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Perforare

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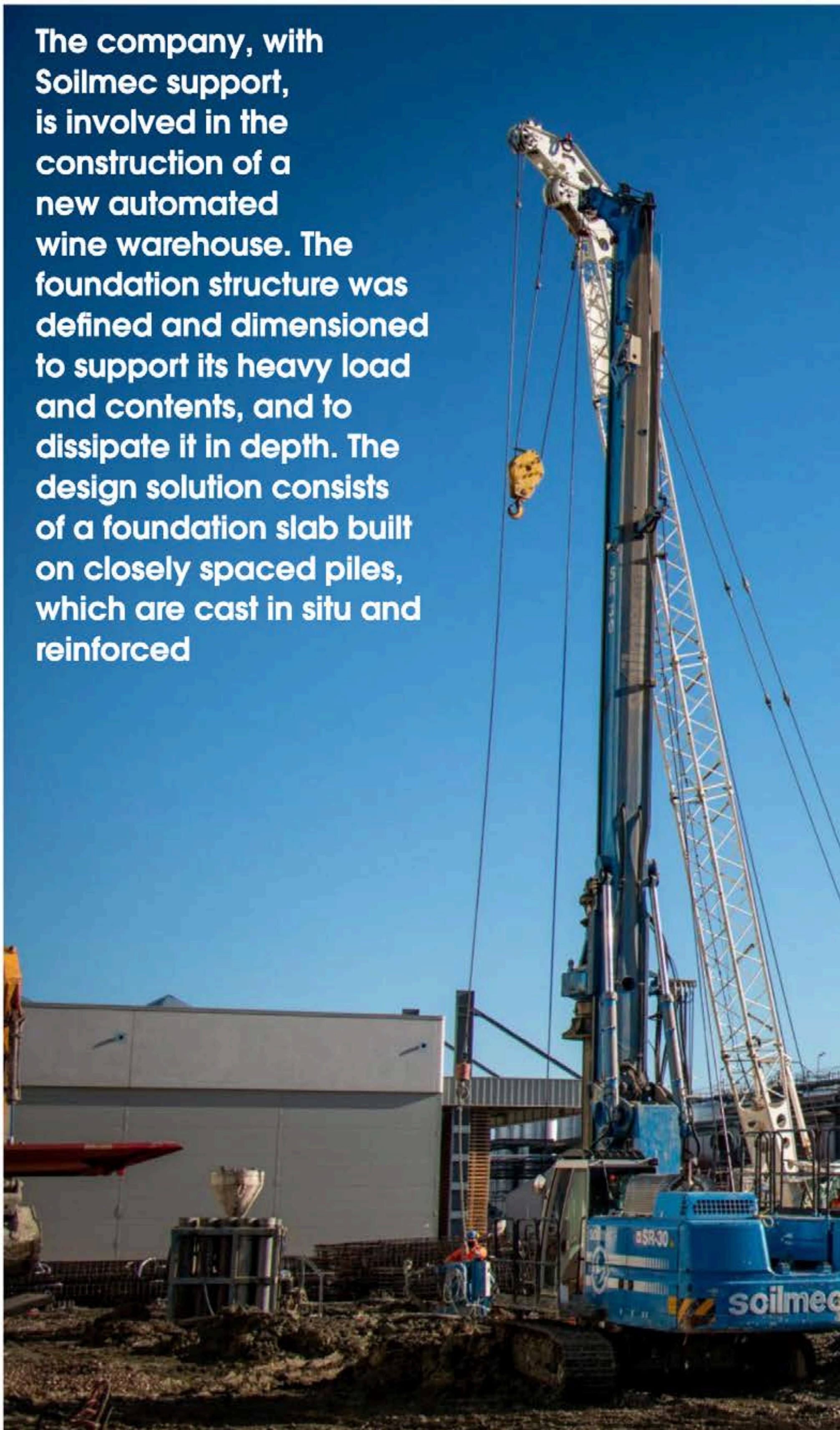
Veins of **warehouse**

The company, with Soilmec support, is involved in the construction of a new automated wine warehouse. The foundation structure was defined and dimensioned to support its heavy load and contents, and to dissipate it in depth. The design solution consists of a foundation slab built on closely spaced piles, which are cast in situ and reinforced



A good root system is a prerequisite for the vine, just like solid deep foundations are essential to ensure the solidity and safety of large buildings. It is therefore no coincidence that, in the land of the Sangiovese wine, three companies of excellence that are based in Romagna, namely Caviro, Trevi and Soilmec, are involved in the construction of a new automated wine warehouse. As client, foundation contractor and manufacturer of the drilling machines, these three companies have cooperated in the expansion of the Caviro production centre in Forlì, one of the locations of the wine co-operative founded in Faenza and which consists of 11,650 winegrowers.

