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No 3. September 2009

Geotechnical engineering report

With the focus growing in the division on to the geotechnical business segments, a need for further support to customer centres has developed. As such from the Product Company side the geotechnical team, both the product line management and the role the regional managers play, is increasingly in focus. Also increasingly important is our territory management coverage and our channels to the end customer. Classically the territory management and channel management concepts have been fostered in CMT for many years. Territory management is defined as the tool for reaching our targeted end users in the most effective and efficient way. Part of the process is the use of Strategic Channel management, improving presence that increases the impact on closing business and increasing market share.

We all know that the product companies and customer centres have separate missions that are harmonised to maximise opportunities that exists. The Product Line Manager is responsible for the long term, strategic development of the product line, to secure customer demands, sales objectives and profitability. The customer centres are responsible for daily operational support to end users via sound territory management and technical and applications support at local levels. However GDE is a complex division with many products and serving a very broad customer base, having competency in all aspects of GDE is a tremendous expectation, especially as our bias in the business has been through our exploration experiences. The role of the regional manager within the geotechnical arena is to assist customer centres and help them to develop the skill sets needed in all requirements set by the division today. The regional manager has the mission to gather all aspects of market intelligence and report back to the product lines and division on the business opportunities in the region, they work in concert with the CCs and PLMs to ensure that the flow of information from the region they are responsible for meets the criteria set by the divisional management. From there the information is used to build forward the strategies of the regions, product lines and ultimately feed to the division.

Geotechnical business line has great opportunities to develop and only through a co-ordinated and co-operative team approach can this business harness the opportunities that are coming forth. I wish you all luck in the development of this important business line to GDE.

Steve Greer
High productivity drilling for jet grouting in Peru

Pre-holes for jet grouting
Percussive drilling with simultaneous casing tubes can be used in various types of applications. One of them, not yet well known, is drilling pre-holes for jet grouting. In tough ground conditions with rocks and boulders, bringing jet grouting tools into ground is a difficult task. Atlas Copco Peru brought the productivity of their customer to a new level by finding them the most suitable casing drilling solution for a dam construction site.

Hydropower generates electricity
Hydropower is the main source of energy in Peru. The latest hydroelectric power plant named El Platanal will start operating this year. It will be the second biggest hydroelectric plant in the country. El Platanal is located in the Cañete River basin 150 km (93 miles) south of the capital city of Lima. The purpose is to generate electricity utilizing renewable energy sources, to be supplied to the Peruvian National Inter-connected Electric Grid. The installed capacity of the plant is 220 MW and the expected average generation is 1 063 GWh per year. Project costs exceed 200 million US dollars. The owner of the plant is Compania Electrica El Platanal (Celepsa).

Jet grouting expertise
The Peruvian - Brazilian consortium Geo-tecnia Peruana S.R.Ltda. – Novatecna was responsible for implementing all works related to the foundation of the dam on the work site. Novatecna is the company who introduced jet grouting technique in South America and is the leader in this field in the continent. They offer expertise in designing and executing e.g. slope stabilizations, cut off walls, soil consolidation for tunnelling and settlement problems.

Challenging conditions
Jet grouting was used for curtain grouting of the dam. The design depth of the jet grouting holes was from 36 m (118 ft) to 50 m (164 ft). Drilling was conducted in very abrasive alluvial material, with stretches of sand, silt, and boulders of varying diameters, between 0.30-3.00 m (1-10 ft) in diameter. The thickness of the alluvial material was greater than 50 m. When working in alluvial riverbeds and valleys jet grouting can be very problematic since rotary drilling through and within hard boulders is impossible. Percussive drilling is the required drilling method. In such situation casing drilling is required to drill through strata with stones and boulders.

Basic working sequence with casing
Work starts by drilling casing down to the hole with a down-the-hole hammer and Odex or Symmetrix casing advancing system. The drill string is then pulled out from the hole and hole straightness is checked. Casing is filled with grout and lifted out of the hole. When all jet grouting rods are drilled into the required depth, jet grouting is executed

Odex got the work started
The contractor was already familiar with Odex drilling and started the work with the Odex system. Drilling was done telescopically in three phases: Odex 240 until depth 10 m (33 ft) / Odex 140 until depth 15 m (49 ft) / Odex 115 until depth 25 m (82 ft). Targeted depth was not reached due to some setbacks during drilling.

Symmetrix multiplied productivity
Drilling in such difficult ground conditions was time-consuming and Atlas Copco Peru started to look for better solution for this particular work site. After a lot of meetings and presentations the customer was convinced to try out the Symmetrix system without telescoping. Symmetrix retrievable system R178/10-141 for casing size 178 mm (7") was chosen (old system name...
“N141”). The system was tested on site giving excellent results and work continued with the concentric system.

In this job site Symmetrix beat Odex due to very hard ground conditions of the Andes foothills. Demanding conditions together with relatively deep cased hole depth made it favorable to use the concentric system. Working time using Odex drilling for one hole including grout injection was 3 days and final depth 25 m. With Symmetrix total working time was 8 hours per hole. Now the customer achieved targeted 36 m depth in one round without telescopic drilling.

