8. Driving Assistance

8.1 Jetting

8.1.1 General

Under certain conditions, driving, vibrating and pressing of piles can be achieved only with the help of jetting. This also prevents overloading of the installation machine, damage to the piles and reduces ground vibrations.

The objective of this procedure is to locate a pressurized water jet at the toe of the pile connected by a pipe to a supply pump on the ground surface.

The water pressure loosens the soil and removes loose material. The toe resistance of the pile is reduced and, depending on the soil conditions, the rising water reduces surface and interlock friction.

The effectiveness of the jetting is influenced by the density of the soil, the available water pressure and the number of jetting pipes. Care must be exercised to ensure that the ground treatment does not endanger adjacent structures.

Test driving to define the parameters is recommended.

8.1.2 Low pressure jetting

Low pressure jetting is mainly used in dense non-cohesive soils.

In combination with a vibratory pile driver, jetting can enable piles to penetrate very dense soils. Especially vibrators with variable eccentricity have proved very succesful.

Two to four tubes of 20 mm diameter are fixed to a pair of sheet piles. Each tube is served by a pump, giving a pressure of 20 bar. Water volume per tube should be 120–240 litres/min. The toes of the tubes are at the same level as the toe of the pile and the jetting starts simultaneously with the driving to prevent intrusion of soil into the tube.

In general the soil characteristics are only slightly modified, although special care must be taken when piles have to carry vertical loads.

Figure 8.1.2-1

Figure 8.1.2-2

8.1.3 High pressure jetting

High pressure jetting may be used for driving in extremely dense soil layers.

If there is a risk of settlement, high pressure jetting is preferred to low pressure due to the reduced amount of water being used.

High-quality tubes are required, the pump pressure being 250 to 500 bar.

Special nozzles, sometimes flat jet nozzles, are used (30 mm diameter for the tubes, 1.5 or 3.0 mm diameter for the nozzles). Water consumption is 60–120 litres/min per tube. Soil mechanical characteristics are not modified by the system: this has been proved by test-driving in chalk, boulder clay and hard clay.

The tubes, fixed at the pile top, are guided in side brackets welded to the piles so that they can be re-used. The nozzles are located 5–10 mm above the pile tip.

Intensive monitoring is required during the work to adapt the system to the local conditions.

The diameter of the nozzles has to be adapted to the ground conditions, as have the number and the arrangement of the lances.

8.2 Blasting

8.2.1 General

This process is applicable to most types of soil which until now would have been classified as difficult or impossible for driving steel sheet piles, H-section, box and tubular piles.

8.2.2 Normal blasting

Explosives are lowered into drilled holes and covered with soil before detonation. This creates a V-shaped trench along the proposed line of the wall. The size of the fragments in the trench is dependent upon the amount of explosives used.

The driving conditions in the loosened area are still very tough and toe reinforcement of the piles is recommended.

8.2.3 Shock-blasting process

This blasting technique is a highly specialized form using very low-powered explosives, the principle being to reduce solid rock to a fine granular material without displacing it, rather than to blast a cavity in the rock.

The volume of rock affected is very small, being just sufficient to encompass the dimensions of steel piles.

The width of the granulated rock zone would be 500–700 mm and to the exact depth of the required pile penetration. The rock immediately adjacent to this zone remains totally intact.

The sheet piles should be driven into this granulated zone as soon as possible after blasting to obtain maximum benefit from the process.

The act of driving the sheet piles into this zone compacts the soil ensuring adequate support for the embedded piles.

8.3 Drilling

Easier impact driving, vibrating and pressing can be achieved by pre-drilling. Holes of about 30 cm diameter are drilled at centres of the system width of a pair of piles. This spacing is reduced for more difficult driving conditions.

The holes have the effect of reducing the resistance of the soil strata, by allowing redistribution during subsequent driving of the piles.

If greater diameters of holes are required, they must be filled with suitable material.

Even soils including hard rock layers can be made suitable for driving by this method.

Sometimes the loosening of the soil by an auger may be sufficient.

