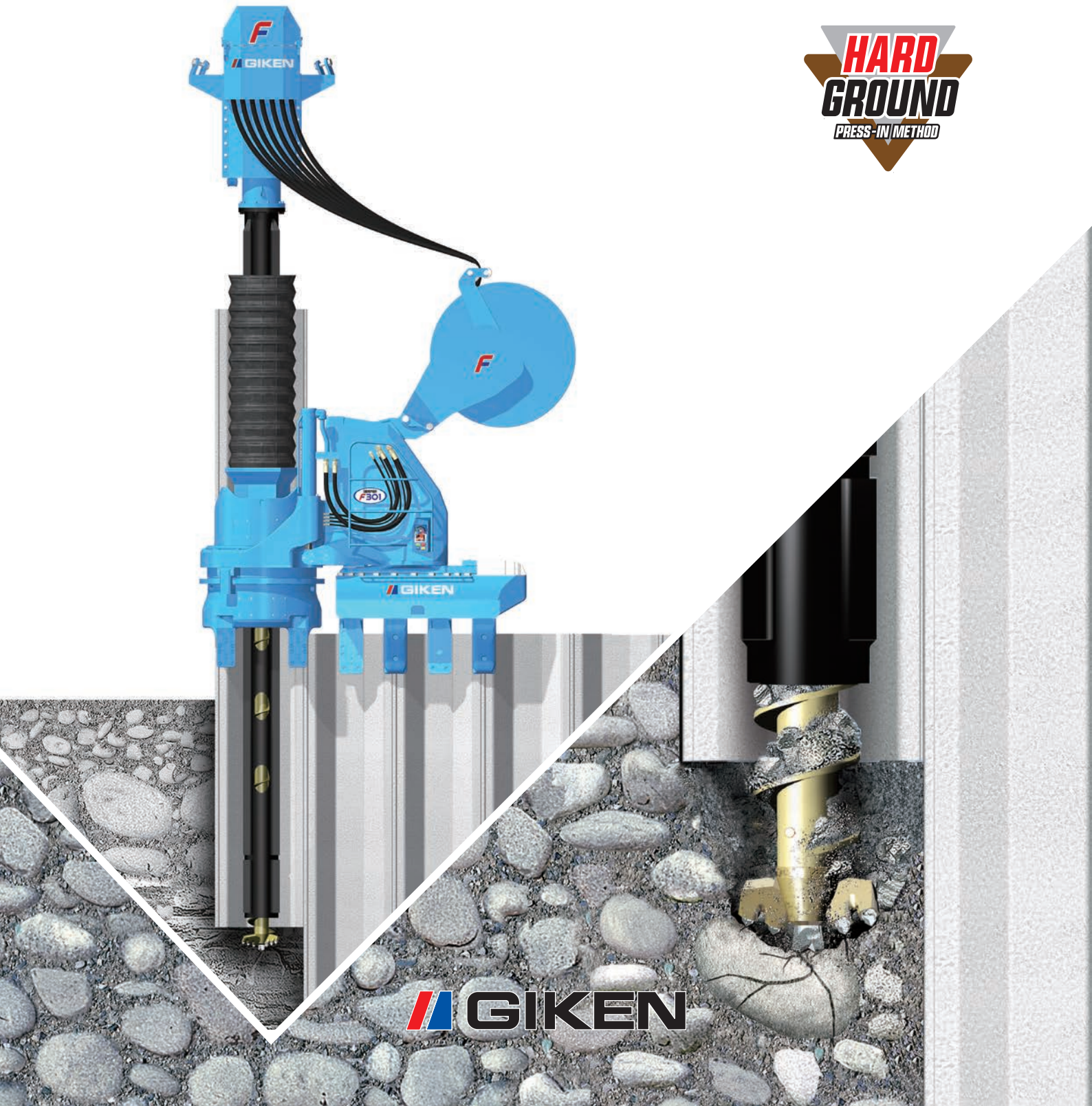
Construction Revolution

Constructing continuous pressed-in piles into cobblestone and gravel layers or bedrockGI