The project is aimed at the technological and plant development of the warehouse in order to improve its production yield and environmental performance. The overall project covers different interventions and installations, including the construction of a new shed, new equip- ment, energy efficiency measures and a new automated warehouse. The Cesena city based company Trevi SpA was entrusted with the special foundation works to support the new auto- mated warehouse. The structure, to be built inside the plant, will be used for the handling of the wine producer's packaging management.

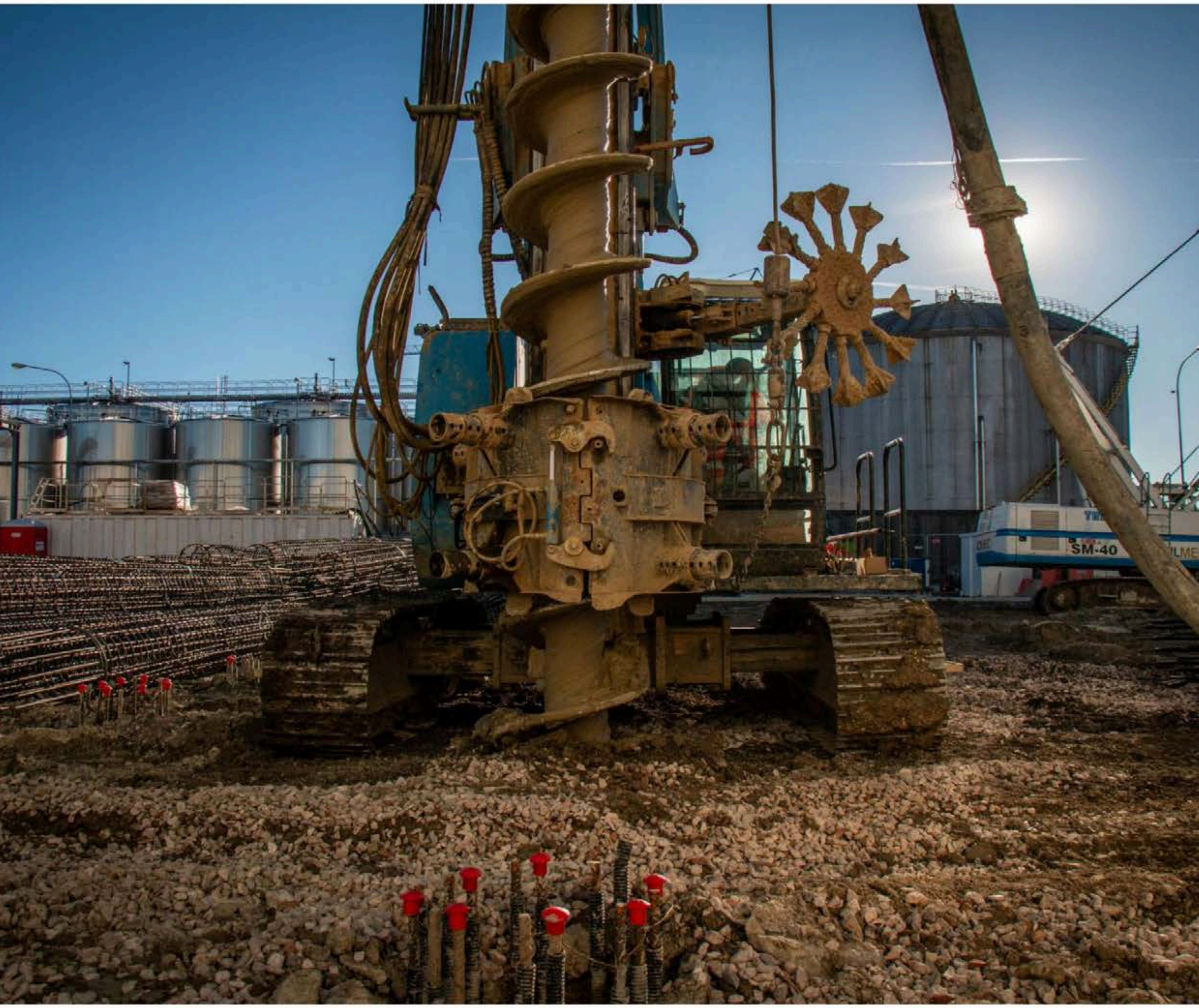
Soil geology

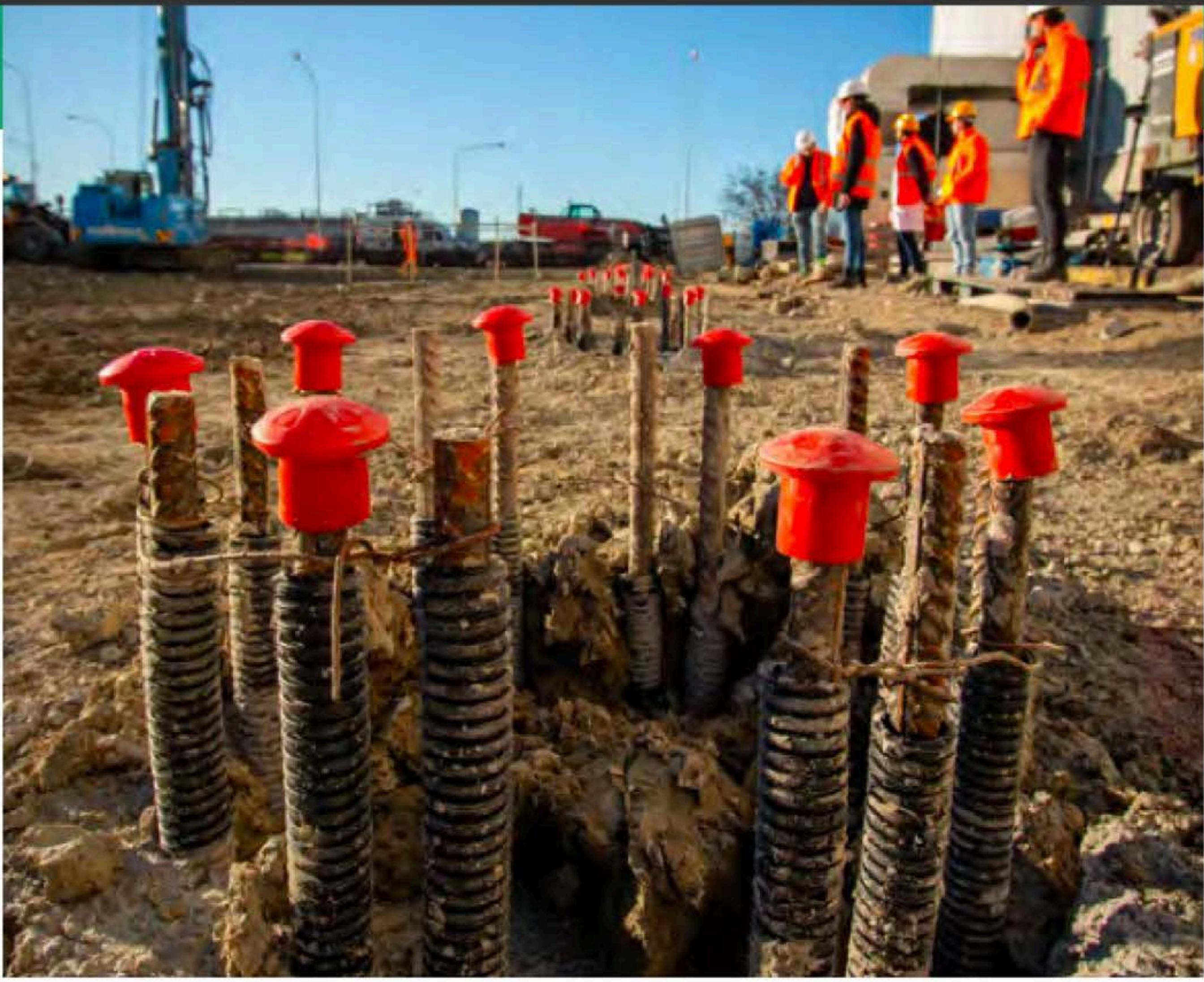
The project area, which covers approximately 2,000 square metres, falls within the Forlì territory straddling the Apennine-Paduan border. The soil geology consists mainly of alluvial deposits of the Po Valley that are characteristic of the Emilia-Romagna Super-synthema. In particular, there are soils belonging to the Ravenna Sub-synthema, characterised by silty clays, clayey silts and sandy silts of alluvial plain. In detail, the geognostic surveys and penetrometric tests carried out in the working areas have shown that after an ini- tial short layer of backfill there is an alternation of silts, sands and clays with a loose to medium density and medium plasticity in the first 10 to 15 metres of depth, increasing to stiff and very stiff as drilling gets deeper.

