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# international construction

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# Towering achievement

## Foundations for tallest building in Scandinavia

In Gothenburg, Sweden, the Karlastaden development includes no fewer than nine high-rise buildings. One of these is the 245m-tall Karlatornet tower, the tallest building in Scandinavia.

Having completed its tasks on the Karlatornet project, specialist construction solutions firm Groundforce is now working on the adjacent building, Capella.

The basement of this building measures 72m long by 60m wide, with a cut-out in one corner. The excavation is only between 2m and 3m deep, but comprises soft clay soil, meaning the sheet-piled retaining walls require support ahead of the basement slab being cast.

Due to the irregular heights of the basement sides, Groundforce braced the retaining walls across the corners with 150 tonne capacity MP150 hydraulic props as 'knee' braces.

These raking props transfer the lateral loads from the waling beam to concrete thrust-blocks cast into the floor of the excavation.

Groundforce's European sales manager Sam Oldroyd says, "All the loadings were supplied by the client's consulting engineer and it was then a simple matter of sizing the equipment.

"The modular design means our props can be incredibly flexible. You can quickly modify the length by adding or removing components.

"In total, the Phase 2 excavation required only four MP150 knee braces and four MP150 raking props. If we can reduce the number of props required, that will drastically cut down on transport and cost."

In construction, nothing goes up before first going down. **Mike Hayes** looks at some foundations challenges and their imaginative solutions

**The complexity and requirement for cutting edge construction technology in Trevi's work on the Grand Paris Express project is staggering**

# Deep

In France, one of the largest and most ambitious infrastructure projects in Europe is ongoing – the Grand Paris Express.

When completed, the new metro network will reduce road traffic in the French capital, improve air quality and, hopefully, make the lives of Parisians a little easier.

The project encompasses the extension of line 14 of the etro and the construction of new lines 15, 16, 17 and 18. Along with approximately 200km of new lines, some 60 new stations are being constructed. In total, the planned investment for the network is more than €35 billion (US$40.5 billion).

**Trevi utilising the foundation drilling equipment of its subsidiary company Soilmec during construction work on the Grand Paris Express**

## Capital solutions

Undertakings of this magnitude can only be built on the most robust foundations, which is where the Trevi Group comes into the equation.

The company is undertaking foundation work as part of the construction of the underground stations of Paris' Le Bourget Airport, Aulnay and Saint-Denis Pleyel, set to be the largest of all the Grand Paris Express stations and crossed by tunnels of lines 14, 15 and 16.

Marcello Varese, project director at the Saint-Denis Pleyel station says it is "the main station of the whole Grand

# innovations

Paris project, as it connects four metro lines with two railway lines and is located near the Stade de France [the national sports stadium of France]."

What makes the station unique is its 9000m² surface area, as well as the fact that Trevi is undertaking excavation here using the 'top down' method. In fact, in order to allow the 'top down' excavation, it was necessary for the company to add 36 plunge columns, which permit simultaneous superstructure construction and basement excavation.

So, not only did Trevi construct 141 structural diaphragm wall panels, it also fabricated 36 plunge columns, each weighing 90 tonnes and which had to be laid to a depth of 36m. According to Trevi, this is a first.

Trevi is undertaking groundwork across the Grand Paris Express project, with one of the first items on the agenda being land treatment; consolidating the treated soil and significantly lowering the level of groundwater to ensure tunnels can be excavated safely.

Trevi is also involved in the excavation of a number of service shafts by tunnel boring machines (TBM), which will allow access for rescue and evacuation of passengers, ventilation and power supply.

These shafts run to significant depths and require the construction of reinforced retaining walls through diaphragm walls that can sometimes reach more than 60m in depth.

For these applications, Trevi is using drilling equipment including advanced heavy-duty buckets and hydromills.

## Square drills in round holes

Just as the Grand Paris project attempts to future-proof the capital city, in terms of transportation, Bauer Maschinen is looking to the future of megacities with its latest technology.

In cooperation with construction firm Denys, Bauer has developed the 'Cube system' of underground cutting equipment, which allows for the construction of, for example, subway stations, in busy urban areas, with greatly reduced noise, dust and traffic upheaval.

The Cube milling system is based on Bauer's existing cutting technology, but with the cutters fitted into a container-sized frame, which can be individually lowered into a shaft.

The system can then progress along microtunnels with diameters as small as 3.8m, milling diaphragm walls.

Dr Rüdiger Kaub, managing director of Bauer Maschinen, says, "Imagine you're planning a new subway line in a densely populated metropolis.

"With our Bauer Cube System…this is now possible. It can be used exactly where the new subway station is to be built: underground – under the existing buildings.

"This opens up completely new possibilities for planners and architects."

The Cube system is still being tested by Bauer and Denys, but is expected to be fully developed and launched before the end of this year.

## The river and the rig

Where laying foundations is challenging on land, on the water things can get complicated in the extreme.

Such is the case with the foundations for Norway's longest railway bridge over >

## Drilling in the digital age

### Technology making drilling more accurate than ever

On the site of a hospital to be built in Oberwart, Austria, deep foundations specialist Züblin Spezialtiefbau introduced connected Liebherr equipment to prepare the land for construction work.

In an area of 23000m², Züblin was tasked with installing 1,310 piles in preparation for the hospital building. The piles are being installed using the continuous flight auger (CFA) method, with an anticipated construction period of approximately four months.

Züblin brought in a Liebherr LB 28 drilling rig for the job, equipped with the LIPOS positioning system, as well as a Liebherr THS 110 concrete pump in support.

First, the total construction area was measured, with the location of each of the piles accuracy identified. This data was used to create a drilling plan, which was fed into the on board LIPOS system.

The operator was able to see the position of the rig at all times, with centimetre accuracy, moving easily between drilling points – no stakes or colour markings are required.

Using the LIPOS technology, the operator was able to handle the rig more quickly and flexibly, without having to worry about watching for ground markings or the concrete hose. The optimal drilling plan is also programmed into the LIPOS system.

Liebherr says that, without the system, the drilling points would have to be newly measured, drawn and marked at least three times a day. Züblin was able to complete the contract in just three months; one month earlier than planned.

Site manager, Harald Fugger, says, "The LIPOS positioning system is ideally suited for completing jobsites, especially using the CFA method. It has proven itself well on the jobsite."