Hard Ground Press-in Method

HARD GROUND
PRESS-IN METHOD

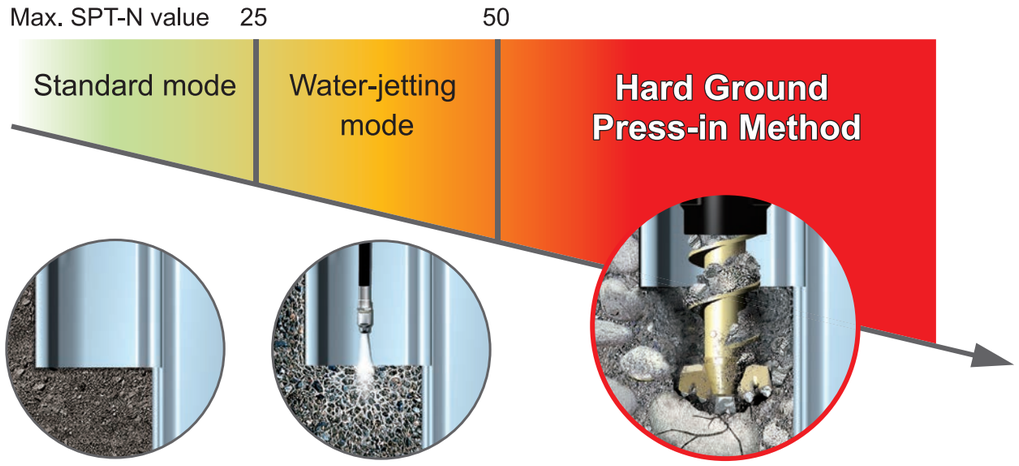


GIKEN

Method Overview

Applicable to ground conditions with a max. SPT-N value of over 50 without compromising the superiority of the press-in method by employing a unique Coring Theory

The Hard Ground Press-in method is a driving assistance for press-in machines that apply a superior press-in method. It allows press-in construction on hard ground with a max SPT-N value of over 50 by adopting the "Coring Theory," a unique coupling of press-in and augering functions.



Features of Hard Ground Press-in Method

◇ Applicable to ground conditions with a max. SPT-N value of over 50

Press-in construction can be implemented in cobblestone and gravel layers or bedrock with a max. SPT-N value of over 50, which is difficult with conventional methods.

◇ Applicable to construction over water, on slopes, and other severe conditions

The compact size of the system makes it ideal for working in severe conditions, e.g. over water or on slopes.
Furthermore, it does not require a temporary pier or other working platforms.

◇ Minimum soil displacement

A unique “Coring Theory” minimizes excavation, which limits soil displacement and disruption of surrounding ground.

◇ High level of safety with no risk of machine overturning

The press-in machine main body firmly holds the completed pile, eliminating any risk of machine overturning.
A unique chucking mechanism locks the pile auger and piles to maintain a high level of safety.

Construction works can be carried out with environmentally friendly considerations, lower cost, and shorter work duration at any work conditions.

Superiority of press-in method

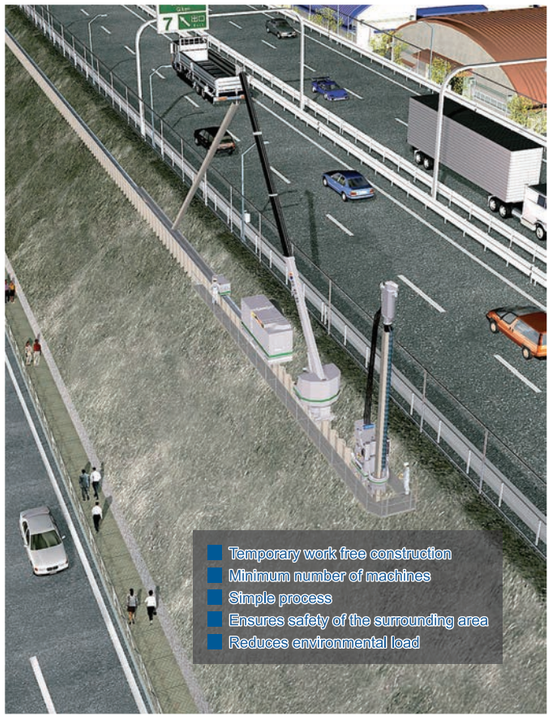
- Vibration-free and noise-free
- No machine overturning
- Lightweight and compact press-in machine main body
- Pile bearing capacity can be checked during construction
- High measuring accuracy

Coring Theory
(coupling of press-in and auger)

The “Coring Theory,” a unique coupling of press-in and augering functions, enables pressing into hard ground without compromising the superiority of the press-in method.

