

**GEOTECHNICAL COURSE DATES:**  
 Rock Description Workshop  
 2nd Sept. 2014, 7th Nov. 2014  
 In Situ Testing  
 8th October 2014

**GEOTECHNICAL COURSE DATES:**  
 Geotechnical Foundation  
 Design - 10th June 2014  
 21st July 2014  
 Soil Description Workshop  
 8th July 2014  
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# REST AND BE THANKFUL

Thanks to Maccaferri's  
 Debris Flow Barriers  
 on the A83

**Included in this month's issue:**

- Preserving Britain's Seaside: Piling on Worthing Pier - a case study reviewing Aarsleff's work at Worthing Pier.
- Meridian Drilling completes landmark Allana Potash Project - a case study examining Meridian's work in Ethiopia.
- The use of drilling diagraphy systems in tunnelling works



Issue No.  
**30**  
 May 2014



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# Welcome

Welcome to the 30th Edition of **theGeotechnica** - the UK's fastest growing online geotechnically focussed e-magazine.

This month, once again, we have a fantastic line-up of insightful and informative articles that make for a must-read.

The cover article this month comes from Jeff Laverack of Holmes Media, writing on behalf of geotechnical specialists, Maccaferri. This month Jeff writes to **theGeotechnica** as Maccaferri complete their debris flow barriers that have been installed to protect Scotland's A83, Rest and Be Thankful Pass.

Our second article is penned by Chris Primett, Managing Director of Aarsleff, who writes for **theGeotechnica** for the second time. This month, Chris carries out a case study on Aarsleff's work at Worthing Pier, as they use their vast experience in the marine environment to help preserve the British coastline.

Following on from Chris Primett is Peter Reading, now a part-time lecturer at Brunel University. In this month's issue of **theGeotechnica** Pete looks at the current state of the geotechnical industry and whether we are prepared for the high influx of work coming our way in the near future. Although the upturn in work and profitability in the geotechnical industry can only be seen as a good thing, Pete discusses what needs to be done to make sure that this workload is managed successfully as well as responsibly.

The final article in this month's issue comes from Amedeo Valoroso, CEO of DAT Instruments, an Italian company that specialises in the design and production of advanced foundation instruments and software. In this, Amedeo's second article in as many months, Amedeo carries out a case study on the use of drilling diagraphy systems in tunnelling works. The article is a great insight into tunnelling works, and how it is important to obtain as much information on the ground conditions through which the tunnel

is being constructed.

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

Finally, for any content that is submitted we will ensure that an advertising space, proportionate to the quality of content provided, is reserved should you wish to place an advert in that single edition of the magazine. We hope you enjoy this month's edition of the magazine and are inspired to contribute your own content for the coming editions of **theGeotechnica**.

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# MACCAFERRI DEBRIS FLOW BARRIERS PROTECT SCOTLAND'S A83, REST AND BE THANKFUL PASS

Writing on behalf of geotechnical specialists [Maccaferri](#) is Jeff Laverack of Holmes Media. This month Jeff writes to **theGeotechnica** as Maccaferri complete their debris flow barriers that have been installed to protect Scotland's A83, Rest and Be Thankful Pass.

Installation of an extensive network of debris flow barriers from Maccaferri is currently under way at the Rest and Be Thankful pass in Argyll & Bute.

The Rest and Be Thankful carries the busy A83 trunk road between Arrochar and Inveraray through mountainous terrain in the west of Scotland.

**“The pass has suffered frequent debris flows especially over the last seven years, with the road closed four times in the last six months.”**

The pass has suffered frequent debris flows especially over the last seven years, with the road closed four times in the last six months.

When the road is closed, a diversion of roughly 50 miles is

required.

As the A38 trunk road crosses an area of outstanding natural beauty around the Rest and Be Thankful, which is part of the Loch Lomond and Trossachs National Park, Transport Scotland required that any debris flow prevention measures had to have a minimal visual impact on the surrounding landscape.

The area suffers high levels of rainfall which act as the trigger for failure. Movement of the surficial soils usually starts high up on the hillside and is progressively channelled into natural gullies above the road, forming a debris flow.

By the time a debris flow has reached the road it has gathered sufficient material, including large boulders, to completely inundate the carriageway. It has also developed sufficient translational kinetic energy to cause significant damage



**“Consequently, debris flows represent a considerable risk which must be mitigated wherever possible.”**

to any vulnerable structures, vehicles or people that it may strike. Consequently, debris flows represent a considerable

risk which must be mitigated wherever possible.

Chris Gell, of Consulting Engineers Waterman [Perth] who is leading the design of the current phase of work in association with rockfall protection specialists Maccaferri, explained the challenges faced by the design team.

“Because of the remote location on steep and unstable ground, the measures had to be easily installed with the minimum of heavy plant and machinery. In addition, variable depth to rock head required a range of designs to account for differing ground conditions”.

