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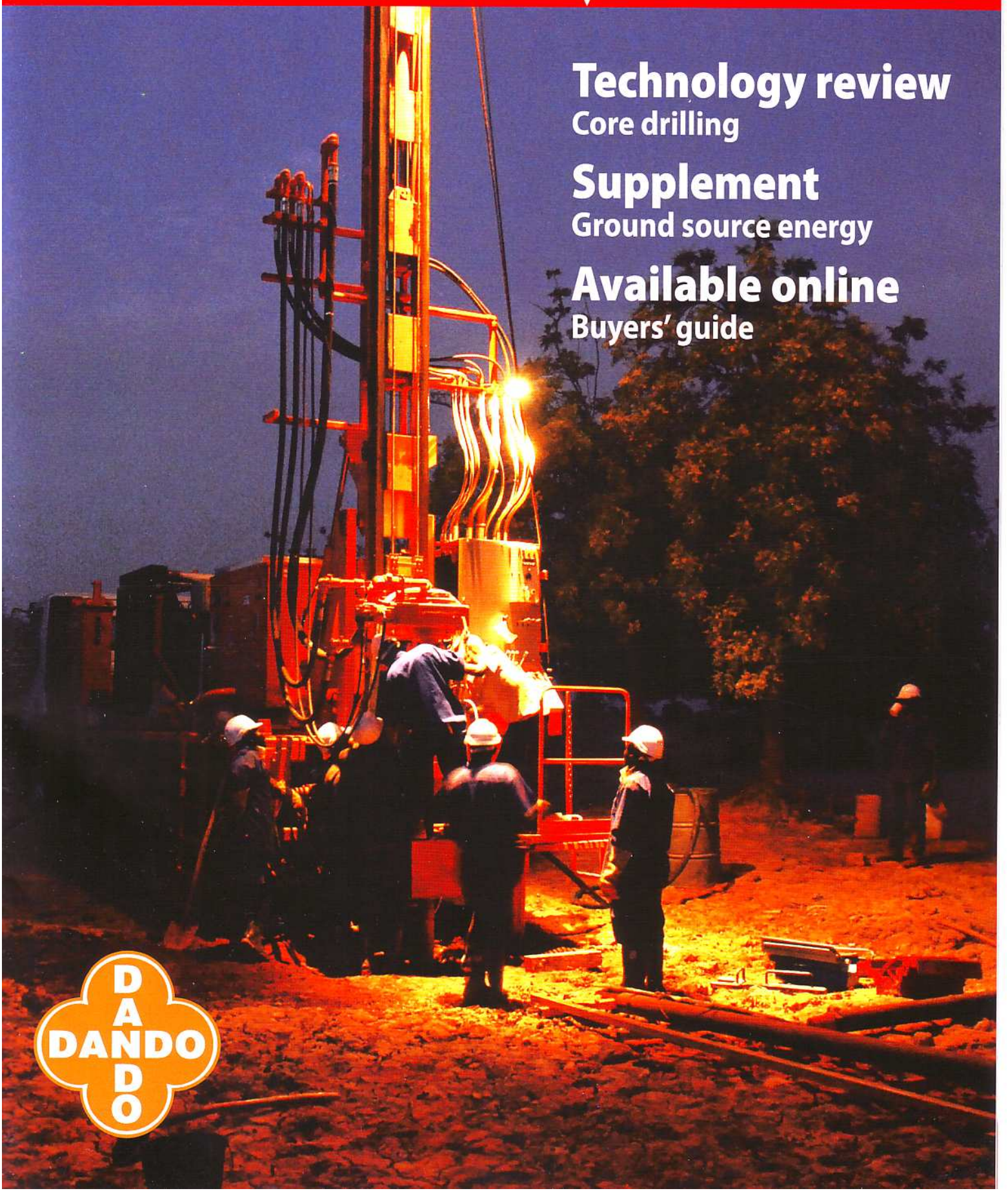
GeoDrilling INTERNATIONAL



Technology review
Core drilling

Supplement
Ground source energy

Available online
Buyers' guide

DANDO DRILLING

Sicilian success for Trevi

THE FS Italian railway society has started a series of projects to modernise the railway network in the Palermo area of Sicily, including the addition of a second track. This involves an extension of more than 30km of railway, of which 20km crosses an urban area, and the construction of 17 stations and 22 stops. Furthermore, to reduce Palermo's chaotic road traffic and secure a direct link to the airport, 7km of track will be moved from the city surface to an underground tunnel.

The Trevi job site spreads from the eastern outskirts of Palermo's Brancaccio zone, crosses the city to the extreme west, and connects to the Falcone-Borsellino airport. In total, 23,000m of secant piles were installed across the site. It was necessary to perform the job without interrupting train schedules, and also limit pollution and noise. The job site conditions were solved by using the CAP/CSP pile application.

