



On firm foundations

The TRM pile system

The TRM pile system consists of centrifugally cast pipe of ductile cast iron with conical sockets and with spigot ends which have a matching conical taper. As a result, the individual lengths of pipe can be assembled into longer units as the driving progresses without the need for any special tools. Due to the rigid joints, they then form a load-bearing member which is one continuous unit – the pile. A driven pile is sunk into the soil – by driving – and then dissipates, or transmits, forces from the structures situated above it into the soil. In actual fact, this procedure is a very old one; in the Neolithic period and the Bronze Age, piles for constructing dwellings were already being driven into the shores of bodies of water or directly into the bodies of water themselves; this is how the structures known as lake dwellings were built.

The piles are made of ductile cast iron, and this is a very elastic material which is able to withstand tremendous mechanical stresses – such as occur in the driving operation. At a standard length of 5 m, they

Grimming-Therme thermal spa in Bad Mitterndorf – on deep foundations driven with TRM piles

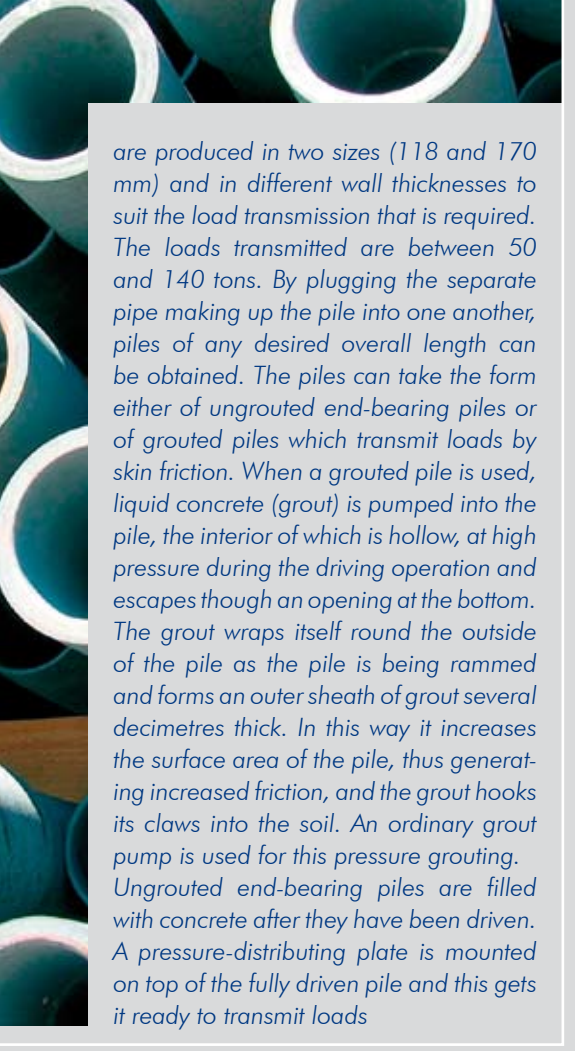
A site measuring 40,000 square metres, those words alone are enough to give some idea of how big the project is – Nestling between the mountains of the Ausseerland area in Austria's Salzkammergut, the Grimming-Therme thermal spa and its hotel resort are being built in Bad Mitterndorf. The project is intended to continue the development of the region and to be a driver of year-round tourism. The hot springs at Bad Mitterndorf, which were known even in Roman times, will help to ensure that even greater use is made of existing tourist attractions such as the Tauplitz and Loser area for Alpine and cross-country skiing.

When the ground was broken for this 50 million Euro project in December 2007, it marked a change to the overtaking lane for the tourist industry in the Salzkammergut. From the 8,000 square metres of land that the spa itself will occupy, future guests and visitors will be able to enjoy the view they will have of one of the most impressive panoramas in the Steiermark: mountains, interspersed with gently roll-



ing hill and knolls and enthroned above them all the Grimming, the mountain that personifies the Hinterbergertal, about which there is such a rich tapestry of legends and folk-tales. But before that can be possible there is a lot to do. The whole site had to be given deep foundations. For combined environmental and economic reasons and also in view of the minimal settlement that is permitted, the decision that was made in the case of this structurally demanding building project was to use the pile system made by TRM. Due to the existing soil conditions (water table three metres below the surface of the ground and a confined aquifer at a depth of 25 to

27 metres), the work can only be done if the springs are kept running or on other words the deep foundations have to act to some degree as an additional safeguard against uplift. That each pile will have the exterior load-bearing capacity laid down is demonstrated by the driving criterion when the pile is being driven. The piles are pressure-grouted and, in the boggy ground involved, this rules out any possibility of the groundwater mixing with polluted surface water. Hence, the TRM piles have once again shown themselves to be an efficient, fast and inexpensive deep foundation system. If all the piles which have been delivered to the sites were laid end to end, they would cover a total distance of 30 kilometres! Collaboration with the construction company handling the contract, Grund-Pfahl und Sonderbau GmbH, has gone extremely well. The speedy progress of the construction work and the absence of any hold-ups (not a single pile has fractured!) has been the result of good logistics and of course of efficiency in the driving operation.



are produced in two sizes (118 and 170 mm) and in different wall thicknesses to suit the load transmission that is required. The loads transmitted are between 50 and 140 tons. By plugging the separate pipe making up the pile into one another, piles of any desired overall length can be obtained. The piles can take the form either of ungrouted end-bearing piles or of grouted piles which transmit loads by skin friction. When a grouted pile is used, liquid concrete (grout) is pumped into the pile, the interior of which is hollow, at high pressure during the driving operation and escapes through an opening at the bottom. The grout wraps itself round the outside of the pile as the pile is being rammed and forms an outer sheath of grout several decimetres thick. In this way it increases the surface area of the pile, thus generating increased friction, and the grout hooks its claws into the soil. An ordinary grout pump is used for this pressure grouting. UngROUTED end-bearing piles are filled with concrete after they have been driven. A pressure-distributing plate is mounted on top of the fully driven pile and this gets it ready to transmit loads