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Creating sustainable resources



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# Slogging through a slump

The current mining-industry downturn continues to have a stranglehold on mining equipment and drilling companies, in Australia and beyond. This was, once again, evidenced at the end of March when one of the world's largest drilling-service companies, Canadian Major Drilling Group International, announced the closure of its Australian branch, saying that the country had been hit particularly hard by the mining slump.

Earlier in the month, in advance of the final decision, the company's president and CEO, Francis McGuire, commented: "In Australia we continue to see no improvement since the beginning of the year. The utilisation rates for surface rigs are extremely low. Price competition has been especially intense in eastern Australia, where our operations are concentrated."

Mining-services company Ausdrill has, in turn, reported that all its key divisions recorded a decrease in revenue in the first half of the financial year.

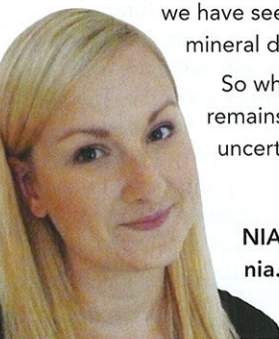
Ausdrill's managing director, Ron Sayers, puts this down to the "toughest business conditions for some years", resulting from "the sharp curtailment of spending by the mining companies and deferral of new projects". The company does not expect the trading conditions to improve in the second half of the financial year.

Ausdrill did, however, note that the resource industry is expected to improve over the medium term in Australia and Africa and, as a consequence, the company remains well placed for a recovery beyond the current financial year.

Last year was also particularly challenging for global players such as Boart Longyear, which experienced a reduction in demand for its drilling services and products. Its services-division revenues witnessed a reduction of 39% from 2012 to US\$917 million in 2013, while its product-division revenue was down 38% at US\$306 million. The company also declined to provide a market outlook for 2014 given market uncertainty.

At the beginning of this year, Boart Longyear's senior vice-president of products, Kent Hoots, did tell *GeoDrilling International* that while there are no regions indicating growth in mineral exploration, "the bottom of the market seems to be near, as we have seen Australia and Latin America begin to level off in terms of mineral drill-rig utilisation".

So whether we'll start to witness some encouraging signs in 2014 remains to be seen, but the main message seems to be that uncertain times will continue – at least for the year ahead.



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**"The main message seems to be that uncertain times will continue – at least for the year ahead"**



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**COVER**  
 The new multipurpose microdrill rig Soilmec SM-17 in action in Duisburg. The SM-17 has drilled the anchor holes with the double rotary method for the foundation works of a new bridge in the Ruhrorter Port. To achieve excellent results, the new special kinematic mechanism and great rig stability were paramount.  
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## Circling the capital

Over the past two years, Copenhagen residents have witnessed a large fleet of Soilmec drill rigs and cranes wedged in between residences and historic buildings throughout the heart of the city. The equipment is playing a critical role in the construction of a new metro line

*Trevi workers construct diaphragm walls at the Gammel Strand station, using a Soilmec SC-120 crane with a Cougar hydromill*

The new Cityringen metro expansion will consist of a twin-tunnelled 15.5km railway circling the centre of Denmark's capital, with 17 stations and four service shafts at 30m below ground. It will include interchanges with the existing underground network to link areas not already served by the city's S-trains or metro system.

### GREAT CITY, HARD BUILD

As the primary foundation subcontractor, approximately 250 Trevi personnel are working on 21 separate construction sites

managed by the joint venture Cityringen Metro Team. Trevi is responsible for the construction of the permanent supporting walls for all stations and service shafts. Trevi and Soilmec are sister companies within the Trevi Group.

The structural walls for the underground stations comprise a combination of hydromill diaphragm panel walls and cased secant piling (CSP) walls. CSP is being used for all walls that are shallower than 28m.

After the structural walls are complete, a twin TBM-bored



tunnel will break through the stations' end walls to connect the stations.



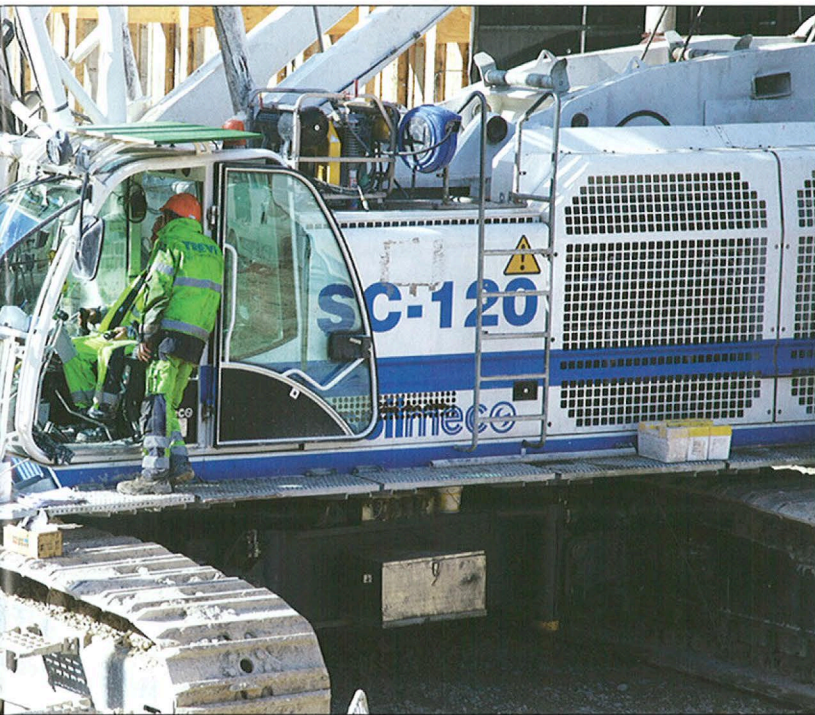
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AGS Association of Geotechnical & Geoenvironmental Specialists



