theGeotechnica

equip

inside this edition...

an uncertain winter forecast
are you ready?
how to battle the elements this winter

also included...

- an update on eurocode 7 attachments
- NEC contracts explained
- more on drilling fluids - recycling and productivity

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issue no. 8
february 2012

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Geotechnica ME
Doha, Qatar - November 2012

BREAKING NEWS

The organisers are very excited to announce that Geotechnica this year will also be held in the

Grand Hyatt, Doha, Qatar
7th & 8th November 2012

Geotechnica ME 2012 will be a high quality geotechnical conference and trade show highlighting services and opportunities for geotechnical and drilling related companies in the region.

For more information on sponsorship opportunities and trade stand space contact:

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an introduction

Welcome to the first edition of **theGeotechnica** for 2012 - Happy New Year to all of our readers.

It seems a long time since the winter break, but it would appear that many have started the New Year with renewed vigour and reasonable order books. Let's hope this is a sign of better prospects to come.

In this issue we have a timely reminder from Tom Phillips regarding the perils of winter weather. It is easy to become complacent about the unseasonal temperatures we have experienced in the past few weeks, but don't be fooled; cold weather is just around the corner. Tom provides a useful guide and tips for all who work on site.

In the geotechnical section we have a fascinating article by James Tweedie of geoMEM on their electronic borehole orientation systems, a real must for anyone who needs to understand borehole geometry.

There is another article in the series from James Mansell on drilling muds and fluids. This series is building into a definitive set of informative articles, covering the essential art and science of groundwater and borehole stability control with the use of muds and polymers.

This month also sees the start of another series of articles on the NEC form of contract. Although these have been around for a while there is a renewed impetus for all construction related contracts to follow the NEC suite of contracts. There has been much distrust with the contract style, mainly born out of misunderstanding and misuse of the contract, this series of articles is designed to explain how the NEC contract suite works particularly for Geotechnical works.

Following on from the Keynetix user group meetings held at the end of last year, there has been much interest in KeyLogbook and other programmes and solutions offered by Keynetix. This is also supported by Roger Chandler who looks at forms of electronic on site data capture.

Should you have any comments, suggestions or views on articles published or events within the geotechnical community, why not write or email the editorial team? We are always happy to publish the views of our readers provided they are not defamatory or blatant advertising.

It should be noted that the views expressed in any article in **theGeotechnica** are those of the author and do not necessarily reflect the views of the editorial team. Although every care is taken to ensure accuracy within articles, absolute accuracy is not claimed.

Editorial Board
theGeotechnica

Contents: What's in this issue?

Deviating boreholes are something that we have all been a victim of at some point or another. In his first article for **theGeotechnica**, James Tweedie of geoMEM looks at what can be done to prevent borehole deviation.

We drill holes to obtain sub-surface information, to plan construction work or mineral extraction and for placement of sub-surface utilities or monitoring devices.

"All drill holes deviate to a greater or lesser extent."

All drill holes deviate to a greater or lesser extent. The greater extents can be surprisingly large – up to 50m off line after 150m of drilling has been known. The lesser may be a matter of centimetres over a few hundred metres. The one certainty is that the drillers and those responsible for the drilling project do not know how much the deviation is or the path of the borehole unless it has been surveyed to get a 3D trajectory.

Brief history:
The need to survey boreholes was recognised in the 1870s as deeper oil wells were being drilled and the oil industry to a great extent drove the development of borehole survey instruments. From 1870 to the 1930s a large number of different types of borehole survey tool were developed. These were mostly single shot systems, some finding inclination only and some finding both inclination and direction at points

"Many early systems used a pendulum system to get inclination ... and a compass to get direction."

down the hole. Many early systems used a pendulum system to get inclination (this is why the oil and gas industry use a dip value measured from vertical) and a compass to get direction. Almost all were cumbersome, difficult and time consuming to use. Despite these difficulties, in 1928, Alexander Anderson published research that showed extensive deviation in deep holes. At about the same time Sperry-Sun developed the first gyroscopic system and modern borehole surveying was born. Since then, and especially

"Since then ... technological advances have allowed the development of ... instruments which are capable of providing fast and accurate surveys of boreholes."

since the late 1970s, technological advances have allowed the development of smaller and much more powerful instruments which are capable of providing fast and accurate surveys of boreholes.

Why do boreholes deviate?
Deviation is caused, and controlled, by a number of factors including:

- Rock type(s) and rock structures being drilled
- Drilling technique used and driller experience
- Speed of drilling
- Rod material and diameter (steel rods allow greater bend than aluminium for a given diameter).

These present a large number of variables so each drilling project will show a range of borehole deviations as well as being different to any other project.

Why does borehole deviation matter?
Borehole deviation during drilling can be a serious issue. Spectacular examples of failures due to lack of knowledge of borehole position and path include drills intersecting underground railways (and trains) and dams collapsing. Thankfully, these are in the minority but knowledge of borehole paths at the time of drilling can save considerable downstream costs and concerns.