Another possibility is the creation of a trench by a powerful auger. This trench can be filled with suitable material or may just consist of loosened soil.

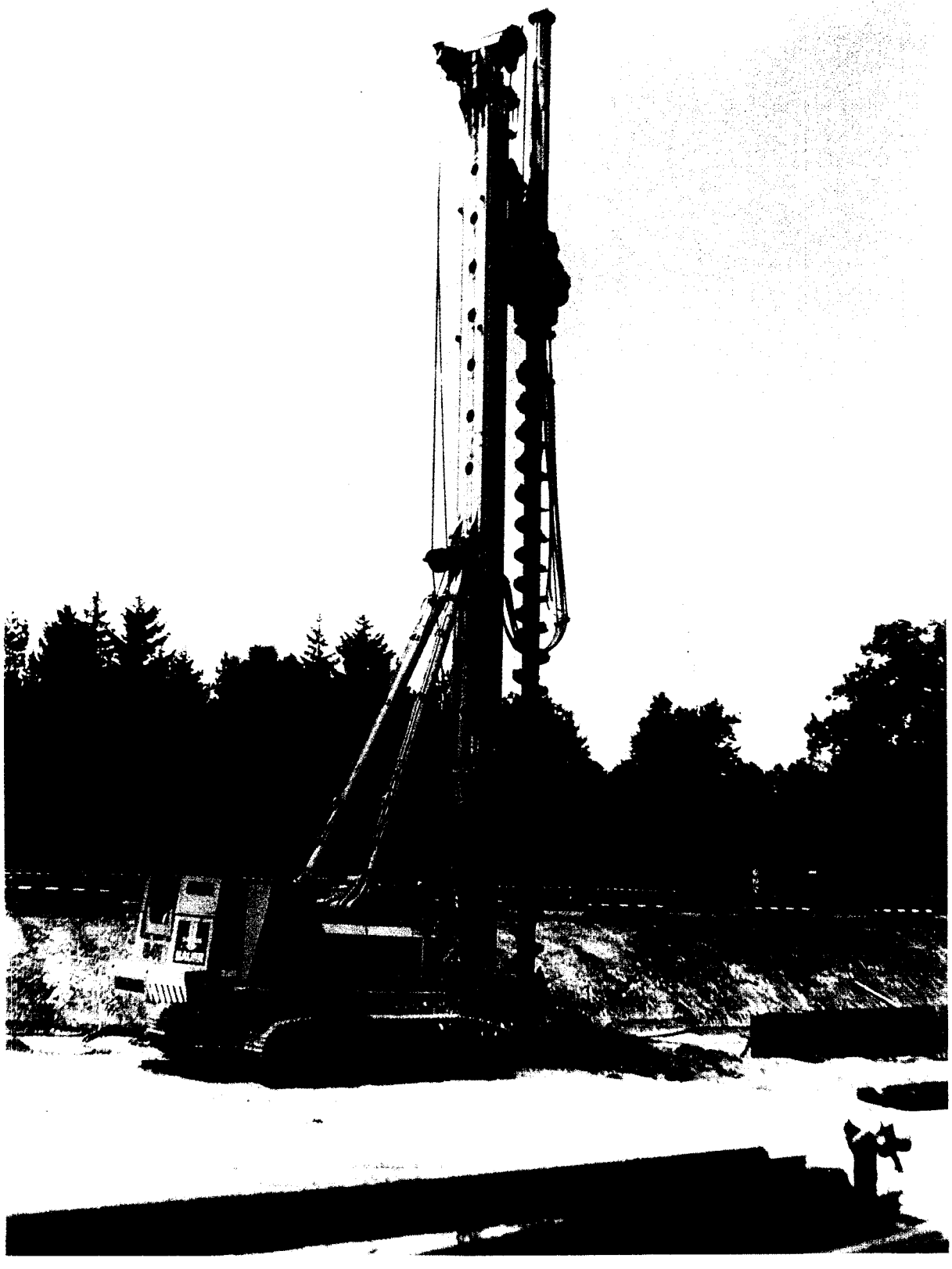

Figure 8.3