

OnSite

UNDERGROUND

March 2021

Drilling

The Galataport
Istanbul Project

Tunnelling

Malaysian Tunnellers Beat
the Odds Again

Technologies

The "Sixth Sense"
of Epiroc

Brenner Base Tunnel

The longest underground rail link in the world

WWW.ONSITENEWS.IT

Soilmec

Hydromills designed for profitability

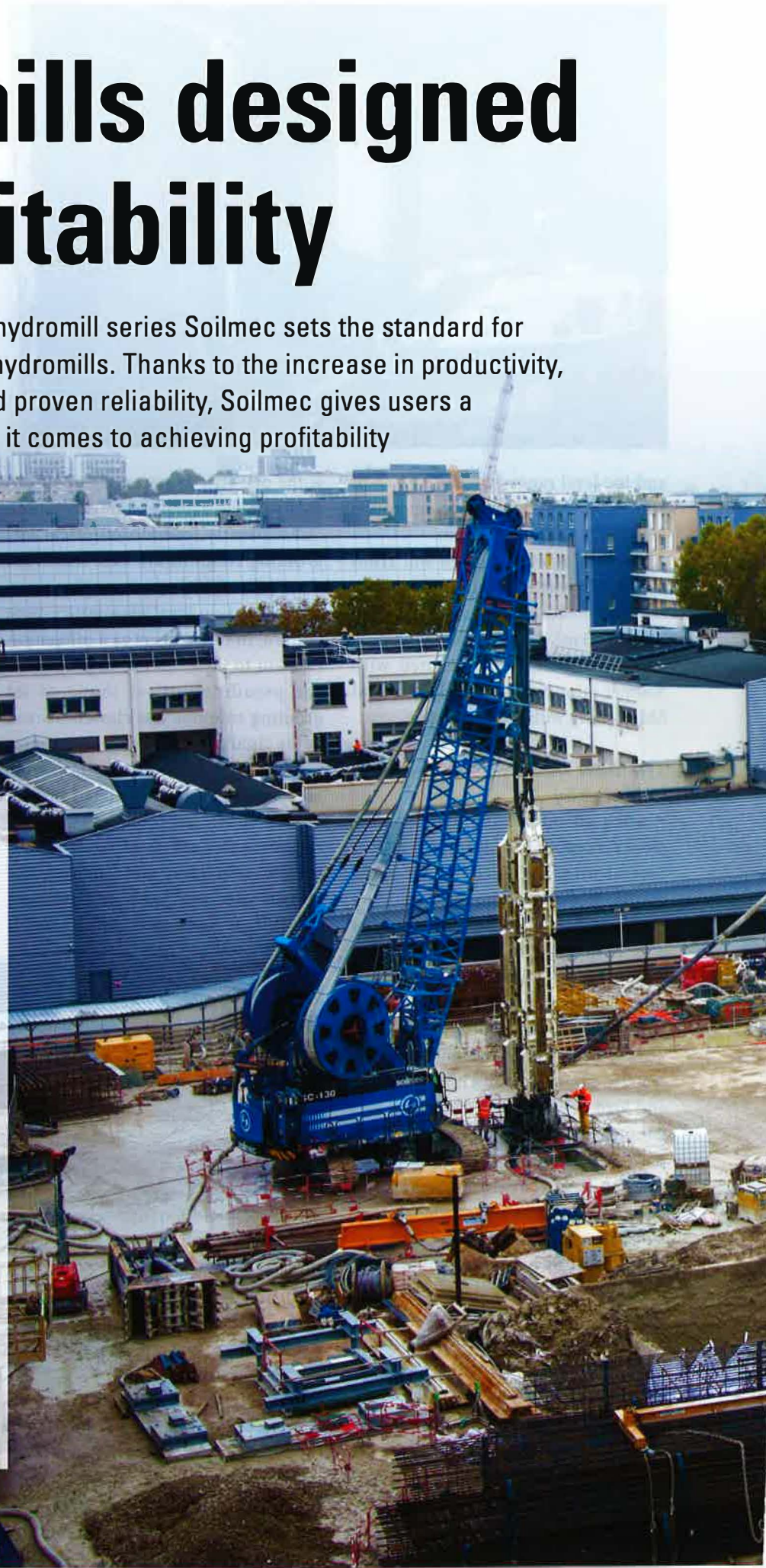
With the SC-130 and SC-135 hydromill series Soilmec sets the standard for excellence in the domain of hydromills. Thanks to the increase in productivity, lower maintenance costs and proven reliability, Soilmec gives users a competitive advantage when it comes to achieving profitability