Trece is managing many construction challenges at the Cityringen job sites, not the least

of which is variable soil conditions with boulder inclusions within the overburden soils and

intermittent bands of extremely hard flint rock within the underlying limestone bedrock.

In addition to the subsurface conditions, Copenhagen's city ordinances place extensive requirements onto the job sites, including a formidable list of restrictions related to noise, emissions, vibrations, work hours and the environment.

For instance, the groundwater level has to be maintained within 50mm of the pre-construction conditions to prevent existing buildings from settling, so water must be pumped back in at job sites using dewatering during excavation.

Copenhagen's dense downtown area offers only limited construction and staging areas, and construction is proceeding very close to existing buildings and structures. Walls for the Marmorkirken station, for example, are only 100mm away from the foundations of the ▶

**“Copenhagen’s city ordinances place extensive requirements onto the job sites, including a formidable list of restrictions”**

# BOODE

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*Soilmec SR-100 rigs using modified CSP tools to break through hard flint layers at the Oslo Plads station site*

“Copenhagen is an ideal location to test out Soilmec’s new technology, designed to meet the challenge of limited space and strict environmental rules”

► 260-year-old Marble Church, the largest domed church in Scandinavia.

#### **OPPORTUNITY FOR INNOVATION**

The European Parliament adopted more-stringent Stage III/IV emission standards for all non-road engines in 2004. Stage IV standards came into force in January 2014.

On January 1, 2014, North America’s similar ‘Tier 4 interim’ emission standards came into effect for all diesel engines used in (non-road) construction equipment in the US and Canada. Copenhagen’s city ordinances pertaining to air emissions are even more stringent.

Soilmec has been planning for the Stage IV/Tier 4 milestone for more than two years and used

the opportunity to completely revamp its product line. New Soilmec Stage IV/Tier 4 prototype models were field-tested on the Cityringen project before production release. Soilmec engineers have worked hand-in-hand with Trevi site staff to troubleshoot and optimise the new line of drill rigs.

The result is that the latest Soilmec equipment exceeds the Stage IV/Tier 4 requirements.

#### **HYDROMILL WALL**

The general hydromill diaphragm-wall construction sequence is to install primary panels to a typical depth of 40m for the station walls, then secondary panels to the same depth between and overlapping into the adjacent two primary panels.

During excavation of each panel, a bentonite slurry is used to stabilise the trenches. After the total depth has been reached, reinforcing steel cages are lowered into the trenches. The excavation is backfilled by tremie with concrete, displacing the bentonite slurry.

Trevi is using its proprietary ‘Milano Joint’ for the overlap between panels. The Milano Joint consists of breakable PVC pipes affixed to the rebar cages on both ends of the primary panels. As the secondary panel is excavated, the PVC pipes are destroyed and the joint surfaces are scratched and cleaned with a special bit.

The diaphragm walls are being constructed primarily using Soilmec SC-120 cranes with a Cougar hydromill.

#### **DEALING WITH DRILLING**

Cased secant pile walls are constructed with primary cased auger piles (CAPs) and secondary CAPs properly overlapped. Soilmec SR-100 drill rigs in the cased auger pile mode are being used to construct the CSP walls

that will serve as the walls for entrance stairways that lead down into the deeper stations.

To construct a single CAP, a continuous flight auger and an outer steel casing are advanced together into the soil. The auger and casing are driven by two rotary heads on the same drill shaft but rotating in opposite directions.

After reaching the desired depth, the auger and casing are extracted as concrete is pumped into the drilled pile through the hollow stem of the auger.

A full-length rebar cage is set in the fresh concrete. Each CAP becomes a reinforced concrete column, capable of resisting both vertical and lateral loads.

Intensive pre-drilling is required to break through the deep, hard layers of limestone rock and flint to prevent excavation problems for cased secant piling.

The use of these pre-drilling techniques has doubled the speed of production. This is typically done using a Wassara high-pressure water hammer. However, sonic drilling is used in locations where water flushing is not allowed due to existing chemical contamination of the soil.

In Copenhagen, the cased secant piling tools (casings, coring bits and augers) were significantly modified for excavation to get through the hard flint layer. Because flint is highly abrasive, Soilmec is now using a thicker, higher quality steel and adjusting the tool position to create a more aggressive auger with reduced breakage. Trevi is also using the maximum rotary torque capability of the SR-100 machine.

Copenhagen is an ideal location to test out Soilmec’s new technology, which is designed to meet the challenge of limited construction space and strict environmental rules. ▼

*This article was written by Paolo Cavalcoli, a Trevi geotechnical engineer and manager of the Cityringen project, and Vincent Jue, a vice-president with Soilmec North America. Reach Vincent at: vjue@champion-equipment.com.*