The barrier installation work builds on detailed

geomorphological assessments by Geomorph Consulting and additional surveys by locally based main contractor, Geo-Rope.

Due to the scale of the site, it was felt to be impractical to erect barriers along the whole length of the roadside. Costs would have been prohibitive and the barriers would also have created a hazardous ►►



physical obstacle to local wildlife – potentially trapping animals on the carriageway.

**“For this reason, Maccaferri proposed a network of debris flow barriers totalling roughly 1500 sq m.”**

For this reason, Maccaferri proposed a network of debris flow barriers totalling roughly 1500 sq m. The barriers are positioned in such a way as to conform to the site topography and offer the best balance of engineering performance and minimum cost/materials requirement. At the same time, they exceed the client’s requirement for volumetric impact capacity whilst creating a relatively small and discrete visual profile on the slopes.

The barriers are loosely based on Maccaferri’s high capacity 3000kj and 5000kj RMC rockfall catch fence systems. They comprise hinged steel

supporting posts from which heavy duty interceptor panels of steel-wire ring-mesh are suspended. Bracing cables, anchored laterally and up-slope, are equipped with patented aluminium energy dissipaters, as offered with all Maccaferri dynamic impact systems.

These act to minimise impact-induced shock loadings on the system in a controlled way and are specified on a rope-by-rope basis in debris flow systems.

**“The dissipaters are also highly resistant to corrosion and according to Maccaferri, are simple to install as they are fitted into the relevant ropes in the factory thus requiring no on-site assembly.”**

The dissipaters are also highly

resistant to corrosion and according to Maccaferri, are simple to install as they are fitted into the relevant ropes in the factory thus requiring no on-site assembly.

Dr David Cheer, rockfall mitigation specialist for Maccaferri, explained some of the issues faced by the design and installation team. “Compared to Rock Fall Barrier projects, Debris Flow situations constitute a much more complex scenario. There are many more variables to consider and all the time, we have to keep functionality and practicality of installation in mind. Debris Flow is a serious problem but one that can be successfully addressed using the right technology and the correct technical approach”.

Cheer continued, “In this project, the geometric configuration and positions chosen for the barriers allowed us to reduce both the impacting forces and consequently the size and costs of the foundations and

barrier anchorages - especially important, bearing in mind the highly challenging ground conditions on site”.

He concluded, “By carefully selecting the barrier locations it was possible to minimise the total requirement for barriers. This approach is more design-intensive but it offers much better value to the client compared to the “spread-shot” approach of protecting large lengths of road in a blanket fashion, hoping to intercept a flow”.

**“In this latest phases of work, ten bespoke debris flow barriers are being installed by roped access geotechnical contractor Geo-rope.”**

In this latest phases of work, ten bespoke debris flow barriers are being installed by roped access geotechnical contractor

Geo-rope.

Geo-rope specialises in complex geotechnical and rope access solutions and because of the difficult terrain, brought in a specially adapted helicopter to lift and place components of the 2.00m – 6.00m high barriers into position.

Performance of the barriers will be constantly monitored using a web hosted asset monitoring and data storage system developed for use with the Maccaferri systems by itmsoil. The instrumentation system will integrate real time remote monitoring and logging of barrier conditions and automatically triggered day/night photogrammetry.

This will provide quantitative data on barrier performance and condition while helping with network management and scheduling of unplanned maintenance events in response to debris flows.

**“The system is remotely controlled and adjusted with the ability to monitor slope and barrier conditions and take photographs of the area around the barriers...”**

The system is remotely controlled and adjusted with the ability to monitor slope and barrier conditions and take photographs of the area around the barriers either in response to a previously defined alarm condition or on request by a web-portal user.

When the current works are completed, a total of eighteen Maccaferri debris flow barriers will have been installed over nine work phases at the Rest & Be Thankful. ■



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## GEOTECHNICA 2014 CONFERENCE PLAN

The Geotechnica 2014 Conference will provide an impelling insight into the future of the geotechnical industry, as well as providing everything consultants and contractors need to be aware of to comply with current and changing standards. Attendance is a must for those procuring, specifying, supervising and carrying out geotechnical and drilling works across the UK.

The conference is led by Equipe, the UK's leading training provider for the geotechnical and drilling industry and is supported by many leading industry speakers. Topics which will be covered during the two day conference will include ground investigation, piling, ground improvements, laboratory testing, data management and health and safety. The speakers include many of the UK representatives on the CEN (European) Standards committees and UK mirror committees which themselves represent the industry and relevant trade associations such as FPS, AGS and BDA. The imminent commencement of HS2, combined with the consistent growth already seen across the UK over the last 12 months, provides a major challenge to the UK geotechnical and drilling industries, which hasn't been seen since the 1980's. As this growth comes on the back of the most severe recession in living memory - how will the UK industry sectors cope? There are many questions which are not being asked but we will at Geotechnica.