by Ettore Zanatta

For well over a decade, Soilmec has made important contributions to the technological development of the hydromill by devising solutions that have ultimately led to production of the SC-130 and SC-135 hydromill series. The integrated design of the crane-milling module, combined with the experience of users, has enabled a degree of productivity, reliability and precision that has literally defined a new parameter for the sector, as proven by the success of these machines at work around the world.

Job site in mind

Soilmec greatly values the experience of contractors working in different geotechnical conditions and geographical areas, drawing from field observations to define solutions – structural, hydraulic, mechanical and electronic – that fully satisfy the demands of contractors. By balancing





and toe level ranged between -10.5 m and -12.0 m msl. Therefore, micropile maximum length was 13.5m.

All activities were carried out from inside the existing buildings, with a reduced headroom (maximum free height of 3 m). All jet grouting columns and micropiles were executed with Soilmec mini-drilling rigs (SM-103 and SM-5), both with electric engine.

The new buildings in Karaköy

Among all interesting geotechnical works executed in Karaköy site, a special mention needs to be made to the Multi-Purpose Bottom Plug (MPBP). This innovative geotechnical was employed for the excavation within the footprint of the demolished buildings, to allow their reconstruction with 2 or 3 basement floors.

The MPBP solution is a combination of seepage control, ground improvement, and load bearing elements, which was adopted to allow the deep excavation within the footprint of demolished buildings. Excavation depth was approximately 12.5 m below the working platform (11.0 m below sea level). The main body of the bottom plug is composed of overlapping jet grouting circular columns, executed with the double-fluid method and designed to have a 2,000 mm diameter. Columns are executed on a triangular pattern with an average centre to centre spacing of 1,500 mm. The bottom plug's thickness

is the one strictly necessary to ensure the hydraulic stability of the excavation. Subsequently, pseudo-elliptical jet-grouting columns are executed from the top level of the bottom plug up to the excavation level on a lattice-type pattern, in order to act as a mitigation element to liquefaction. In particular, the pseudo-elliptical shape of jet grouting columns was chosen instead of the circular one in order to optimize the lattice geometry, by minimizing the amount of jetting and related time of execution. The lattice-type jet grouting treatment also acts as a foundation for the future building and will carry the vertical structural loads in permanent conditions. Average width in plan of

elliptical jet grouting column is 4.0 m. Finally, the stability of building against uplift is ensured by permanent Double Corrosion Protected (DCP) steel bars, which are installed as drilled and grouted micropiles through the previously-executed elliptical jet grouting columns. DCP steel bars have a diameter of 63.5 mm and are installed within a 250 mm diameter drill-hole. The technologies involved and the electronic control devices employed for the execution of MPBP are of latest-generation.

In particular, for the execution of the double fluid jet grouting bottom plug, the drilling rigs were equipped with the "Jet-Vision System" and with the "Drilling Position System" (DPS) electronic devices. The former controls, monitors and records the automatic rising of the drilling tool/rods during the jetting phase; the latter monitors and records the 3D position of the drilling tool during the drilling phase, which is of basic importance to ensure the overlapping between the jet grouting columns and the consequent successful execution of the bottom plug.


For the execution of pseudo-elliptical jet grouting columns, the Jet-Vision system was provided with the "orbital jet" option, which allows to modify the rotation speed during the jetting phase in a planned way. The rotation speed varies from Vr1 to Vr2 to create variable radius sectors. ■



