Report

Waterjet Assisted Pile Driving

WOMA®

Water as a tool
for a clean environment

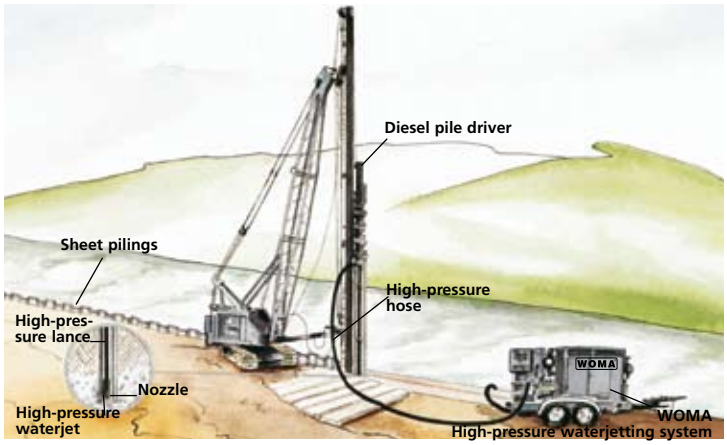
Driving and pulling of sheet pilings, trench sheetings and beams usually are done by diesel pile drivers or vibrators, respectively. Nevertheless, both methods have technological restrictions. Thus, depending on the surrounding conditions, such as soil conditions, degree of urbanization and available cross section, supporting systems can or must be employed. One of these supporting systems is WOMA's high-pressure jetting technique.

In ground and soil engineering, WOMA's high-pressure waterjet systems can additionally be used for:

- Driving and pulling of sheet pilings, trench sheetings and beams.
- Cleaning of incrusted locks at pulled holding-up sheet piles.
- Rust removal from ram piles.
- Soil stabilization by Soilcrete or high-pressure injection.
- Trenchless installation of pipes and cable systems by water jet assistance.
- High-pressure washing and decontamination of soil.
- Cleaning and roughening of concrete foundations.
- Cleaning and decoating of sewers and pipelines.
- Drilling, cutting and fracturing of rocks.
- Hole drilling in frozen slabs.
- Push-trough of clay layers in gravel pits.

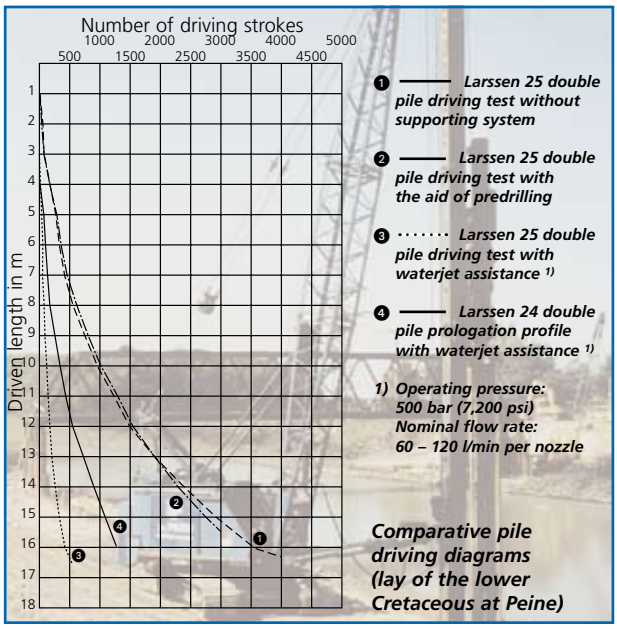
Why High-Pressure Waterjetting?

- Reduction of the driving time for walls and beams by up to 75 %.
- Significant decrease in the required drive power.



Structure of a waterjet assisted pile driving system

Diesel pile driver with a WOMA high-pressure waterjet system



Comparative pile driving diagrams (lay of the lower Cretaceous at Peine)

Piling element with mounted high-pressure lance and high-pressure hose

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▶ Increase in the driven length.

▶ Significant reduction of the number of driving strokes for a given driven length.

▶ Reduction of the vibrations on foundations and buildings by up to 50 %.

▶ Almost complete avoidance of vibrations in dry, densely bonded soil.

▶ No generation of critical vibrations.

▶ Decrease in the noise exposure by op to 35 %.

▶ Reduction of the skin and interlock friction due to the flowing water.

▶ Reduction of the point resistance at the pile foot due to loosening the ground by the waterjet.

▶ Application for pulling jobs is possible.

▶ The method is recommended by the German Society of Geotechnique e.V.

Material Range

The waterjet assisted pile driving has successfully been used for the following soil types: Uniform sand and fine gravel, hard clay-marl-soil, marl of the Upper Cretaceous, clay of the Lower Cretaceous, dry and densely bonded soil.

The Technique

WOMA offers stationary and mobile high- and ultra-high pressure water jetting systems with operating pressures up to 3,000 bar and water flow rates up to 1679 l/min, consisting of electric or combustion drive, high-pressure plunger pump, guiding and control devices, water tools, and high-pressure accessory.

The special high-pressure program for waterjet assisted pile driving also includes the following components:

▶ High-pressure plunger pumps for single or multiple lances with operating pressures up to 200 bar and 500 bar, and nominal water flow rates between 50 l/min and 500 l/min.

▶ High-pressure plunger pumps with abrasive resistant pump (ARP®) heads for purifies water for operating pressure up to 400 bar.

▶ High-pressure lances to be mounted at the pilings.

▶ Hydraulic clamping devices.

▶ Flexible high-pressure hoses.

▶ Wear resistant high-pressure nozzles.

▶ Nozzle protection caps.

Advantages of the waterjet assisted pile driving

1) Comparative results are not available

Advantages compared to other methods	**Other methods**		
	Simple pile driving or vibrating	pile driving/vibrating and boring	pile driving/vibrating and blasting
Reduction of the time for pile driving or vibrating by up to:	75 %	65 %	dependent on soil type
Abatement of ground vibrations:	50 %	yes 1)	not investigated
Decrease in the noise exposure time by up to:	75 %	65 %	yes 1)
No geological modifications	Substantial structural modifications in the subsoil		
Reduction of the steel sheet pile section for pile driving:	impossible	only rarely possible	possible
Reduction of the pile driving or vibration cost by up to:	50 %	15 %	not investigated

Waterjet system for pushing through clay layers in gravel pits

Mobile high-pressure system type 1000 Z

Pile elements at the Hamm-Dattel-Canal, driven with waterjet assistance