Unlike other conferences, Geotechnica encourages audience participation and discussion which allows the industry to challenge potential problems, shortfalls and more importantly how we can drive standards and best practice across. Issues such as competence, compliance, resources and quality will be discussed with particular attention to potential impact on growth for 2014 and beyond.

### Speakers Include:

- Prof. Barry Clarke, University of Leeds
- Tim Fitch, Construction Strategist
- Dr Derek Egan, Technical Director, Keller
- Chris Raison, Director, Raison Foster Associates
- Dr John Powell, Technical Director, GEOLABS
- Prof. Paul Nathanail, Director, Land Quality Management
- Dr Roger Chandler, Managing Director, Keynetix
- Tracey Wilkins, Programme Manager - Construction, BSi
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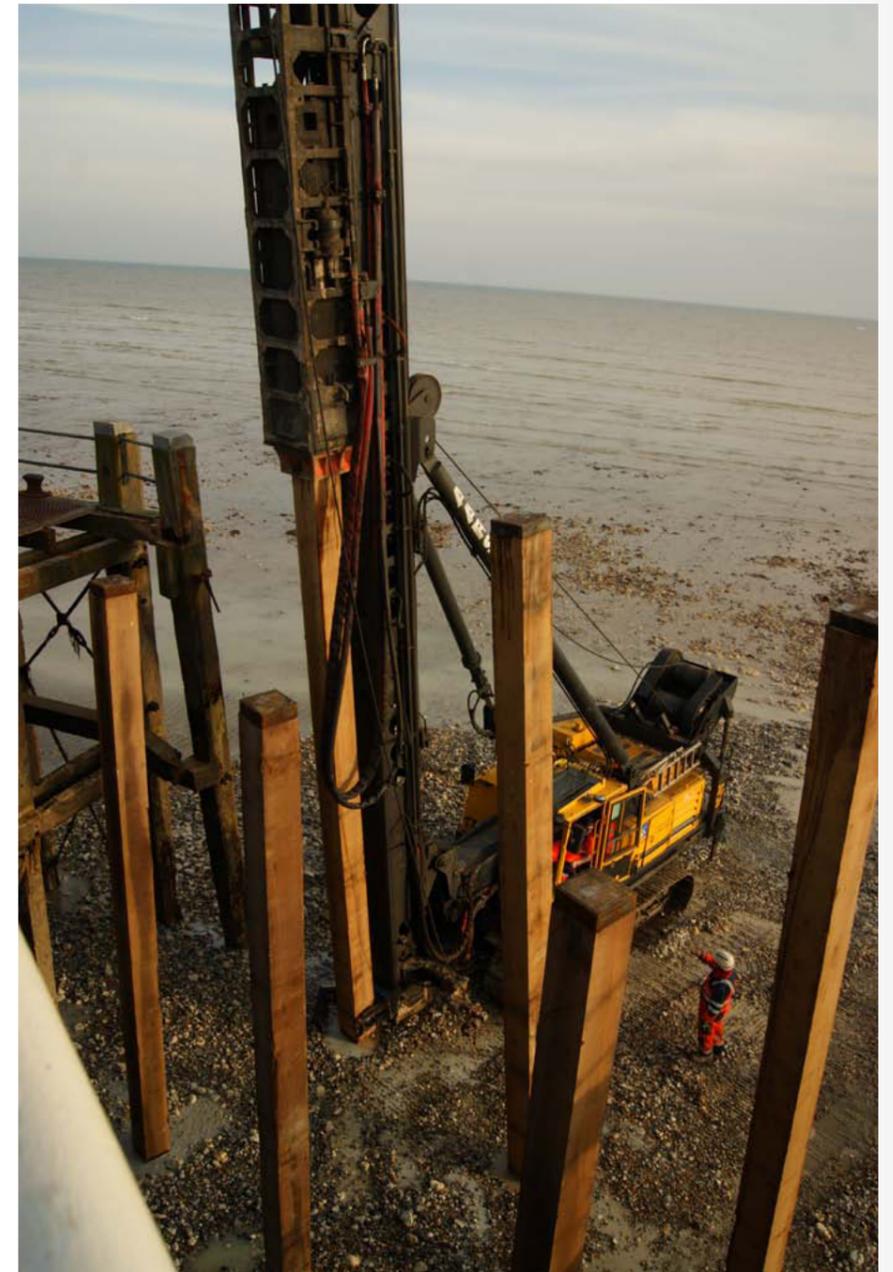
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# PRESERVING BRITAIN'S SEASIDES: PILING ON WORTHING PIER



Following on from last month's feature on precast piles, we have another article from **Chris Primett**, Managing Director of [Aarsleff](#). In this month's article, Chris carries out a case study on Aarsleff's work at Worthing Pier, as they use their vast experience in the marine environment to help preserve the British coastline.