ITALIAN ABSTRACT

IL PROGETTO GALATAPORT

Dopo un lungo periodo d'inattività in Turchia, Trevi ha preso parte a uno dei progetti più prestigiosi dell'ultimo decennio in Turchia, il Progetto Galataport, situato nell'antico quartiere di Galata, ora Beyoğlu, nel cuore del centro storico della città. Galataport Istanbul ha un valore di investimento totale di \$ 1,7 miliardi, inclusa la gara d'appalto, copre una lunghezza di 1,2 km di costa sul Bosforo e un'area di 100.000 m². Il progetto è diviso in due pacchetti: Salıpazarı e Karaköy, che sono stati inizialmente emessi come due diversi bandi e sono stati poi aggiudicati entrambi a Trevi, che ha qui agito sia come appaltatore principale che come progettista di proposte per tutte le opere di ingegneria geotecnica. Le difficili condizioni idrauliche e geotecniche, la pericolosità sismica del sito, la presenza di edifici storici da rinforzare, la contestuale ricostruzione della banchina da parte di altri appaltatori e il funzionamento continuativo del porto durante lo svolgimento delle attività di costruzione, hanno richiesto l'impiego di tecnologie all'avanguardia nel campo dell'ingegneria delle fondazioni.



the design process with the demands of the job site, this method has led to improvements in productivity and overall reliability of hydromill systems, accompanied by the life extension of components, while allowing the user to directly oversee maintenance procedures. The upshot for the user is a drastic reduction in costs.

Because the application cycle of hydromill systems is so demanding, Soilmec performed an in-depth study of the stresses placed on all milling module components. Thanks also to experience gained in dynamic compaction for its successful Heavy Duty crane lines, Soilmec offers milling modules featuring exceptional structural strength that can withstand the strains induced by prolonged stresses. Unlike other manufacturers who focus on technical solutions that obligate the user when it comes to maintenance cycles, Soilmec offers hydromills that increase profitability and reduce the

time to recover the cost of investment, thereby giving the contractor the best added value.

High production, maximum profitability

Through its extensive onsite experience, Soilmec is well familiar with these challenges. When studying systems for excavating diaphragm walls, it thought about how to offer the best productivity in highly difficult operating scenarios, e.g., excavation of rock masses with high values of RQD (low or non-existent fracture) and an unconfined compression strength (200 MPa and over).

To assure performance Soilmec design engineers first studied oil flows and the routing of hoses in order to reduce any pressure drops that could affect the system's efficiency, resulting in an increase in available power. Along with a careful study of the cutting systems, Soilmec is able to provide the best excavation capacity available

on the market today with torques that, depending on the type of milling module (SH-30, SH-40, SH-50), range from 91 to 153 kNm for each wheel.

The exceptional hydraulic power available, in addition to the robustness of the hydraulic motors and gearboxes, meant that there was no need to install shock absorbers protecting them, an ordinary solution provided by other manufacturers. This allows excavation capacity to be unleashed all to the advantage of hourly production.

In fact, Soilmech hydromill systems have no hydraulic power limiting device so that the operator is given the go-ahead to “push” performance when necessary to boost excavation capacity. Compared to those of other manufacturers, Soilmech hydromills in actual working conditions have demonstrated a 25% higher productivity (an hourly and/or daily average) without any reliability issues or significant early wear. Thanks to the proven efficacy of the DMS system, now in a 4.0 version, the operator has the guarantee of verticality values

with margins of error in the order of 0.2%, even at depths exceeding 150 m. Furthermore, the DMS manager, among other functions, provides predictive maintenance and a project advancement report, both very important to establish better timing and planning of the job site.