Hard Ground Press-in Method

Example of Hard Ground Press-in Method

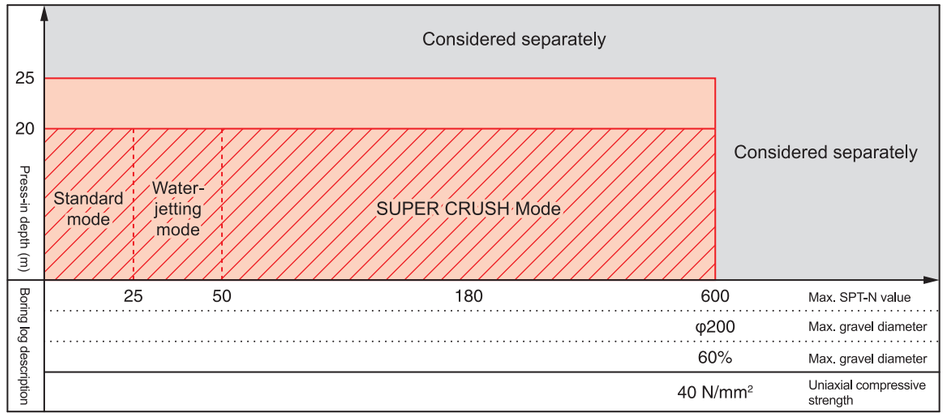


Conventional method

Applicable Ground

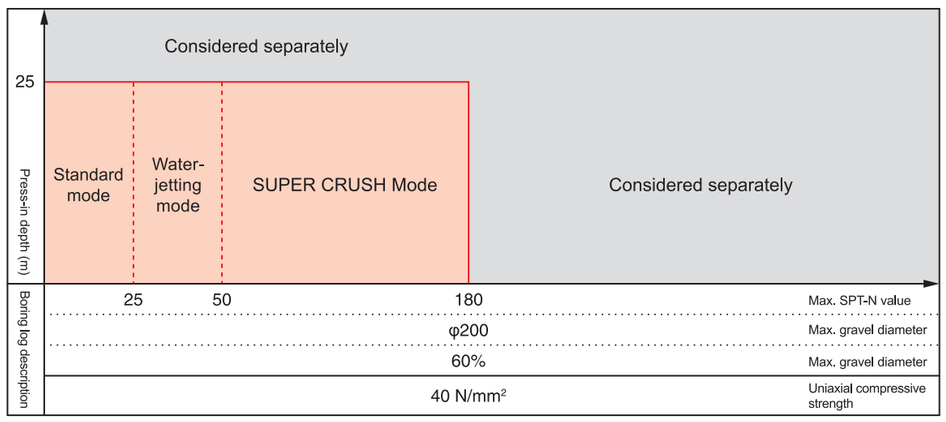
U sheet pile (400, 500, and 600 mm-width)

: Applicable range of 400 mm-width : Applicable range of 500 and 600 mm-width



Hat sheet pile (900 mm-width)

: Applicable range of hat sheet pile (900 mm-width)

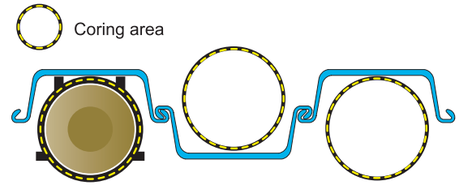


(Note) 1. Use values in borehole data for values to determine the soil property.
2. Determine the applicable range using the maximum values of soil determination items in the borehole data
3. The press-in depth is the depth of a steel sheet pile pressed in from the ground surface, which is different from the steel sheet pile length.
4. The standard minimum press-in depth is 4.0 m or more.
5. Applicable for max. SPT-N value of 50 or less.

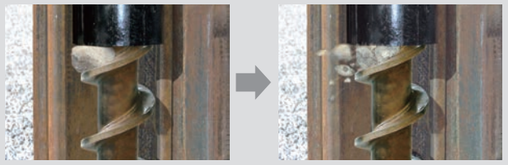
* Construction works have been completed for grounds "Considered separately." Contact us for details.