Figure 1 shows a 150m "straight vertical" geothermal hole drilled in hard metamorphic rock in Trondheim, Norway. It was not surveyed when drilled but became of concern in 2011 when its working life was ended and a tunnel was being planned in the vicinity. A 93 m survey (beyond the depth of concern for the tunnel) showed a smooth deviation which results in an 18m offset from the planned and assumed path of the "vertical" hole. Extrapolating the same curvature to the end of hole results in a 43m offset at 150m. Even at 20 metres the offset is about 1.5m – this may be unacceptable in most geotechnical drilling.

In this case there were no pre-existing sub-surface built structures but it is clear from this example that the lack of knowledge of borehole path could lead to serious difficulties where these exist.

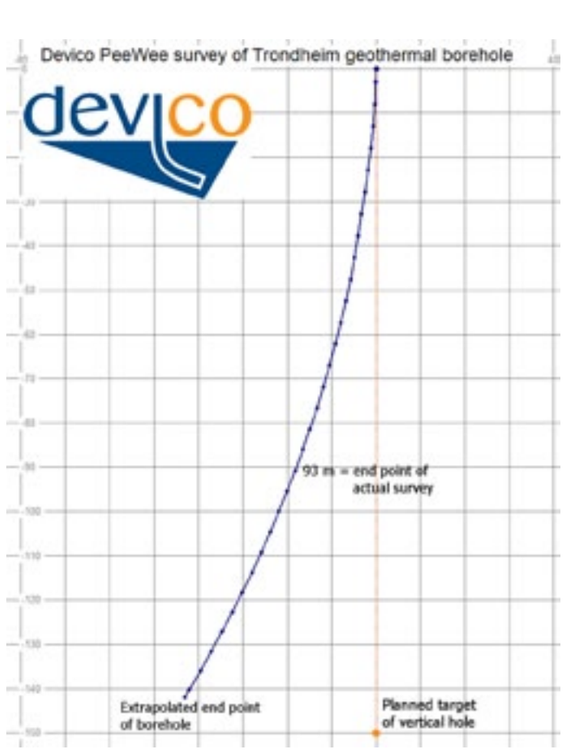

Figure 1: Deviation of a 150m "straight vertical" borehole. Data courtesy of Devico AS.

The survey process
A typical borehole survey involves obtaining two angles, the dip and direction, at known station depths down the hole.

"Depending on the instrument the interval between these stations may be anything from 1 metre (3 feet) up to 30 metres (100 feet)."

Depending on the instrument the interval between these stations may be anything from 1 metre (3 feet) up to 30 metres (100 feet). In general smaller station intervals will improve survey accuracy and 3 - 5 metre spacing appears to be good for accuracy and speed of surveying.

With the downhole depth and the dip and direction angles known, the XYZ co-ordinates of the stations

"There are a number of interpolation methods in use – mostly developed for use in the Petroleum industry..."

can be calculated by interpolation (known as de-surveying). There are a number of interpolation methods in use – mostly developed for use in the Petroleum industry but applicable in all borehole surveying. The most widely used and accepted at present is Minimum Curvature which attempts to create a natural curve between two stations based on the interval, dip and direction data for the two stations. Further smoothing may be applied but is not usually necessary.

The end results of this process usually include:
1) A table of results including the depth, dip, direction, easting, northing and elevation for each station.
2) A graphic display of the borehole path in plan, various sections and 3D.

3) Ability to export to other software for further processing as needed.

Currently available borehole survey instruments

Modern slim survey instruments for use in engineering, geotechnical, mining/quarrying and mineral exploration fall into two main categories with some sub-types:

1) Magnetic Survey Instruments:

"These instruments use magnetometers to define north and, therefore, cannot be used in areas with considerable magnetic disturbance..."

These instruments use magnetometers to define north and, therefore, cannot be used in areas with considerable magnetic disturbance or within steel casing or steel drill rods. Short sections of disturbance can usually be dealt with (for example, collar casing or a thin band of magnetic rock).

They are conventionally referred to as EMS (Electronic MultiShot) instruments and contain two sets of three sensors (accelerometers and magnetometers) orientated to 3 perpendicular axes within the tool. The accelerometers define the tool (and hence borehole) inclination, the magnetometers the tool direction relative to magnetic north.

"These tools are quick and easy to run requiring little or no set-up work before running in hole."

These tools are quick and easy to run requiring little or no set-up work before running in hole. They can be run on rods, wireline or even rope.

There are a good number of these instruments available from various international manufacturers at present including: Devico, Norway (Combo, PeeWee); Reflex Instruments, Australia (Ez-Trac); Icefield Tools, Canada (MI3); Ranger Survey Systems, Australia (Explorer); and GlobalTech, Australia (Pathfinder EMS).

Figure 2: A typical EMS instrument – approximately 85cm long with 3cm outer diameter. This houses the sensors, memory and control circuits and batteries. It requires protective running gear when surveying.