Works

The foundation structure was defined and dimensioned to support its heavy load and contents, and to dissipate it in depth. With regard to the deep foundation design of the automated warehouses, it is important to carefully assess the subsidence and distortions that can occur in both the foundation structure and the superstructure. The foundation-soil complex must guarantee uniform support in the event of ground deformation, particularly for high automation warehouses where the automated guided vehicles move according to a pre-set mapping, which must not be subjected to variations

or inclinations in order to work correctly and safely.
The design solution consists of a foundation slab built on closely spaced piles, which are cast in situ and reinforced. Foundation piles were built with a diameter of 800 mm and four different drilling depths, varying between 12 and 39 metres.
In order to effectively counteract the load of the structure to the underlying soil, piles are arranged in groups, uniformly around the entire perimeter of the warehouse, and excavated with increasing depths towards the centre. Working within a plant in operation and therefore with personnel and vehicles at work, the two main needs were clearly defined: time and logistics. In order to carry out the work in the shortest possible time,
two different technologies were used: the CFA, with continuous flight auger, for the 12, 16 and 22 m deep piles, while the 39 m deep piles were drilled using polymer piles. The need to occupy as little area as possible, not to mention the considerable number of piles to be drilled, led to the choice of the two drill rigs: the Soilmec SR-30, set up with telescopic kelly bar and bucket, and the SR-45 set up in its CFA version.
Both machines are equipped with a rotary power automatic control system to enhance drilling performance by optimising torque and rotational speed, and a low-idle system for the diesel engine that guarantees better fuel consumption and reduced environmental impact.
In addition, the DMS On Board is renewed with regard to customisations and is complete with many drilling automatisms to simplify and optimise excavation management by the operator. ◆





Memories of a masterpiece

The stabilisation of the Leaning Tower of Pisa was completed a long time ago. On June 16, 2001, the day of Saint Rainier (Pisa's Patron Saint), the citizens of Pisa were returned their monument. On December 31 of the same year the International Committee that had been established more than 10 years before with the task of studying and implementing measures to restore the tower to health, was disbanded. The Committee studies, the gradual and painstaking research and understanding of the tower's problems, the devising and definition of temporary and permanent stabilisation works and lastly their implementation have repeatedly been mentioned and dealt with in several scientific articles published in specialised journals. The executive planning and actual implementation of the works devised and planned by the Committee, though less known, but equally rich and interesting was carried out with passion, commitment and great skill by the Consorzio Progetto Torre di Pisa (Tower of Pisa Project Consortium) composed of the companies Trevi, Rodio, Italsonda, Ismes and Bonifica.
Because of two-fold risk (geotechnical risk of overturning and structural risk of failure due to brittle fracture) and also because of the worsening situation, the Committee adopted a two-stage strategy: immediately carrying out temporary stabilisation works, making sure these works were reversible, so as to buy some time and then carefully study, experiment and implement the final stabilisation works.
As with regards to the structural risk, temporary works consisted of circling some parts of the Tower with slightly pre-tensioned strands. Final, permanent works consisted of inserting stainless steel bars to connect the inner and outer surfaces, performing injections in the masonry works and wrapping the top of the first order and the bottom of the second order with harmonic stainless steel wires; these works affected very small areas of the Tower.
As with regards to the geotechnical risk, the temporary works consisted of applying a counterweight to the Tower, on the Northern side; the counterweight was made of a pile of lead ingots weighing about 1,000 tons.
the Committee decided to reduce the Tower inclination by about one half degree, inducing controlled subsidence beneath the Northern edge of the foundation. In addition to substantially improve the stability conditions of the foundation, these works should also be able to reduce the tensile stress in the Tower, thus reducing the necessary structural reinforcement; moreover, this work would also fully respect not just the formal integrity of the monument but also its material and historical integrity.