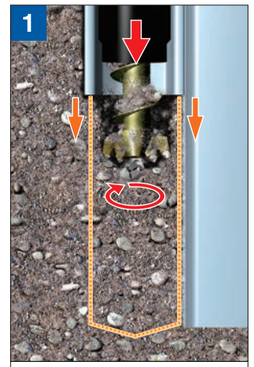
Coring press-in (sandy soil and clay)

By employing a unique "Coring Theory" established by GIKEN LTD., a minimum amount of ground is first excavated using the pile auger to create a coring condition. Then, a pile is pressed in while extracting the pile auger. Excavation is necessary only to assist the press-in process. Therefore, piles can be installed with a high bearing capacity because the soil displacement amount is low and the surrounding ground is not disturbed.



Crushing boulders by wedge effect



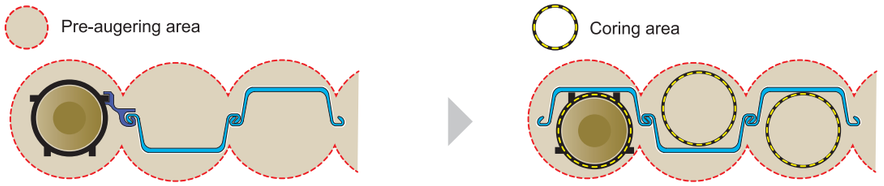


Simultaneous augering and pressing-in

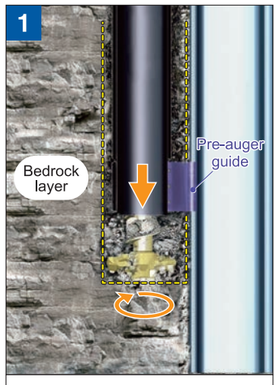
Extracting the pile auger after press-in is completed

Pre-augering press-in (bedrock, sandy soil, and gravel soil)

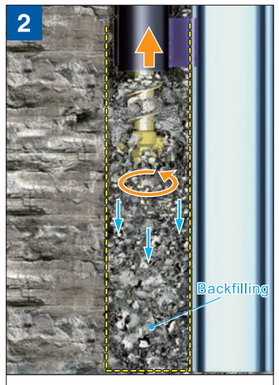
When installing piles into bedrock with conventional methods, a large area was excavated while crushing the bedrock layer, and sand was filled into the area before installing piles. This process requires a high cost and a long period. These disadvantages can be solved by pressing in piles after a minimum amount of pre-augering using the pile auger on the press-in machine main body. Highly efficient construction is possible by completing the excavation of bedrock and press-in of steel sheet piles with one machine. In addition, excavation with high measuring accuracy is possible since joints of completed piles are used as a guide for pre-augering.



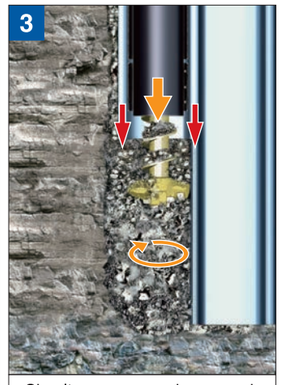
Crushing and ripping of boulders



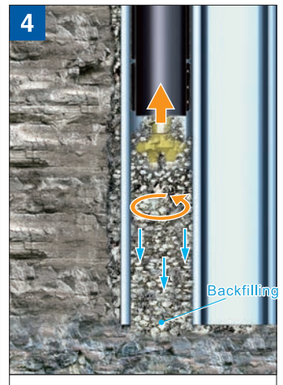
Pre-augering (pre-auger head)



Pile auger extraction and backfilling
Backfilling is completed automatically by reversing the auger rotation for extraction

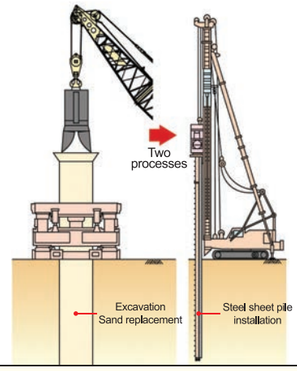
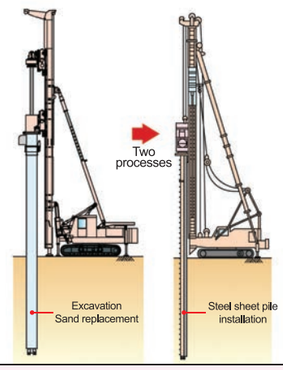
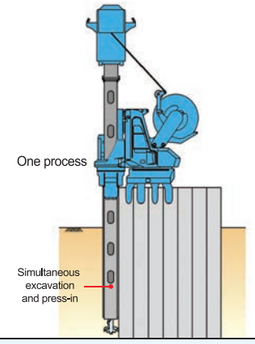
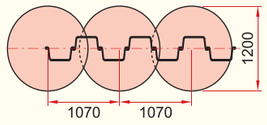
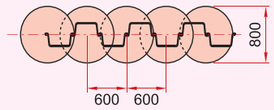
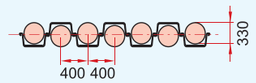