2) Non-magnetic instruments
A non-magnetic instrument does not rely on magnetic data to obtain direction. There are two main operational methods to find direction down the hole. The current generation of these tools usually incorporate accelerometers or inclinometers to record inclination (dip) which serves as a check against any other dip method used.

a) Differential (or incremental)
This method requires the accurate independent measurement of the starting direction of the hole (inclined hole) or a reference direction for a vertical hole at the collar. The system then calculates the direction

"This is heavily reliant on an accurate initial direction and good surveying technique."

difference between each station and hence the direction for each station down hole. This is heavily reliant on an accurate initial direction and good surveying technique. However it can produce very good results. Available "differential" instruments have a variety of methods to product the survey. All can be run within casing or drill rods – indeed for some it is essential to

contents

provide accurate results.

The Devico DeviFlex uses strain gauges which measure bend of the instrument over its length. The Reflex Instrument Maxibor uses light reflecting rings and the Reflex MEMS Gyro uses gyro navigation between stations.

b) North-seeking gyros (inertial navigation systems): These instruments use the Earths rotation to define north (termed "gyro-compass") at each station and so are the non-magnetic equivalent of the EMS systems. The present generation of North Seeking gyros are mechanical (moving parts) but MEMS (Miniature Electro-Mechanical System) technology is becoming a contender. Producers of north seeking gyros include: SPT, Sweden (GyroTracer) and DHS Oil (Target INS).

"At present, the costs involved in these systems may preclude them from being used in any but the larger geotechnical and engineering projects."

At present, the costs involved in these systems may preclude them from being used in any but the larger geotechnical and engineering projects.

The surveying decision

When a project relies (as most projects do) on the accurate knowledge of borehole paths then surveying is not an option, it is essential. The added cost of surveying must be balanced against the added cost (and possible legal repercussions) of basing planning on assumed and probably incorrect location data. The requirements will vary from project to project and on the accuracy required for the drilled locations.

When holes are surveyed the driller or contractor can prove to the client where the holes have gone. If surveyed during drilling then corrective action can be taken (if required) before borehole deviation becomes a large (and therefore expensive) problem.

"Many drilling companies now provide borehole surveying either as part of their standard service or as an option..."

Many drilling companies now provide borehole surveying either as part of their standard service or as an option and it is to be hoped that before long borehole surveying will be seen as an essential component of drilling services.

Directional drilling

An effective solution to the "drill then survey" situation when it is important to be on target is to use directional drilling. In this case the hole is surveyed whilst drilling and the path adjusted according to a pre-planned route. The hole can be steered or guided to the required target rather than drilling then surveying and living with where the hole ended up (or drilling another one).

Directional drilling offers the following advantages:

- Will hit the planned target
- Can be drilled so the path is within tolerance along the length of hole.

Figure 3: Directional drilling/surveying in a city (Hong Kong) environment (photo courtesy of Devico).

- Steer round sub surface obstacles (e.g. tunnels, pipelines).
- Multiple child holes from single parent – minimising surface environmental impact and allowing single point drilling in built up areas.

The process of directional drilling is more costly than drill/survey but actually results in savings because a) the target is reached and b) fewer rig set-up/ take down / movements are needed and c) hole branched from a parent involves much less drilling length. Devico, who are pioneers of geotechnical, engineering and exploration directional drilling, report savings of up to 80% on large projects, with typical savings between 10 and 60% over standard multi-location drill holes.

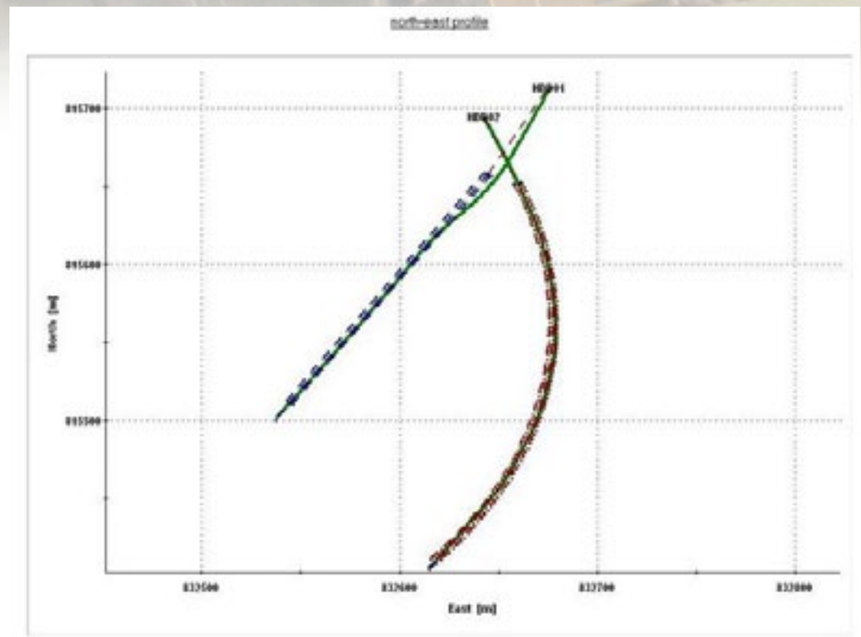

Figure 4: Two directionally drilled holes. HDD01 shows original deviation before being steered into tolerance for remainder of hole. HDD02 shows highly curved controlled hole following planned tolerance requirements (Plot courtesy of Devico).