British seaside piers are as synonymous with holidaymakers as sticks of rock and Worthing Pier is no exception. Designed by Sir Robert Rawlinson, Worthing Pier was the thirteenth pier to be built in England at a cost of £6,500 by the Worthing Pier Company. The first pile

for its construction was driven into the seabed back in 1861 and has survived, not without damage, numerous storms and a fire as well as a 120-foot hole blown into its decking to hinder any potential enemy invasion during WWII. Little wonder then, this majestic and elegant Grade II listed tourist

attraction is in need of constant maintenance and Worthing Borough Council is currently undertaking such a task.

Phase I of the project required essential maintenance to the timber framed landing stage that surrounds the end of the pier. Special strength testing had revealed that some of the piles had deteriorated, due to wear from the constant movement of the seabed material at beach level and needed replacing.

**"PMG had no piling capability, so called upon Aarsleff, who have vast experience of the marine environment..."**

Paine Manwaring Green Ltd (PMG) who had been maintaining the pier for over 30 years, were awarded the contract to dismantle part of the landing stage, extract and replace piles and then reassemble the timber bracing

and walkway. PMG had no piling capability, so called upon Aarsleff, who have vast experience of the marine environment, having previously installed thousands of timber piles for new groynes on Eastbourne Beach, for advice and assistance.

Aarsleff visited the site and made a number of recommendations, such as proposing that seven piles be removed and replaced; four in the back row and three front rakers, to ensure that the

piles were installed square to the existing grid pattern and to gain access for its Banut 700 piling rig. The proposals were accepted by Worthing Borough Council's engineers, and PMG awarded the piling contract to install the new 12m long Greenheart piles worth £20,000, to Aarsleff.

The existing piles were first removed by PMG, work which could only be undertaken during an approximate 1-hour window coinciding with the extremes of the low tides.

Aarsleff had to track the rig back and forth 300m from the shore to the pier head at each low tide. Working at beach level on a navy mat working platform, Aarsleff planned to install one pile during each consecutive low tide to a depth of between 3.5m to 4m into

**“Aarsleff started work at the back row of the vertical 300mm square section piles and completed the first pile within the tight time frame.”**

the underlying chalk. Aarsleff started work at the back row of the vertical 300mm square section piles and completed the first pile within the tight

time frame. However, the beach subsequently proved strong enough to support the piling rig without the working platform, thus enabling Aarsleff's site team to complete the three remaining vertical piles on the next low tide and the three 239mm square section front row piles, sloping at 8.5°, on the following tide. As a result, the job was completed nearly 60% ahead of schedule.

PMG works director Alistair Ktori said, “Aarsleff has been absolutely fantastic, brilliant, I can't fault them. There was only one week where the low tides would allow us to work on the beach and install the piles. Aarsleff didn't need the working platform as the beach was able to support their rig and they completed the piling in just three tides, instead of

the seven predicted. The line of the installed piles couldn't be better and will help us when we come to reassembling all the additional timber bracing. Aarsleff has been extremely helpful right from the start of us contacting them from our search on Google. We saw on their website that Aarsleff had been involved with other marine piling projects. Aarsleff was also recommended to us, as they had successfully installed about 6000 greenheart piles for new groynes on the beach just along the coast at Eastbourne in the 1990s. There are some more piles to be replaced here on the southwest corner of the landing stage and if Aarsleff's price is okay we would anticipate they could also install those.”

Phase II of the project was



**“Specifically, the works on the pier are on-going with rotten and degraded piles being replaced as required...”**

awarded to Aarsleff by KD Engineering following its success on phase I and its work with PMG. Specifically, the works on the pier are on-going with rotten and degraded piles being replaced as required and the pier being modernised over time. For this phase of the project 8 piles needed to be replaced, which like previous works, would not be without challenges due to the tight tidal time frame available for pile installation.

In fact, the tidal working window was 1.5 – 2 hours and a spring tide was essential to

ensure that the sea retreated sufficiently to allow the Junttan PM20 rig to work. In addition enabling works, such as setting out of pile positions and the transportation of piles etc., also had to be planned around the low tide window. Even the wind, which would cause the tide to stay in longer, has to be planned for and carefully factored into the work schedule.

Specifically 8 Greenheart timber piles were installed to replace the 8 piles that were rotten due to age and general age-related wear and tear. Works were completed over two tides, some 75% ahead of the 8 tides that works were originally programmed for. Alistair Ktori, Managing Director, KD Engineering said, “Once again, Aarsleff exceeded our expectations with professionalism and efficiency. We first worked with Aarsleff

back in April 2010 and the project went very smoothly and **“... with the added knowledge of what we were doing, the work was completed in a quarter of the time allowed.”**

without problems. This time, with the added knowledge of what we were doing, the work was completed in a quarter of the time allowed. We look forward to working with Aarsleff and their crew again in the near future.