Also cement consumption for jet grouting was reduced because injection was performed in a single run. The customer also benefited from decreased consumption of drill bits. Now they needed only one system size instead of three different sizes. As a concentric system Symmetrix drills straight holes and therefore deviation of the holes was coming close to zero.

**The right tools for the right job**

Percussive casing drilling in El Platanal was proved to be successful. The customer used a Mustang A66 drilling rig for installing casings. Atlas Copco delivered also down-the-hole hammer COP54 and compressor RVS455 to the customer. Moreover Atlas Copco Peru completed the package delivering casing tubes for the project. Total drilled meters with casing was 4 700 m (15 420 ft) of which 1/3 was done with Odex and the rest with Symmetrix. This time Symmetrix completed the job, but next time the turn might be back for Odex.

In Peru the second phase of the project also includes a new hydropower plant in the Morro de Arica region in the distant future. Atlas Copco Peru is looking forward to supplying productive solutions for the next project phase as well.

**QUICK FACTS**

<table>
<thead>
<tr>
<th>Application</th>
<th>Drilling of pre-holes for jet-grouting</th>
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<tbody>
<tr>
<td>Utility</td>
<td>El Platanal hydroelectric power plant</td>
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<tr>
<td>Location</td>
<td>Cañete Province, Peru</td>
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<tr>
<td>Project</td>
<td>Dam construction, curtain grouting</td>
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<tr>
<td>Customer</td>
<td>Geotecnia Peruana S.R.Ltda. -Novatecna</td>
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<tr>
<td>Challenge</td>
<td>Execute jet-grouting in very abrasive alluvial ground conditions</td>
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<tr>
<td>Products used</td>
<td>Mustang A66, Odex 115/140/240, Symmetrix R178/10-141, COP54 DTH hammer, RVS455 compressor</td>
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<tr>
<td>Solution</td>
<td>Drilling of pre-holes for jet-grouting with simultaneous casing advancement, through pre-drilled holes it is possible to bring jet-grouting tools into the hole for injection.</td>
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**For more information on this article**

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Explore your customer to build a strong relationship

We need a proposal for grouting equipment, could Atlas Copco help us? That was the question coming from the other side of the line, which pushed the trigger for a bunch of opportunities in GDE. After a few minutes exploring the customer, we found out that the customer representative was describing the biggest hydropower project in Colombia, in the northwestern part of South America – the Porce III Project.

Porce III is a hydropower development of Empresas Públicas de Medellín (EPM) in the Department of Antioquia on the western side of the Cordillera Central and 147 km (91 miles) to the northeast of the city of Medellin.

The power plant will be equipped with four generating units with an installed capacity of 844 MW. Construction of the main works started in 2006 and the river was diverted in 2007. Commissioning is scheduled for end 2010.

This conversation was two years ago. Since then, we have started a close interaction with the customer, building up a strong relationship. Today all grouting is done using Atlas Copco pumps, drilling with Diamec 262 prepared for DTH. An old Mustang is responsible for the tie-back anchoring and micropiling. There are also ongoing negotiations for a nice amount of MAI SDA self-drilling anchors.

Asking the right questions

Delivering the right value and understanding clearly the needs of the customer were the keys to achieve the success in this project. How did we achieve this? First of all, by asking the right questions. And, how did we do that?

If the customers ask for specific equipment, ask them about the application and the surrounding activities. Surely you will find a plenty of Geotechnical Engineering opportunities. Second, try to hook what really matters for the customer, where he or she perceives value.

Back to our project in Colombia. We indentified a need for installing tie-back anchors and micropiles (Mustang), anchors for slope stabilization (MAI SDA), GIN monitor for grouting (Logac System), Resin cartridges (Minova), and rock sampling (Diamec), and of course: the reason of the customer calling, the Unigrout Plant for grouting.

On the top of all, include a good service, and it is done! The most valuable thing for the customer was “peace of mind” in all senses. The aftermarketing provided it.

Packing a complete offer

Packing the complete offer, our chances are substantially increased, and the probability to get a deal was also multiplied. Obviously it is hard to get the whole package, but we have to agree: we are in a better position than our competitors, since they do not have a similar offer.

Certainly there is a long way to run, but we need to start somewhere. Put Geotechnical Engineering in your agenda! Together we need to develop technical skill, adding competences, and finally surprising the customers offering much more than a piece of equipment.

Special thanks to Vivian Arango, who today is responsible for this valuable customer.

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Pre-excitation grouting in the Frodeåsen tunnel

Unigrout MAX 244C for Norwegian contractor LNS

Norwegian contractor LNS (Leonhard Nilsen & Sønner AS) was awarded the construction of the 1.75 km (1.1 mile) long Frodeåsen twin tube rail tunnel. The project, owned by Jernbanverket - the Norwegian railway administration, is included in a three phase plan that will link Barkåker to Tønsberg. The 368 million NOK first stage (Jarlsbergen entreprisen) includes the twin tube tunnel of Frodeåsen, part of the link between Barkåker and Naeringsområde, and is to be executed between March of 2009 and May of 2011.