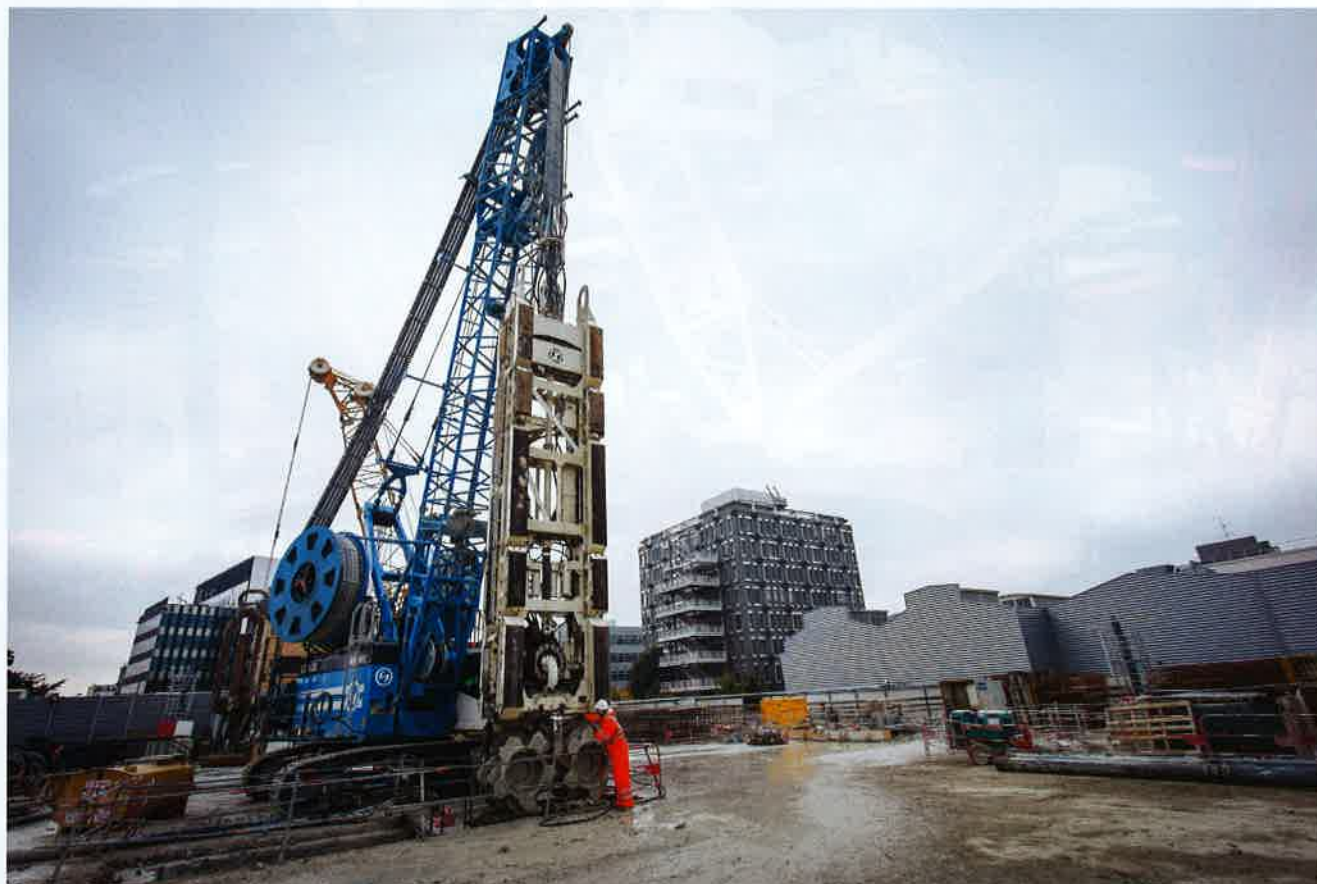
More production, less downtime


The Soilmech hydromill module’s hydraulic motors do not require periodic maintenance for up to 1500 hours, and experience on site has determined that they can achieve 2000 hours. Even on complex, “non-standard” job sites where the ground contains rock masses with high strength values (100 MPa and over), the motors have demonstrated no need for overhaul prior to 1000 working hours. Added to this exceptional reliability is the fact that the hydraulic motors of the module are designed so that periodic maintenance can be performed by qualified and Soilmech-trained personnel directly on site without having to be sent back to the factory, a technical and

commercial decision that differs from the policies of other manufacturers who make that a requirement.

Moreover, disassembly and reassembly of excavation wheels are greatly simplified thanks to a hexagonal conical housing with only six bolts, so the task can be completed in two hours instead of a much longer interval, as is the case with other manufacturers. This also has an effect on the method and timing for performing excavation, because in the case of mixed terrain (e.g., clay/rock) the cutting drums can be changed based on need without impacting job site schedules. All Soilmech hydromills are designed to prevent contamination on the main hydraulics so to ensure production and profitability also in the event of breakdown or failure.

The SC-135 has a double hydraulic system fitted with independent tanks; a solution no other manufacturer offers, unless by including an external auxiliary unit. Should pumps become contaminated or the milling module blocked when inside the excavation,



 The integrated design of the crane-milling module has enabled a degree of productivity, reliability and precision. Here the SC-130 hydromill series Soilmech in action in Paris

the double circuit enables the crane to extract it, thereby reducing the time it is immobilized, or in a worst case scenario the possibility it must be abandoned. The user can thus resume work within a time period that, depending on the extent of the problem, is 50-70% less on average than what has been historically experienced before on the market, which translates into greatly reduced costs of repair and restoration. The crane's main components have also been studied to afford easy access; the combustion engine, pumps, electrical panel and all other parts have all been positioned keeping in mind the technician who is to repair or replace them.