The project was a huge success for Aarsleff, who subsequently received a number of enquiries, such as from the Hastings Pier Charity, who were keen to exploit the company's knowledge and expertise on these types of projects. ■

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# MERIDIAN DRILLING COMPLETES LANDMARK ALLANA POTASH PROJECT

Writing for *theGeotechnica* this month on behalf of [Meridian Drilling](#) is Claire Savage of Accord PR. In this article Claire presents a case study of Meridian's recent landmark Allana Potash Project in Ethiopia.

After four years working a 24/7 operation in one of the world's most remote and hostile environments, the Danakil Depression in Ethiopia, UK and Dubai-based Meridian Drilling looks forward to the future, more sure than ever of its team's ability to adapt and perform, whatever the challenges of the project.

2009 was a landmark year for Meridian Drilling as it started one of its most technically, physically and logistically challenging projects – working in the searing heat of the Danakil Depression for Canadian junior, Allana Potash.

Meridian Drilling Managing Director, Jeremy Moore explains how he was warned about the obvious challenges of the contract, which initially involved just 3,000 metres of diamond drilling:

“When we first took the contract, everyone thought we were taking a considerable risk,”

Moore recalls. “The problems were obvious – the heat, the remoteness of the location and huge logistical challenges – but I had a hunch, that the project could be extended, and the management and drilling experience that we could gain, would be invaluable.”

Meridian assembled a good **“Aware of the health and safety issues of working in such a hostile environment, the company took expert advice from Equipe...”**

drilling team. Aware of the health and safety issues of working in such a hostile environment, the company took expert advice from Equipe, which provided training as well as devising procedures for safe operating. With the procedures, people and rigs,



**Acid pool: At the heart of the Danakil desert is a volcanic crater, Dallol. Surrounding the volcano are acidic hot springs, mountains of sulphur, pillars of salt, small gas geysers and pools of acid isolated by salt ridges.**

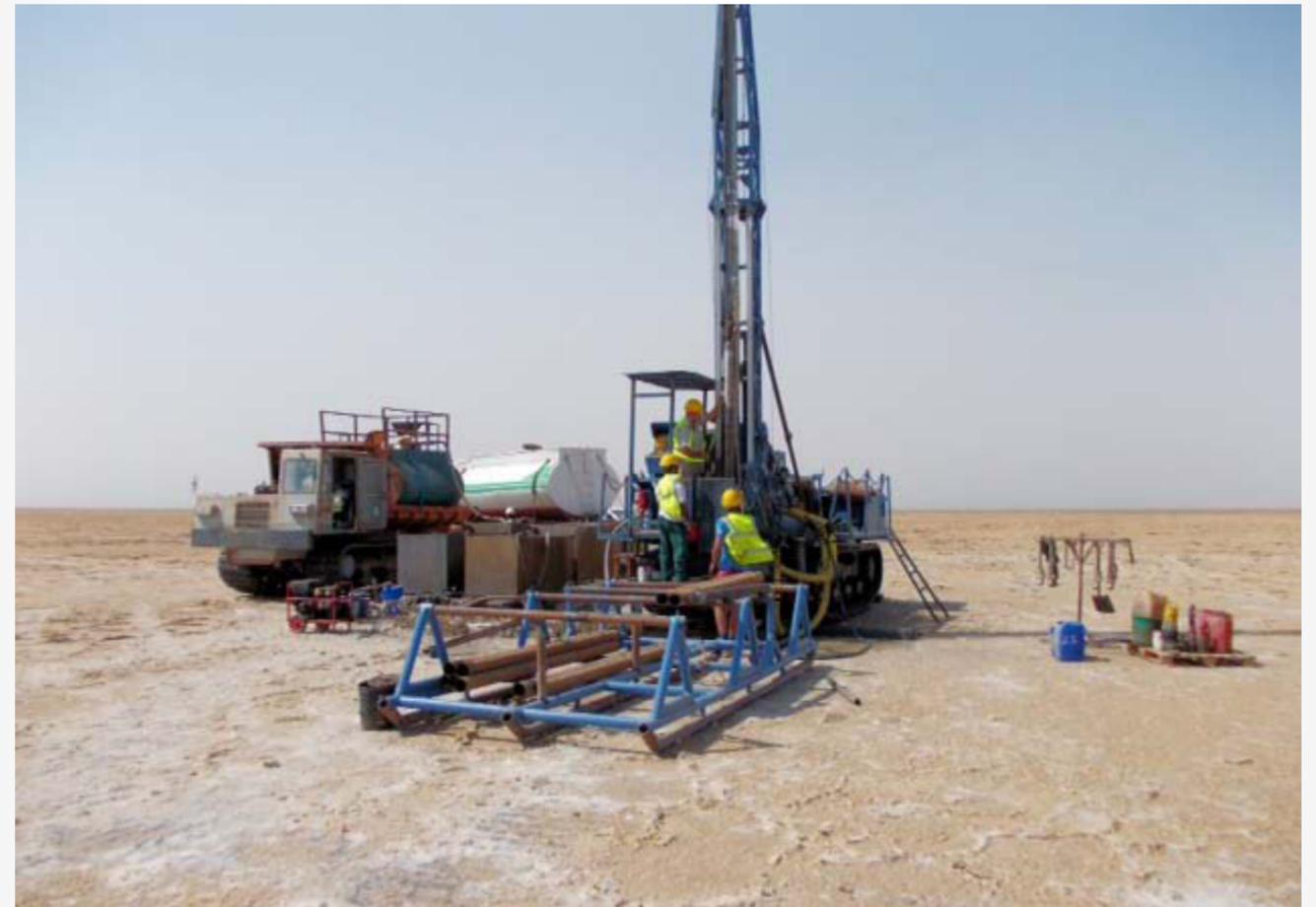
Meridian Drilling was ready to start work in Danakil.