With an extensive program of pre-excitation grouting, that will guarantee a good water sealing of the structure, LNS selected the premium model of the Unigrout family, the MAX 244C. This model features two independent mixing units each equipped with a 1.3 ton cement silo, Cemix 203 HWB colloidal mixer mounted on load cells and the fully automated weight batching Dosac system.

This particular unit was also the first one to mount the just released Cemag 403H, which inaugurates a new design of grout agitator with a conical bottom and a vertical blade shaft. The third generation of the Cemag has been a long request by the users of this type of containerized large grouting plants – to permit a easier cleaning of the agitator barrel – and by the design engineers, as the new lay-out allows more flexibility in the design, without the constraints of the previous version.

The four agitators are independently connected to each grouting pump (the Pumpac 80/110 HD). A Logac G5 records the parameters of the four grouting delivery lines and controls the Addit system, a new feature that allows the injection of the additive at the mouth of hole, through a device specially installed in the top packer. This is a standard in the grouting works in Norwegian tunnels.

The full unit is enclosed in a specially made container that is mounted on a frame to be placed over a truck chassis. The setting also includes the hydraulic crane that sustains the alloy basket which in turn allows one of the operators to reach the holes and set the top packers.

A very good delivery time was the main sales argument to get this deal with LNS. Osvald Inderberg, the GDE’s Business Line Manager at Atlas Copco Norway, and his team are the champions on sales of this type of equipment. AC Norway, throughout the years, has sold more containerized units for tunnelling works than the rest of the world, a performance that really shows the knowledge, customer relationship and field presence Osvald and his crew master so well.

A happy Ulf Persson (Atlas Copco Grouting Senior Design Engineer) delivers the Unigrout Max 244C to LNS representative in Märsta, Sweden

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The Max 244C ordered by LNS is the very first one to include the just newly released third generation of the Cemag agitators, allowing for better cleaning and more freedom of design.
Simultaneous drilling and grouting

A quite common method of installing the MAI self-drilling system

MAI SDA self-drilling anchors are installed with air driven or hydraulic rotary percussion drilling equipment and a borehole flush medium suitable for the specific ground conditions.

There are three types of borehole flush:
- water flush for long boreholes in dense sand, gravel formation or rock conditions, for a better transportation of large cuttings and cooling of the drill bit,
- air flush for short boreholes in soft soil such as chalk and clay, where water spillage is to be avoided,
- and simultaneous drilling and grouting (SDG) for all length of boreholes in all unconsolidated soil conditions.

Using SDG, the grout stabilizes the borehole during installation, providing a better grout cover along the nail shaft. The grout has good penetration into the surrounding soil, so higher external friction values are reached, and the installation is completed in a single drilling operation, saving time.

By utilising a sacrificial drill bit the MAI SDA rod is drilled continuously forward without extraction, until the design depth is reached. To reach a required nail length of 12-15m, the 3 to 4 m standard rod lengths are easily coupled together.

When using the first two flushing media for the drilling operation, the soil/steel interface has to be created by grouting through the hollow stem of the anchor rockbolt. The grout exits through the flush holes of the drill bit and backfills the annulus around the nail that has been cut by the larger diameter of the drill bit.

For the third operation, the flushing medium is already a grout mix, which has the ability to harden after the installation process in completed.

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Product knowledge rules!

CMT USA performs tests and demos

With a new structure on the geotechnical area and new grouting products to discover and handle, the dynamic team of CMT USA doesn’t stop. Tests and demos have been performed at some of the references of the industry, like Hayward Baker and Schnabel. Competitors have not been spared and direct performance comparisons have been done, in order to get the maximum input from the field, operators and customers.

Grouting specialist Ken McClanachan is the maestro of these actions and he puts more miles in his truck than an intercontinental A380. On a market still crossing a severe crisis, the orchestra is playing better and better so when the room will be crowded the applause will be quite audible. That is for sure.

To replicate these best practices in your country

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EU rules dictates minor changes on electric power units - PUG 22E taller

New regulations from the European Union for electric motors dictated changes in some of the power packs used in grouting platforms. Such is the case of the PUG 22E, used on the Unigrout E22H, where the height increase of 80 mm is the only visible aspect that differentiates it from the previous version. The main reason is the bulkier 22 kW electric motor supplied by ABB.

In case of change of the electric motor on the older versions of the PUG 22E, besides the motor it will be necessary to change three brackets (two on the front and one on the rear) as well the cover of the hydraulic tank.

The new PUG 22E is available in two versions: one without electrical cabinet (part number 3716 5968 76) and one with electric cabinet (3716 5968 75) for 400 V / 50 Hz current.