A “comfortable work environment”

Unlike with a drilling rig, the operator of a hydromill can work long shifts, sometimes stretching over ten hours. This is because the phases of excavating and casting the elements to make a panel are influenced by several factors, not always predicted with any certainty

(extremely hard rock masses, difficulties in handling the cages, delays in casting, etc.). This explains why seat comfort, climate control, ergonomics of the controls and optimum visibility of the instrumentation of the area nearest the

machine are key features intended to put the operator in the best working conditions.

Knowledge first
Having trained personnel is a critical

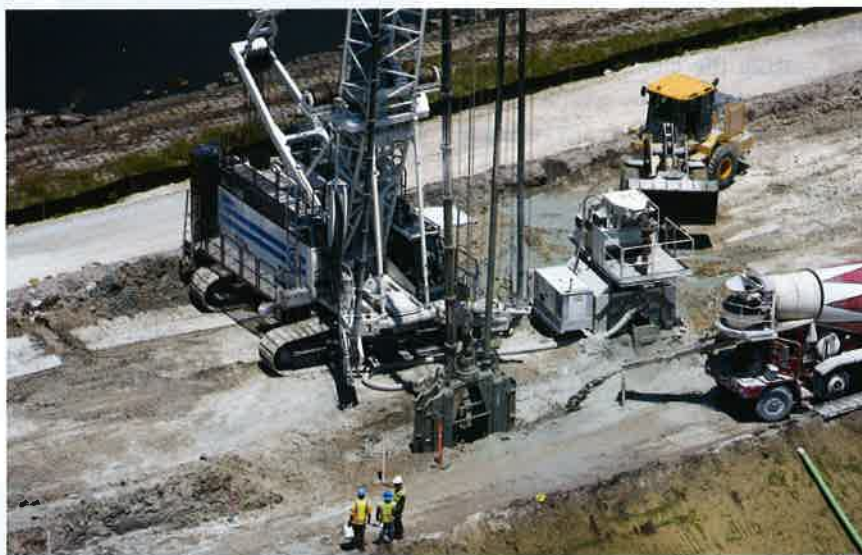


 The SC-135 (here in Frankfurt) has a double hydraulic system fitted with independent tanks. A solution no other manufacturer offers, unless by including an external auxiliary unit



> Soilmec offers hydromills that increase profitability and reduce the time to recover the cost of investment, thereby giving the contractor the best added value

aspect for such a complex machine as the hydromill, which demands in-depth knowledge of systems and processes; this also holds true for operators who have already worked in the foundations sector and in other ground engineering activities. To properly train personal, Soilmec has a task force made up of specialized operators and mechanics, coordinated by a supervisor with long experience in job site setup and management. With the purchase of a



ITALIAN ABSTRACT

PROGETTATE PER LA PRODUTTIVITÀ

Con le perforatrici SC-130 e SC-135 della serie hydromill, Soilmec definisce uno standard di eccellenza nel settore. Grazie all'aumento garantito della produttività, ai minori costi di manutenzione e alla comprovata affidabilità delle sue macchine per la perforazione, il costruttore offre agli utilizzatori finali un vantaggio evidente quando si tratta di raggiungere alti standard di produttività. Per oltre un decennio Soilmec ha fornito importanti contributi allo sviluppo tecnologico in quest'ambito, ideando soluzioni che hanno portato alla produzione dei modelli SC-130 e SC-135. La progettazione innovativa del modulo, unitamente all'esperienza assicurata dagli operatori in campo, consente di raggiungere un alto grado di produttività, affidabilità e precisione, come testimoniato dal successo di questa tipologia di macchine attive in cantieri di tutto il mondo.

new hydromill, Soilmec always includes and makes available a team of technicians who also link the production cycles with those of the mud treatment unit.

The team includes an operator, specialized mechanic and job site technician who, together with the contractor's personnel, will guarantee the start-up of the hydromill and the mud treatment unit, as well as organize all operational, technical and production aspects of the machine. If the contractor requires a longer period of assistance at the job site, Soilmec offers the experience of its own technicians on a consulting basis with contract for more extended periods.