THE CAP/CSP METHOD

CAP/CSP consists of pile augering with casing protection, and was chosen for its ability to eliminate vibration and minimise disturbance to adjacent structures. Noise emissions are also reduced and there is no need to use bentonite mud for drilling.

With CAP/CSP, it is possible to execute piles in contact with existing foundations, avoiding decompression of surrounding soil, and ensuring the accurate and precise positioning of each pile. In addition, the use of protection casing secures vertical drilling, with less than 0.7% deviation.

Using CAP/CSP, piles are augered into the soil at the same time as the protective casing. Concreting is carried out through the auger shaft during auger extraction. The reinforcement cage is then driven into the fresh concrete, after which the temporary casing is removed. To construct secant pile diaphragms, the wall continuity is secured by overlapping secant primary and secondary piles. The guiding wall is used to secure the alignment of the diaphragm and guide the casing from the top.

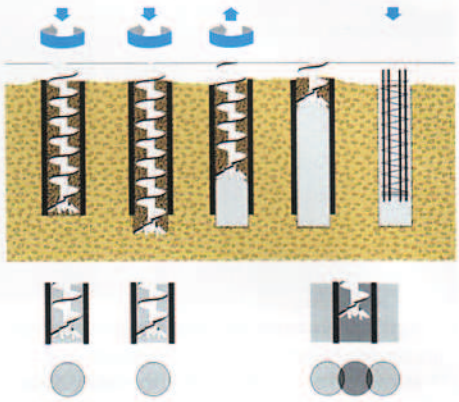
For the execution of the CAP/CSP piles, Trevi used the multi-functional Soilmec R-825 and SR-90 rigs. These drilled the piles to depths of 25m with a diameter of 920mm. The primary and secondary piles overlapped by 80mm.

PROJECT PHASES

The various phases of tunnel and underground road passage construction are designed to minimise disruption to the existing railway and road traffic. For example, at the WBS GA17 tunnel, where new railway tracks have been installed, the soils are mainly composed of soft, dense calcarenites up to 10m deep, followed by clay and silts.

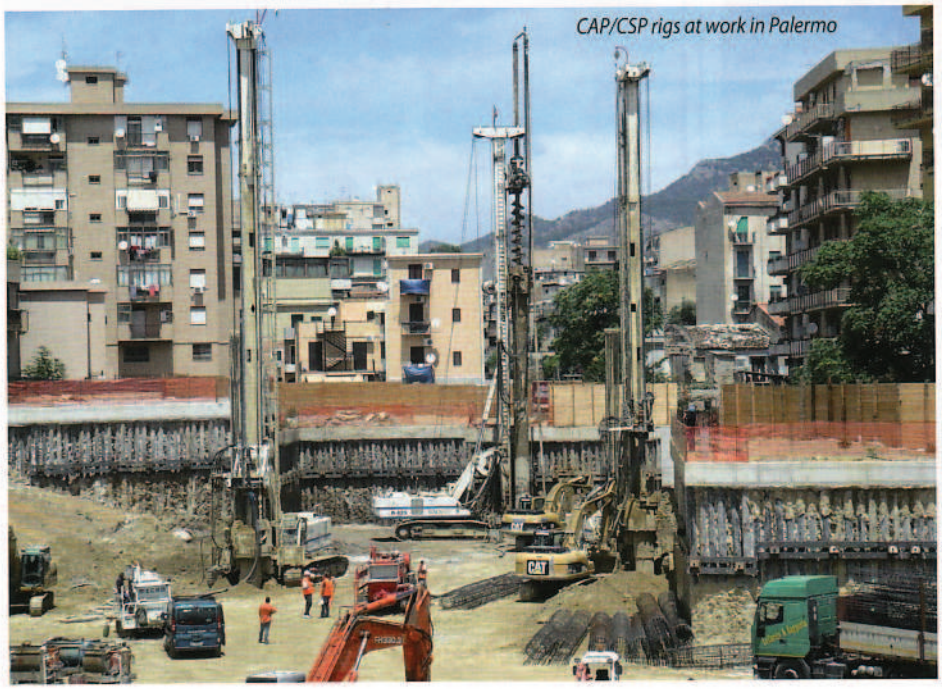
The construction phases have been as follows:

- Construction of side wall with CSP piles, without interrupting the existing railway track;
- Execution of intermediate wall with micropiles to reinforce the structure;



- Construction of half coverage slab on the tunnel;
- Excavation of the first-half gallery;
- Traffic diverted on to the temporary track inside the half gallery or above the half coverage;
- Execution of second side wall with CSP piles;
- Completion of tunnel coverage; and
- Construction of two definitive railway tracks inside the artificial gallery.

In light of the production figures, the choice of the CAP/CSP method, executed with Soilmec rigs, had excellent results. In fact, despite having travelled about 30km as they were moved to different locations on the project, each rig had a drilling rate of 65m/d in 2009, and have surpassed 70m/d this year.



CAP/CSP rigs at work in Palermo

Road job marking

Construction of underground passage