a practical vision for a better future, even though it's hard, and some will say impossible, because its right, and offers a genuine chance to reclaim a fuller vision of what safety is?

Ncpms have decided. We choose, to be defined by where we are going, and what we are becoming; not by the unchangeable history which led us to this intermediate point.

I would love to meet that steel works safety manager again. Perhaps he will read this. I would love to thank him for that troublesome comment, and tell him he was wrong! There is another way; ncpms may not be quite out of the woods yet, but we have our eyes set firmly on the hills, and we are going to get there... soon. ■

Recently we have seen the launch of the UK Register of Ground Engineering Professionals. Here, Paul C Maliphant, Vice President of the Geological Society as well as Chair of the Chartership Committee of the Geological Society, UKRoGEP Panel member and UK Registered Ground Engineering Adviser writes for **the-Geotechnica** about the importance of the Register.

'... ground conditions are often the cause of very large cost and time overruns' (Clayton, 2001)

'..... very substantial savings are achievable – at least 15 per cent, or an estimated £2 to 3 billion annually, on the costs of building and maintaining the UK's infrastructure [compared to its European peer group].' (HM Treasury and Infrastructure UK, 2010)

Perhaps the greatest challenge is how we can deliver a built environment that supports the creation of a low carbon economy for the UK. (Constructing Excellence, 2009)

“...more effective management of geotechnical risks will result in ground engineering solutions that will reduce construction costs...”

Considered together it is reasonable to deduce that more effective management of geotechnical risks will result in ground engineering solutions that will reduce construction costs whilst creating greater potential to reduce the carbon impacts of construction. Furthermore, Clayton (2001) also noted that the three principal ground hazards are the nature of the ground beneath our feet, the site geometry (eg a slope or cav-



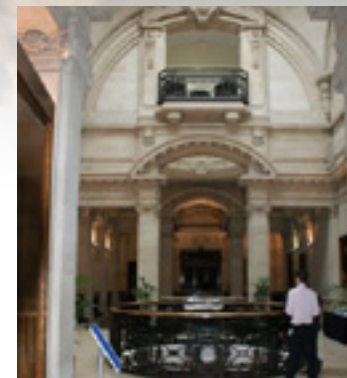
Benefiting: BGA Conference.

ity) and the people hazard represented by the work of an incompetent professional. It is this latter hazard that is addressed by the launch on 8th June 2011 of the UK Register of Ground Engineering Professionals (UKRoGEP).

Jointly sponsored by the Geological Society of London (GSL), Institution of Civil Engineers (ICE) and Institute of Materials, Minerals and Mining (IoM3), the Register will have CGeol, CSci or CEng from one of these institutions as compulsory core qualifications, and will build upon them. It will: allow engineers and geologists alike to demonstrate that their expertise lies within ground engineering (rather than another area of geology, civil or mining engineering) and (by passing through UKRoGEP grades of Professional, Specialist and Adviser) help practitioners to demonstrate progressively increasing competence, predicated on recognition by their sponsors and formal assessment by their peers.

UKRoGEP will enable clients and other professionals to identify those ground engineering practitioners who are likely to bring the greatest value to a project. Registration will demonstrate an individual's technical competence, professional attitude and experience. All Registrants will be bound by the Code of Conduct of their host body, and be required to undertake and record appropriate Continuous Professional Development.

To join the Register applicants will have to undertake a review of their competence in the all six RoGEP attributes (innovation, technical solutions, integration with other disciplines, risk management, sustainability and management) by written submission, sponsorship by two appropriately qualified and experienced peers and interview for marginal cases. Registration will be granted for a fixed period of 5 years. In order to remain on the Register it will be necessary for Registrants to demonstrate every 5 years that they still hold chartered status and have maintained their CPD record. All applications to join the Register must be submitted to UKRoGEP. Full details of the scheme, copies of all application forms, details of fees and



Home: BGA.

the Register itself can be found at www.ukrogep.org.uk.