Summary

All boreholes deviate to a greater or lesser extent. By surveying boreholes we can:

1) Take corrective action if required.
2) Provide proof that the borehole is as planned and has met requirements.
3) Provide accurate locational information for current and future work.

"Many borehole survey systems are currently available..."

Many borehole survey systems are currently available to suit the range of environmental conditions encountered on drilling projects. Most are now quick and easy to operate and although involving some extra costs can repay investment in a short period.

"The formation of the Federation of Drilling Specialists indicates a strong desire in the industry to attain high and provable standards in drilling practise."

The formation of the Federation of Drilling Specialists indicates a strong desire in the industry to attain high and provable standards in drilling practise. The routine surveying of boreholes or use of directional drilling provides powerful methods of both proving that the borehole is as specified and providing data that can be used both in the current project and in any future work in the area. ■

EC7 - an update on attachment progress

eurocode

During 2012 there are to be a number of standards up for public comment. In this article, Dr John Powell of Geolabs discusses which of these standards are to be published, and which are up for comment.

There are 12 standards that have been finalised for some time but will now appear in 2012 and are listed in Table 1.

There are also quite a few documents (11) that will be coming out for 'PUBLIC COMMENT' in 2012 and this is YOUR chance to influence them! These are listed in Table 2. Many of these documents will impinge directly on our existing standards which will have to be withdrawn.

These may or may not be of direct interest to you but please let any colleagues who might have an interest know what is going on. ■

Table 1 **Standards in the system to be published in 2012**

Standard Number	Coverage of Standard	
22476 - Field testing	/1	Electrical Cone and piezocone penetration tests
	/2	Dynamic Probing – Amendment 1
	/3	Standard Penetration test – Amendment 1
	/4	Ménard Pressuremeter
	/5	Flexible dilatometer
	/7	Borehole Jacking 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

Table 2 **Standards to appear for PUBLIC COMMENT (enquiry) during 2012**

Standard Number	Coverage of Standard	
17892 - Laboratory testing	/1	Determination of water content
	/2	Density of soil
	/3	Determination of particle density
	/4	Determination of particle size distribution
	/5	Incremental loading oedometer test
	/6	Fall cone test
	/9	Consolidated triaxial compression tests
	/12	Determination of Atterberg limits
OTHER TESTS, number yet to be assigned	/A	Geothermal testing methods for geothermal heat exchanger – Technical principles for execution
	/B	Installation of geotechnical monitoring measurements
	/C	Drilling parameters recording

what is NEC?

specification and contract

contents

Writing for the first time for **theGeotechnica** are Kieran Dineen and Robert Gerrard from Thomas Telford Training. Here, they speak about NEC contracts, explaining what you need to know.

NEC is a modern day family of contracts that facilitates the implementation of sound project management principles and practices as well as defining legal

"Key to the successful use of NEC is users adopting the desired cultural transition."

relationships. Key to the successful use of NEC is users adopting the desired cultural transition. The main aspect of this transition is moving away from a reactive and hindsight-based decision-making and management approach to one that is foresight based, encouraging a creative environment with pro-active and collaborative relationships.

NEC has matured from being a revolutionary contract in the early 1990s with some interest and use from forward thinking organisations seeking change in how they go about engaging suppliers in a non-adversarial manner. NEC2 was published in 1995 and was increasingly the contract of choice of many organisations in the United Kingdom. NEC3 is the result of feedback from industry on many years of successful use and is the first time that the complete integrated set of NEC documents have been launched at the same time. The family has been expanded to provide a Term Service Contract, a Term Service Short Contract, a Supply Contract, a Supply Short Contract and Framework Contract, all complemented with the standard NEC approach of including guidance notes and flow charts. NEC is a family of standard contracts, each of which has these characteristics:

- Its use stimulates good management of the relationship between the two parties to the contract and, hence, of the work included in the contract.
- It can be used in a wide variety of commercial situations, for a wide variety of types of work and in any location.
- It is a clear and simple document – using language and a structure which are straightforward and easily understood.

NEC is an integrated set of contract documents that are designed to provide Clients and their suppliers with processes focussed on achieving desired, planned outcomes. The intention is that use of NEC will lead more frequently to achievement of Clients' objectives in terms of its ultimate quality, performance, cost and time aspects. It should also be possible to set more rigorous targets for these objectives with greater confidence in achieving them.

NEC is drafted on a relational contracting basis that embodies efficient management processes. It is the belief that collaborative working across the entire supply chain optimises the likely outcomes when compared with a typically fragmented and non-integrated approach. NEC gives the tools to the users to draw out their skills to apply to the environment they are working in.

"NEC is intended for global application..."

NEC is intended for global application and is effectively drafted on a neutral jurisdiction basis to achieve this goal. Some United Kingdom amendments are included in secondary Options to meet particular governing legislation and a similar process can be followed where necessary to suit other jurisdictions.