## Challenges

However, as the project began the challenges became apparent. In 2009 there were no roads or infrastructure within miles of the proposed drill site, presenting significant logistical problems. It meant that all of the roads had to be built from scratch.

The heat was oppressive, with daytime temperatures exceeding 50°C and little respite during the night. Meanwhile salt, whipped up by strong winds, caused regular issues with Meridian Drilling's two Atlas Copco CS14 wireline drilling rigs and other mechanical equipment.

Moore says: “I think of those rigs as two Lancaster bombers, they managed to survive a tough battle, but there is every possibility there's not ▶▶



**Getting the job done: With an annual average temperature of 34.4 celsius and day time temperatures regularly exceeding 50°C, Meridian Drilling's team ran a 24/7 operation on the Allana Potash project.**



**Core sample: There are an estimated 60 million tonnes of recoverable ore within Alana Potash's mining concession. Meridian Drilling used a full tri-salt mud system to prevent the dissolution of the potash salts.**

an original part left in them!"

Below ground there were also issues to overcome. Drilling through differential beds of sylvinite, carnallite, bischofite and other halides led to dissolution if the drilling fluids were not correctly balanced.

**"Meridian Drilling used a full tri-salt mud system to prevent the dissolution of the potash salts, while casing was driven deep into the ground..."**

Meridian Drilling used a full tri-salt mud system to prevent the dissolution of the potash salts, while casing was driven deep into the ground and concrete drill pads were constructed to stabilize the soft alluvial soils at surface.

Both PQ and HQ core samples were collected from the potash sequence for analysis, with each hole being logged using industry standard down-hole geophysical logging techniques.

The results were positive, giving an estimated 60 million tonnes of recoverable ore within Alana Potash's mining concession.

In stark contrast to the challenges faced in 2009, at the close of the project in 2013, local road crews were in the final stages of constructing a 120km asphalt road from Dallol to Mek'ale, reducing what was once a 12 to 14 hour journey to just three hours.

Where satellite phones were once the only means of communication, telecommunication masts were appearing. This development will only continue as Allana Potash goes into production.

For Meridian Drilling, Moore's hunch proved correct and the contract was extended twice, amounting to a total of 30,000 metres of drilling, and four years of 24/7 operations.

**"What's more, the challenges of the Allana Potash project were a valuable learning curve for the UK-headquartered company."**

What's more, the challenges of the Allana Potash project were a valuable learning curve for the UK-headquartered company.

"We took a risk in coming to Ethiopia, but the risk paid off," Moore adds. "In the process Meridian has developed a reputation for its ability to deliver professional and reliable drilling services in remote locations." ■

## SAFETY

While the Allana Potash project was a 24/7 drilling operation, there were occasions when work had to stop.

The camp and drill sites were located close to the border with Eritrea. Even though Eritrea and Ethiopia conflict had ceased many years back, certain parts of the border are still disputed, and with many local tribesmen equipped with AK47s, security was a concern throughout the project. The Ethiopian army gave protection to Meridian Drilling's team at all times.

In January 2012, rebel gunmen attacked a group of European tourists, killing five, injuring two and kidnapping four, all within 80 miles of the Eritrean border and a similar distance to the Meridian Drilling camp.

The Ethiopian army stepped up its presence and drilling stopped, with Meridian's team temporarily confined to camp. Eventually the hostages were released, the kidnapers "apologised for the inconveniences", and drilling resumed.

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# THE USE OF DRILLING DIAGRAPHY SYSTEMS IN TUNNELLING WORKS

Writing for *theGeotechnica* for the second time is **Amedeo Valoroso**, CEO of [DAT instruments](#), an Italian company that specialises in the design and production of advanced foundation instruments and software. In this article Amedeo carries out a case study on the use of drilling diagraphy systems in tunnelling works.

DAT instruments – specialists in the production of data logging instrumentation designed for geotechnical and special foundation activities – have designed and launched a product aimed to work in tunnelling projects.

DAT instruments combine accurate electronic equipment with robust performance sensors for use in pre-drilling activities, with the purpose of

investigating the ground in and around the vault of a tunnel when a TBM is in operation.