UKRoGEP is administered by the ICE, and managed by a Panel of 12 UK Registered Ground Engineering Advisers (who have themselves passed the appropriate

competence assessment by their peers on the Panel). Panel members were nominated by Ground Forum, the Executive Committee of the British Geotechnical Association (BGA), as well as ICE, GSL and IOM3. The Panel has invited 18 Rankine Lecturers, Glossop Lecturers and Skempton Medalists to accept honorary membership at 'Adviser' level. The Panel has also sponsored a further 60 or so well-respected ground engineering professionals from a broad cross-section of client, contractor, academic and consultant organisations, to join the Register (though these individuals will have to undergo the same assessment process as any other registrant).

The Panel has set a budget, which will be reviewed quarterly against Registration uptake, fee income and costs. Fee levels have been set generally below those of comparable Registers. The sponsoring institutions are covering UKRoGEP's start-up costs. Any future surpluses will be used to repay the institutions to a maximum value equivalent to their initial outlay, with any further surpluses used for the benefit of Registrants or alternatively to allow fees to be reduced. The institutions will gain no benefit from the creation of the Register save that which it will create for the good of the professions, and society at large.

“UKRoGEP will be refined and improved by usage over time...”

UKRoGEP will be refined and improved by usage over time or fall into disuse dependant on the value that Registration earns for the profession. It will be useable by clients and others as they see fit to improve

the value obtained from ground engineering be that measured in terms of cost, carbon impacts, completion times, health and safety or other metric as considered appropriate.

Support for the Register has already been received from organisations such as Highways Agency and Network Rail and it has been endorsed by the Construction Industry Council (CIC). The Welsh Government responded:

'On behalf of the Welsh Government, I would like to commit our support for the Register. It is essential in promoting best practice, raising standards and supporting government construction objectives. As a major client body which utilises ground engineering services we are only too pleased to support the Register.'

On its own UKRoGEP will not result in the improvements to construction that society requires particularly in respect of the current fiscal and carbon challenges that we all face. Indeed, the value that ground engineering can bring will only be fully captured if the profession also collaboratively addresses the other issues that influence its success. However, effective implementation of the UK Register of Ground Engineering Professionals will mitigate the risks associated

“This Register creates an opportunity for improvement.”

with the work of incompetent or inappropriate professionals from within the membership of the sponsoring institutions or from other professions masquerading as ground engineers. This Register creates an opportunity for improvement.

'... it is now time for the supply side to demonstrate how it can create additional economic, social and environmental value through innovation, collaboration and integrated working – in short, the principles outlined in Rethinking Construction..... We also need industry bodies and professional associations to cooperate better to represent our industry effectively to Government and the public.' (Constructing Excellence, 2009) ■



Geophysics in Geotechnics

22nd September 2011
at The Drilling Academy, nr. Banbury

Free To Attend

Geophysics has often received bad press but through choosing the right techniques in the right **environment** it can be an invaluable tool to enhance any project.

The seminar will increase the awareness regarding the correct use of geophysics for non-invasive investigations, structural and geological mapping and ground modelling which can provide an in depth and continuous understanding of both surface and subsurface conditions and can also reduce the risk of underground hazards and optimise budgets.

Course Content

- How to choose the best techniques
- Key points when scheduling geophysics
- Using geophysics to manage risk
- Overview of surface techniques
- Overview of down-hole techniques
- Advantages and limitations of techniques
- Using suites of tools to enhance the data
- Data handling and interpretation
- Advances in geophysics
- Case Studies

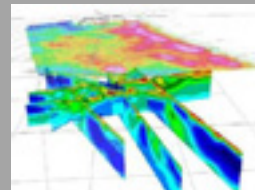
Speakers include:

- Kim Beesley**
Managing Director, European Geophysical
- Dr Simon Hughes**
Operations Manager, TerraDat
- Colin Tickle**
Managing Director, Drilline
- Dr Lucy Catt**
Reynolds International
- Ryan Temple**
Thames Tideway, Thames Water
- Dr Russell Thomas**
Technical Director, Parsons Brinckerhoff
- Helen Scholes**
Director, Geotechnical Consultancy Group