This note is aimed at both new and experienced users of NEC and the purpose is to assist in the application of NEC when selecting procurement and contract strategies to achieve project objectives. In the next article we will look at the contracts that make up the NEC3 suite. ■

drilling

contents

This is the third in a series of articles on borehole stabilisation and the use of drilling fluids and muds. In this issue of **theGeotechnica**, James Mansell of Clear Solutions International Ltd. once again imparts his knowledge on this very important subject.

In this article we will look at how the performance of rotary drilling operations is directly related to the efficient cleaning performance and reuse of the drilling fluid system. It is essential to install an efficient system for the mixing of drilling fluid and removal of drilled solids from the drilling fluid. Solids remaining in the mud adversely affect the drilling processes, whilst also causing significant wear to mud pumps, tooling and surface plant.

Proper and efficient separation of drilled solids from the drilling fluid has many benefits, which include penetration rate (production), reduced drilling fluid costs, reduced water usage, reduced water hauling costs, reduced hauling and disposal costs of contaminated fluid, as well as reduced downstream wear on

"All of this translates into increased production at reduced costs for the contractor..."

pumps, plumbing, and other equipment. All of this translates into increased production at reduced costs for the contractor along with many environmental benefits. The drilling fluid – in many cases, a bentonite drilling fluid (Ultra-Bore®) or polymer drilling fluid (Pure-Bore®) – stabilizes the borehole, controls subsurface pressures, suspends drilled solids, and facilitates transportation of solids back to the surface, whilst also cooling and lubricating the drilling assembly.

As for cleaning the returned drilling fluid, contractors typically have three options:

Discard and replenish. This is the oldest and most expensive type of solids removal. In the early years of drilling, contractors would completely discard the fluid when it became too heavy or unusable, and totally

"In almost every case, this method has proven to be unacceptable from an environmental perspective..."

rebuild their fluid system. In almost every case, this method has proven to be unacceptable from an environmental perspective whilst also being uneconomical.

Gravity settling. Sometimes large earthen pits or tanks are used as settling traps. 'Clean' fluid is skimmed off the top and reused. The settled solids can later be mucked and discarded. This method requires a large area, and is counter intuitive as to ensure efficient drilling we need the drilling fluid to do the complete opposite and actually suspend the drilled cuttings to aid cuttings transport/removal from the borehole.
Mechanical separation equipment. Separation may be performed by vibrating shakers or screens, hydro-cyclones and centrifuges. This is the method principally addressed in this paper.

Separation Plant Design

The drilling fluid separation plants must be designed to handle the maximum volumetric flows and dry tonnage of material removed by the drilling operation.

"The plant must be able to clean the drilling fluid enough to maintain acceptable fluid density..."

The plant must be able to clean the drilling fluid enough to maintain acceptable fluid density is returned to the mud pumps without hindering production. Thorough analysis must be performed on maximum flow rates from the drilling rig; maximum achievable penetration rates, anticipated fluid densities and viscosities and anticipated ground conditions in terms of grain size analysis. The slurry separation plant provider must consider these issues before designing a plant to meet the end-user requirements. In

"...any spatial constraints or maximum sound-level requirements must be factored into the design process."

addition, any spatial constraints or maximum sound-level requirements must be factored into the design process. Density indicates the percentage of solids by volume. Slurry separation plants utilise multiple processing stages, each designed to remove successively smaller solids. Critical steps within the process provide solids removal capacities equal to the maximum drilling rate. During connections, the re-circulating capability of the plant permits it to respond to challenging and constantly changing soil formations and penetration rate.

Primary separation stage
One method of primary separation is to route excavated slurry from the borehole to a static bar screen with openings ranging from 50 to 10mm. However, these units are fast becoming obsolete, as they are being replaced by much more efficient scalping shakers.

"Vibrating screening machines permit initial separation of large oversized materials..."

Vibrating screening machines permit initial separation of large oversized materials such as gravel, sticky consolidated clays, wood fragments, and more. These

machines can be single- or double-deck construction, depending on the manufacturer. Vibratory motion helps de-water the solids and convey oversize material off the discharge end of the shaker onto a conveyor for transport away from the separation plant. As much of the solids as possible should be removed at this stage through the largest possible screen area to reduce downstream loading and improve overall separation efficiency. Depending on the plant design and/ or nature of the excavated solids, the underflow from the primary shaker is either routed to a secondary shaker for finer screening down to 140µm or in most cases fed directly to large- diameter hydro-cyclones for a similar separation of 100-140µm.