For tunnelling works it is important to obtain as much information on the ground conditions through which the tunnel is being constructed. It is normal practice to carry out a site investigation before the works and then to probe the ground ahead of the tunnelling operations from within the

**“ B o r e h o l e diagraphy enables the continuous monitoring of the geological strata penetrated by a drilling rig...”**

tunnel. Borehole diagraphy enables the continuous monitoring of the geological strata penetrated by a drilling rig making it possible to quickly assess soil information and deliver the information to the tunnelling engineers. The use of diagraphy gives much more information than conventional



methods and much quicker. Giving the tunnelling engineers a better understanding of the ground properties and enabling the tunnelling methods to be adapted for the conditions they encounter.

DAT instruments are specialists within the production of drilling and piling electronic monitoring instrumentation, and have adapted their system for use on the small drill rigs used to probe ahead of the TBM. The rigs are capable of drilling ahead of the TBM for a distance of up to 70m. The high quality of the information obtained allows tunnelling operations to take place faster and for longer each day.

The small drill rig used at the TBM is installed with a parameter recorder, the datalogger records information on the drill string and rig parameters as it drills ahead of the TBM, recording the diagraphy before the dig of the tunnel. In this way the tunnelling engineer is able to fully understand the characteristics of the ground

**“This enables the choice of the most appropriate equipment to be used, avoiding a continuous use rock cutting tools and optimising productivity.”**

through which the tunnel is to be bored. This enables the choice of the most appropriate equipment to be used, avoiding the continuous use rock cutting tools and optimising productivity.

At the same time the TBM auxiliary drilling machine can be used to test the vault of the tunnel. The rig used for this operation usually drills to less than 5m into the tunnel wall. This operation is aimed at defining the type of soil to be faced, and enabling the optimum coating to be adopted. In addition information is also needed to determine the final type of sensors that will monitor the tunnel during the entire life of the structure.

**“The data loggers provide a continuous record of the strata drilled which can be used as a permanent record and part of the works certification...”**

The data loggers provide a continuous record of the strata drilled which can be used as a permanent record and part of the works certification. This allows the tunnelling engineer to deliver to the project manager a detailed description of each bore.

The parameters recorded by the DAT instruments equipment, include: drill depth, rod feed force, rod feed speed, rotation torque and rotation speed; mast inclination axes X and Y (optional); drilling fluid pressure, date and start/end time of work and duration of work, calculation of relative energy of the ground. These are presented in graphical form for ease of interpretation.

**Assistance and worldwide support**

**“Although the dataloggers and sensors are highly sophisticated electronic instruments, they are not delicate.”**

Although the dataloggers and sensors are highly sophisticated electronic instruments, they are ►►



**“DAT instruments are made keeping in mind the work site where they will operate...”**

not delicate. DAT instruments are made keeping in mind the work site where they will operate, with a large use of stainless steel and polymer resins of the latest generation to ensure maximum strength

and durability. However, the Italian company has developed a service that leaves no room for doubts and uncertainty and has, as its main objective, a close working relationship with the customer and his site problems.

Amedeo Valoroso, owner of DAT instruments: “We have distributors all over the world with high-level technical

assistance, capable of carrying out any installation and can support customers during the use of the instrumentation. Reseller technicians are trained directly by us and continually supported by our experts”.

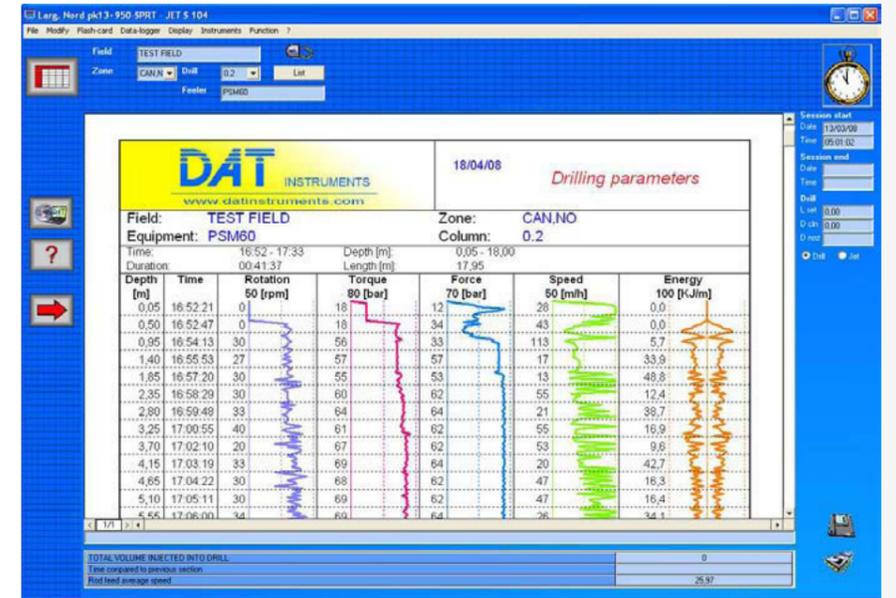
**The use of diagraphy in the Brenner Base Tunnel**

Among the many successful applications recorded by DAT

instruments in the specific field of tunnelling, is the use of the recorders in the Brenner Base Tunnel.