Course Programme

- 09:00 Registration and Coffee
- 09:15 *How to choose and specify the right geophysical methods for your project*
Dr Simon Hughes, TerraDat
- 09:50 *Overview of surface geophysical methods and techniques*
Dr Simon Hughes, TerraDat
- 10:45 Morning Break
- 11:00 *High resolution seismic for overwater engineering purposes*
Dr Lucy Catt, Reynolds International
- 11:30 *GPR Utility Detection: the Pro's and Con's Using Geophysics in the Utility World*
Colin Tickle, Drilline Products
- 12:00 **Geophysics Demonstrations**
- 13:00 Buffet Lunch
- 13:45 *Case Study -*
Dr Russell Thomas, Parsons Brinckerhoff
- 14:15 *Overview of downhole geophysical methods and techniques*
Kim Beesley, European Geophysical Services
- 15:00 *Case Study - Thames Tideway*
Ryan Temple, Thames Water
- 15:30 *Case Study - Crossrail*
Helen Scholes, Geotechnical Consultancy Group
- 16:00 Afternoon Break
- 16:15 *Handling the data and Interpretation*
- 16:30 *Advances in Geophysics*
Dr Simon Hughes & Kim Beesley
- 16:45 *Case Study -*
T.B.C
- 17:15 Close

Event Sponsors



Cone Penetration Testing for Onshore and Offshore Geotechnics

12th and 13th October 2011
at The Drilling Academy™, nr. Banbury

This symposium is an essential comprehensive training course and refresher for geotechnical and geo-environmental practitioners involved in Cone Penetration Testing for Onshore and Offshore Geotechnics. The symposium is devoted to raising the awareness of current test procedures, advances, data derived from the tests and includes practical demonstrations.

If you want to understand the CPT and it's applications or just need to get up to date with the technology this course is for you.

Day 1

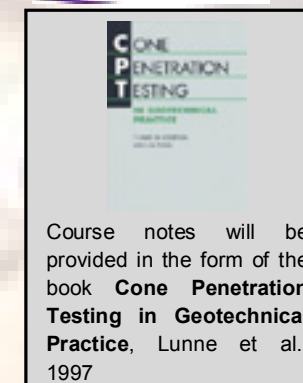
- Historic Overview
- Update on **NEW CEN Standards and Current Guidance**
- CPT and CPTU Measurements and Tools
- **Friction/Piezocone Demonstrations and Discussions**
- CPT as a Sampling Tool – Mostap & Offshore sampler
- Calibrations, Accuracy and Precision
- Quality Control – Onshore and Offshore examples
- Obtaining parameters in Sands and Clays
- Full Flow Penetrometer for soft clays
- Soil Profiling and Identification – Manual v Automated
- **Software Demonstration**

Course Tutors

- Tom Lunne**
Expert Adviser, Discipline Leader of Offshore Soil Investigations, Offshore Geotechnics
- Dr John Powell**
Independent Consultant Technical Director, GEOLABS
- Darren Ward**
Managing Director, In Situ
- Dr Peter Allan**
Managing Director, Geomarine
- John Smith**
Senior Geophysicist, Bactec

Day 2

- Advances in CPT sensors – Seismic, Pressuremeter, Magcone, Nuclear Density, Resistivity, Gamma, Video
- **Seismic Cone Demonstration**
- Use of Magcone in UXO Investigations
- Obtaining parameters in other materials – Silts and Chalk
- Interpretation of the data for direct design
- Overview of CPT as a Geoenvironmental Investigation tool
- Workshop – Practical Interpretation of CPT Data
 - Foundation Design
 - Offshore Structures
 - Offshore Geotechnics i.e. ploughing
 - Practical Use of Advanced Testing Results
- Case Histories
- Further Reading and Guidance
- Summary and Close



Who should attend?