Intermediate separation stages
In most cases, multiple stages of separation are employed using desanding hydro-cyclones, followed by desilting cones. Desanding cones process the underflow from the primary or secondary shaker if included in the plant design. A typical desanding hydro-cyclone performs a separation of about 60-80µm at a flow rate of 120m3/hr per cone. Typically, the number of hydro-cyclones is determined by the need to process about 125-150% of the total circulation rate from the

"For optimal separation, abrasion-resistant centrifugal pumps are commonly used..."

drilling rig. For optimal separation, abrasion-resistant

centrifugal pumps are commonly used to feed the hydro-cyclones at the cone manufacturer's recommended feed pressure. Feed slurry directed into the cone

"...the feed chamber...creates a spinning action inside the cone similar to a tornado."

inlet at high velocity enters the feed chamber, which creates a spinning action inside the cone similar to a tornado. Centrifugal forces and inertia cause the solids to settle outward against the hydro-cyclone wall in a downward spiraling stream. Solids are concentrated and continuously discharged out at the bottom of the cone, while the increasing centrifugal force near the centre of the cone causes the inner layers of the downward spiraling liquid and finer solids to reverse direction and exit the overflow through the vortex finder. The desander cone overflow is passed downstream to the next compartment in the base tank of the plant and becomes the feed to the desilter cones. Additional centrifugal pumps are used to feed the desilter cones at the recommended pressure. Desilter cones can make a separation as fine as 20µm and process a maximum of 15m3/hr. Again, the recommendation is to provide sufficient desilter cones to process up to 150% of the flow from the drilling rig.

In most cases, the underflow (recovered solids) from the desander and desilter cones is not ready for handling at this point, as it still contains some free liquid. Consequently, fine High-g dewatering screens are used to shake the remaining free liquid from the solids in the cone underflow. The screens form the solids in the underflow into a 'stackable, conveyable' consistency, allowing for easier handling of the recovered solids.

Final separation stage – fine solids recovery

If required the final stage of separation is to recover the desilter cone overflow solids (material finer than 20um-40um). This recovery is typically achieved by a high-speed decanting centrifuge treating a portion of the desilter overflow. A centrifuge is a high-speed, high g-force rotating bowl and scroll assembly capable of separation down to 2 microns. A g-force of over 3,000 can be achieved by running the machine at 4,000rpm. In this process, slurry is channelled through a feed tube into the rotating bowl, where centrifugal force drives the ultra-fine solids outward against the interior wall of the bowl. A rotating conveyor in the centre of the bowl transports the recovered solids toward the solids discharge ports, which discharge into a chute. Liquid is retained in the pool and discharged through the liquid discharge ports. If desired, polymer injection units can be connected to these centrifuges to achieve a nearly clear effluent; polymer injected into the feed tube will flocculate the reactive ultra-fine solids, forming a large enough mass for the centrifuge to capture. The result is a nearly clear effluent that may be discharged offsite or returned to the system. Some suppliers offer another option for ultra- fine solids recovery. This method utilises a belt or filter press working in conjunction with a thickening device such as

"Pre- thickened sludge is fed to a series of plates to squeeze out as much moisture as possible..."

a clarifier. Pre- thickened sludge is fed to a series of plates to squeeze out as much moisture as possible and discharge a dry cake of fine solids although these tend to be very maintenance-intensive.

FINAL CONSIDERATIONS

Drilling fluid separation plants must be carefully designed, sequential plumbing needs to be provided in the separation plant to ensure proper fluid flow from stage to stage. During non-drilling time, the system should be able to re-process fluid through the hydro-cyclones and centrifuges to continuously remove the ultra-fine, hard-to-capture solids.

With health, safety and the environment in mind...

Proper walkways, handrails and stairwells should all be included in the scope of supply, along with sufficient lighting and cover from the weather elements, if necessary.

DERRICK SEPARATION EQUIPMENT

Derrick High g-force linear motion dewatering shakers offer an unmatched 7.3g of acceleration. High G-forces are achieved through linear motion generated by dual vibratory motors operating at high frequencies. High g-forces, combined with fine polyurethane or stainless-steel screens, allow for high capacities, drier solids, and reduced fluid losses than traditional

"Clear Solutions International Ltd...produces, supplies and rents drilling fluid mixing and cleaning systems..."

machines. Clear Solutions International Ltd, based in Shropshire in the UK produces, supplies and rents drilling fluid mixing and cleaning systems which utilize Derrick Equipment Company components – these include both unique high-open-area, long- life polyurethane screens and patented stainless- steel Pyramid screen technology. This features 3-D or corrugated screen surfaces that offer over 100% more screen surface area than conventional flat screens.

"This novel design leads to higher shaker capacity, drier solids, and the ability to run finer screens."

This novel design leads to higher shaker capacity, drier solids, and the ability to run finer screens. All are critical components to achieve an efficient drilling fluid separation programme. Derrick is a leading manufacturer of slurry separation equipment for the oil and gas drilling market. Derrick equipment is also revolutionising many tunnelling, microtunnelling, slurry wall/foundation drilling, horizontal direction drilling projects along with many other underground construction applications. ■

ready for an uncertain forecast?

safety issues

contents

Writing for **theGeotechnica** once more, Tom Phillips, an independant chartered occupational safety professionalfrom RPA Safety Services. Here Tom discusses the provisions necessary in order to survive comfortable on site during the cold winter months.

As I sit writing this, it is difficult to think that winter is really here. It has been unusually mild and it looks set to continue to be so despite the high winds we have recently experienced. When it's as warm as it is, we all get a little complacent, but businesses need to be ready

"...the UK climate is notoriously fickle and can change at a moments notice."

to put plans into place as the UK climate is notoriously fickle and can change at a moments notice. As someone said to me on the side of a quarry in the Lake District, if you don't like the weather then wait around – it will soon change.