**“The DAT technicians have been involved in the pre-drilling of the service tunnel...”**

The DAT technicians have been involved in the pre-drilling



of the service tunnel for the Brenner Base Tunnel which is built transversely to the main rail tunnel linking Italy to Austria. Forming a gallery of 10 kilometres with a width

**“In this site the data logger was installed on a small drill that had the task of testing the strata to about 70m...”**

of about 6-7m. In this site the data logger was installed on a small drill that had the task of testing the strata to about 70m, helping with the planning of the TBM drives of 20-25m. At the same time the drill, was rotated 90° and carried out surveys of the entire tunnel providing precise diagraphies of the ground ahead of the TBM.

The work carried out by DAT instruments has proven to be one of the most significant because of the importance of the work at European level, but also for the specific

commitment of the Italian company that, with its skilled staff, has been able to follow the construction through all the stages of the building, and monitoring installation.

The datalogger created by DAT instruments for this particular type of processing is the JET 4000 AME / J, equipped with a special set of sensors that allows data transfer through USB pen drive and to process the parameters using the

**“There are several parameters recorded by the DAT instruments equipment...”**

software JET S 104. There are several parameters recorded by the DAT instruments equipment, including: drill depth, rod feed force, rod feed speed, rotation torque and rotation speed; mast inclination axes X and Y (optional); drilling fluid pressure, date and start/end time of work and duration of work, calculation of relative energy of the ground. ■

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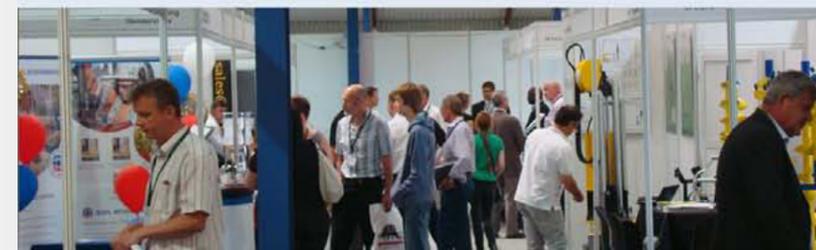
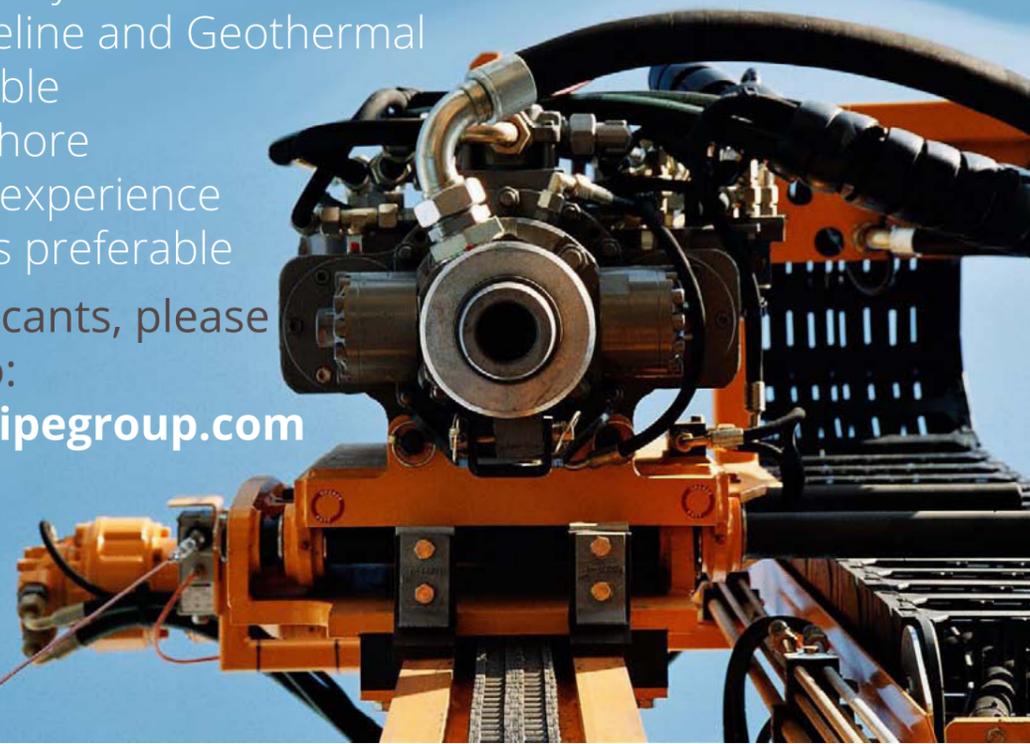
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