This symposium is tailored for geotechnical practitioners procuring, specifying, carrying out and interpreting CPT data for geotechnical and geoenvironmental investigations including highways, railways, offshore structures and offshore geotechnics.

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are you making the most of free digital data? products and innovations



Roger Chandler, Director of [Keynetix](#), continues his series of articles for **theGeotechnica**. Here, Roger introduces a number of free digital data sets that can be of benefit to your company if utilised properly.

The world of digital data has been shaken up in the last two years and what is commercially possible today is very different from where we were at the start of 2010.

This short article follows on from my “Where have all the pins gone?” article in last month’s edition of **theGeotechnica** and will hopefully give you a brief overview on the free digital data sets now available in the UK and what you can (and can’t) do with them. If you step back just two years, the geotechnical industry’s view of digital mapping data could be summed up in one word – “Expensive”.

Then, on the 1st April 2010, this opinion was forced to change suddenly as the Ordnance Survey announced OpenData and made a large number of its small scale **“Once we had got over the rumour that it was an April fool’s joke the enormity of the announcement sunk in...”**

mapping datasets completely free of charge. Once we had got over the rumour that it was an April fool’s joke the enormity of the announcement sunk in and we immediately started to download datasets in the Keynetix office that we would have had to pay tens of thousands of pounds for the day before.



Useful: Free digital data resources.

Since the launch of OpenData, several datasets have been added to the download library and I have included a summary of the four most useful below:

OS VectorMap District

[More Info...](#)

This mapping set is the most detailed vector dataset the OS offers free of charge and can be used in the production of site plans and location maps.

Land-Form PANORAMA

[More Info ...](#)

A digital ground model of the whole of the UK at 50m grid spacing that is very useful if you want to get a coarse 3D model of your site location in AutoCAD or Surfer.

OS Street View

[More Info ...](#)

This is an alternative for OS VectorMap for users who require an easy raster dataset showing a simplified street-level map. As it is raster many people will find it easier to use but it does not have the same theming options that OS VectorMap offers.

1:250 000 Scale Colour Raster

[More Info ...](#)

Again another easy to use alternative to OS VectorMap but on a scale that is similar to the front of many road atlases.

The list continues and includes 1:50,000 Scale Gazetteer, Boundary-Line, Code-Point Open, Meridian 2, Miniscale, OS Locator and Strategi most of which are invaluable if you are putting together a company wide mapping system as described in my previous “Where have all the pins gone?” article.

“Most importantly all of these datasets are free for commercial use...”

Most importantly all of these datasets are free for commercial use. So you can include them in your reports or even bundle them into software products like we do

at Keynetix.

The BGS have followed suit with free digital downloads from their website but you have to be careful what the licence allows you to do and what is free and what you need to pay for. For example the BGS 625,000 scale map is now free for commercial use, but as soon as you increase the scale of the mapping the charge starts to rack up.

“This means that if you have mapping software such as AutoCAD Map or ESRI Arcview you can connect directly to the BGS servers...”

However the BGS are pushing the use of new mapping technology by publishing a number of their datasets in WMS and WFS formats. This means that if you have mapping software such as AutoCAD Map or ESRI Arcview you can connect directly to the BGS servers and download the data from their servers into your drawing or map as and when you need it. This has two main advantages 1) that you do not need to store and manage large datasets in your office and 2) that you will always have the most up to date version

displayed on your map.

The other big achievement on the BGS site is the continual improvements to their online data index which now includes free scanned images of their borehole archive and a really cool iPhone app that I reviewed for [www.geotechnicaldatahub.com](#) last year - so now there is another major geotechnical industry whinge taken care of!

For more information visit <http://www.bgs.ac.uk/data/databases.html>

So, over the last two years we have had to stop complaining about the price of mapping data and the price of BGS borehole logs and had to think about how we can store and make use of the gigabytes of data that are now freely available to us.

Are you making the most of this free digital data?

Next month Roger will be looking at how the UK laboratories are handling their data and give clients and laboratories some advice on streamlining data into and out of the laboratory. ■



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