Are you prepared for winter?

I recall one of my peers recounting a story of a tracked rig being loaded onto a low loader for transportation during the winter. It was an icy cold day but the operation seemed to go okay, so everyone finished by heading off for a cup of tea. When they got back the rig was lying on the engineer's car – or what was left of the car anyway. Due to build up of ice and snow in the tracks of the rig and on the deck of the low loader, the slight

Snowy conditions often make the job more difficult.

incline on which it was parked caused the rig to slide gracefully off the low loader and it was only due to

"It is clear that work which goes on without a hitch throughout the rest of the year, can quickly become a challenge in the winter."

luck that the engineer had also 'gone for a cuppa'. It is clear that work which goes on without a hitch throughout the rest of the year, can quickly become a challenge in the winter.

In this article, I will look at some of the hazards which are made worse by winter weather and the controls a company can consider to protect themselves and their staff. As an example in the opening of this article I said it has been uncommonly mild but I have now just heard snow is falling in Yorkshire and the Pennines – so perhaps winter is here after all.

Working temperatures in offices and laboratories are important for comfort and protection. Although there are jobs where the working environment cannot be kept warm, such as cold stores and refrigerated units, employers should make every attempt to maintain a minimum of 16°c for sedentary work and 13°c for active work. I have worked in logging stores and concrete test labs where it gets so cold in winter, that the cube tanks freeze over and the sample bags are frozen stiff.

"Maintaining a warmer working environment in such cases is often accomplished by supplementary local heating..."

Maintaining a warmer working environment in such cases is often accomplished by supplementary local heating in the form of space heaters or local electrical heaters. Although convenient for supplying local

Warm clothing is essential when working outdoors.

heat, they pose problems in the form of fire risk assessments as they are often located in gangways or vehicle traffic routes and located where they cannot come into contact with combustible materials. For the

"...bottles need to be safely stored and for electrical heaters, the rule is 'one heater, one socket'."

gas powered examples, bottles need to be safely stored and for electrical heaters, the rule is 'one heater, one socket'.

Although there are suggested minimum working temperatures for those working inside, these would be inappropriate if applied to work outside. It doesn't mean however that we can ignore the cold as a factor. Site staff need to be considered when the temperature drops.

When it gets cold, blood flows from the extremities to keep the core of the body warm - a survival mechanism going back millions of years before gloves

"Reduced circulation to the hands causes the capillaries and blood vessels to collapse..."

and thermals were invented. Reduced circulation to the hands causes the capillaries and blood vessels to collapse, thus depriving them of the main protection provided by the blood. Such exposure to extremes of cold can cause a chronic condition known as chilblains, the avoidance of which is largely in the hands of staff who should be encouraged to stop smoking, avoid substances that may constrict blood vessels (caffeine and decongestants) and keep active and warm.

"Wearing warm clothes such as long johns, long boots, tights, leg warmers or long socks should be encouraged."

Wearing warm clothes such as long johns, long boots, tights, leg warmers or long socks should be encouraged. Staff who are diabetic are particularly susceptible as they already have potentially reduced circulation and should be suitably briefed.

Similar precautions should be taken to prevent premature damage to the tiny vessels in the hands, when vibrating equipment is used. Reduced blood flow which may lead to an increased likelihood of hand arm vibration syndrome (HAVS) in cold weather. There may an additional need to reduce exposure times if alternatives cannot be used and a greater need to examine alternatives, once the temperature drops.

Those working at height to free drilling ropes or completing rope access work should be restricted from doing so when wind speeds pick up. For those using

ready for an uncertain forecast?

safety issues

cranes or lifting equipment, there will be clearly defined limits about the extent to which equipment may be used but this is unlikely to be available for those

"...high winds cause unstable structures and make equipment more difficult to handle..."

carrying out geotechnical work. However, high winds cause unstable structures and make equipment more difficult to handle so defining when work should stop and providing a method of measuring wind speeds is important.

Perhaps the greatest risk to staff though, is the risk to those driving during the winter. Increased road spray, fog, ice, high winds and reduced daylight makes a normal working activity, an extreme hazard. Whether

"Ensuring lights work and washer bottles are full is a legal requirement punishable by a fixed penalty..."

staff use a company vehicle or provide a vehicle themselves, some sensible precautions can make all the difference. Ensuring lights work and washer bottles are full is a legal requirement punishable by a fixed penalty and the excuse 'it's not my car', carries no weight. The driver is responsible for the vehicle condition.

The debate about winter tyres has surfaced in the last few years and you may think that changing to seasonal tyres during the winter months is a bit excessive, but they're not only needed for driving on snow and ice.

"Regular tyres harden when the temperature drops below seven degrees and lack 'sipes' on their tread pattern."

Regular tyres harden when the temperature drops below seven degrees and lack 'sipes' on their tread pattern. Increased low level flexibility and sipes (tiny slits in the tread blocks) lead to an increase in traction and grip so winter tyres reduce the risk of spinning off the road and improve stopping if you have to make an emergency stop. Their deeper tread patterns also make them less likely to aquaplane.

There are many more issues which could be discussed such as slips and trips, but the ones outlined are some of those which have sprung to my mind over the last few weeks from discussions with our clients. The main message is not to become complacent. Winter makes work more of a challenge and may strike with little warning so if extreme conditions are foreseeable, plans should be in place before the event, rather than after. ■

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Roger Chandler, Director of Keynetix, continues his seriesof articles for **theGeotechnica**. Here, Roger makes his predictions for 2012, and what technological advances we can expect to see during the course of the year.

What is going to be biggest change the industry will see in the way we manage site investigation data in 2012? January is the month in which people like to make predictions for the year ahead so here goes …

There are currently a wide range of software and technology options to choose from and advances are being made in many different areas at breakneck speed.

"...one developing technology stands out above all others for me as being in the right place at the right time..."

However, one developing technology stands out above all others for me as being in the right place at the right time and that is the use of electronic logging equipment for recording data on site.

The concept of logging data into a PDA or laptop on site is not new. Keynetix were the first company to launch purpose built site investigation logging software (Pocket SI) for a PDA at the Civils show back in 2002 and since then many other tools such as KeyAGS

and KeyLogbook have become available.

Why will 2012 be different?

Mobile computing is now accepted. In the last quarter of 2011 Apple sold 3 times as many tablets and 10

"Back in 2002 when Keynetix launched Pocket SI it was cutting edge, unproved technology, but today it is tried and trusted..."

times more smart phones than laptops. Back in 2002 when Keynetix launched Pocket SI it was cutting edge, unproved technology, but today it is tried and trusted with everybody wanting more and more functionality on these devices. "There's an App for that" seems to be a standard line you can use to almost anything these days.

Onsite logging has been growing in popularity with the small site investigation companies over the last five years. For companies of this size it is often the people logging on site who have to re-enter the data into their borehole log software when they return to

"Having this element removed as a result of onsite logging is a big cost saving for the company and a time saver for the engineer."

the office. Having this element removed as a result of onsite logging is a big cost saving for the company and a time saver for the engineer.

The larger site investigation companies have been slower to adopt this technology as they usually have trained data entry staff back at the office that can enter the data much more efficiently than the engineers. However, with the additional benefits the units now offer it appears the tide is turning fast.

Evidence of this was presented as case studies at the 21st Annual Geotechncial Office User Group Meeting

"For the first time ever there was a common acceptance of onsite logging as either standard practice or an inevitable part of the very near future."

last November. For the first time ever there was a common acceptance of onsite logging as either standard practice or an inevitable part of the very near future.

BAM Ritchies spoke on their experience of using PDAs to log site investigation data. BAM Ritchies recently purchased Pocket SI units for all their site engineers. These have been used on several sites and

"...the feedback from the engineers using them has been very positive..."

the feedback from the engineers using them has been very positive (including one engineer who almost had to be forced to use it now says that they couldn't see themselves without it!)

BAM also highlighted a job on a large railway cutting in Surrey where they were logging the chalk faces by

"The PDA option proved invaluable here as it freed up the engineer's hands..."

abseiling down them and logging as they went. The PDA option proved invaluable here as it freed up the

The future of borehole-logging? KeyLogbook.

engineer's hands and there was no need to run for cover when it rained. As the logging of chalk requires a lot of data the additional advantage of not retyping logs at the end of the job was considerable.

Soil Engineering spoke about the benefits that tablet PCs offered to their drillers and management. Soil Engineering has been trialling KeyLogbook for the past year and assisting with its development. Their presentation was very interesting as it presented both the highs and lows of the previous year and concluded with a very powerful Return on Investment calculation

"...Soil Engineering estimated the use of KeyLogbook would save them in the region of £55,000 a year (even without taking into account the additional cost savings of not re-entering data)."

that showed that Soil Engineering estimated the use of KeyLogbook would save them in the region of £55,000 a year (even without taking into account the additional cost savings of not re-entering data). A full article on this case study is being prepared for the next issue of Geotechnica and I am sure it will be an eye opening read for many.

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We are all being pushed to make efficiencies savings year on year and 2012 will be no different. Following the government's increased construction budget for 2012 we will hopefully see more work than 2011 but

"Using on-site logging devices can save companies as much as one engineer day a week..."

with limited resources to complete it. Using on-site logging devices can save companies as much as one engineer day a week and this is the reason why the industry saw a substantial increase in their use in 2011 and expect to see even more in 2012.

So, in summary, the large site investigation companies will be using electronic devices a lot more on site in 2012 and this will increase the awareness of the products

"As clients push for more and more efficiencies then the time spent re-typing data will be scrutinised even further."

to clients. As clients push for more and more efficiencies then the time spent re-typing data will be scrutinised even further. With mobile devices being widely used by engineers for day to day tasks then I confidently predict that the industry will see onsite logging becoming the major change to the way we handle our site investigation data in 2012. ■

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