Simultaneous augering press-in (press-in auger head)
Replace the auger head for press-in



Backfilling after press-in is completed
After completing press-in, backfill by reversing auger rotation for extraction

Method Comparison

Item	Casing rotary excavation sand replacement pile method	Continuous Flight Auger Pre-boring sand replacement pile method	Hard Ground Press-in Method
Schematic diagram			
Excavation dimensions			
Method Overview	A method to excavate and displace soil inside a casing tube using a hammer grab, etc. by installing cemented carbide tips on the cutting edges of the casing end and rotating/pressing in over the entire borehole length. After checking that the necessary excavation depth is obtained, sand is backfilled while extracting the casing tube to create a sand replacement pile. Then, steel sheet piles are installed using a press-in machine with pile auger.	A method to excavate by rotating special cutting bits installed on the outer casing edge and inner auger edge that rotate in opposite directions. Sand is filled after excavation to create a sand replacement pile. Steel sheet piles are installed using a press-in machine with pile auger as in method 1.	A method to press in a steel sheet pile by erecting a steel sheet pile on a steel sheet press-in machine and excavating using the casing auger while coupling the steel sheet pile and auger.
Characteristics	・Two excavation processes are required to install a steel sheet pile. (1) Casing rotary excavation, soil displacement, soil backfilling (2) Install a steel sheet pile using a press-in machine with pile auger ・Allows excavation of bedrock, large boulders, and boulders as well as ripping of reinforced concrete by applying strong rotation force. ・Generates noise and vibration due to the use of hammer grab for excavation ・A large workspace is required for excavation because a casing rotary excavation machine, crawler crane, backhoe, and other construction machines are used.	・Two excavation processes are required to install a steel sheet pile. ・Construction efficiency is lower than method 1 for excavation of large boulders and boulders. ・A large workspace is required for excavation because a crawler-type base machine (3-point-supported type) crawler crane, backhoe, and other construction machines are used.	・Does not generate noise, vibration, or other pollution because it applies a static-load press-in method. ・Excavation is completed in one process and extra processes (soil displacement treatment, sand replacement, etc.) are not required. ・It has a highly reliable mechanism to firmly hold the pressed-in piles, eliminating any risk of machine overturning. ・Compact machine system allows construction in narrow areas and on slopes. ・High measuring accuracy can be achieved.
Construction period	90 days (132%)	94 days (138%)	68 days (100%)
Estimated cost *1	Excavation + Sand replacement pile = 59.3 million yen Press-in with auger = 6.7 million yen Total = 66.0 million yen (151%)	Excavation + Sand replacement pile = 55.8 million yen Press-in with auger = 6.7 million yen Total = 62.5 million yen (143%)	Press-in with auger = 43.6 million yen Total = 43.6 million yen (100%)
Rating	△	△	◎

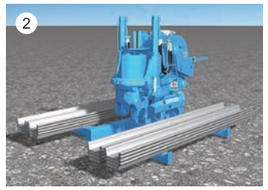
Work conditions	・Used pile material: Steel sheet pile type IV L = 15.0 m ・Installation length: 100 m straight line ・Installed number of sheets: 250 ・Soil conditions: GL to 12.0 m, sandy soil, Nmax < 50 12.0 m to 15.0 m, extrapolated SPT-N value 375 (soft rock, uniaxial compressive strength about 5 N/mm²)

*1 Press-in cost only
(Assembly/disassembly, transportation, and material costs are not included)

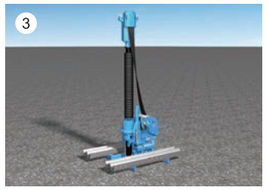
Standard construction process

Initial press-in

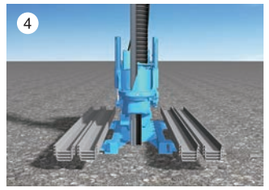
Install press-in machine main body and reaction stand horizontally.



Open the arms and install the counter weights.

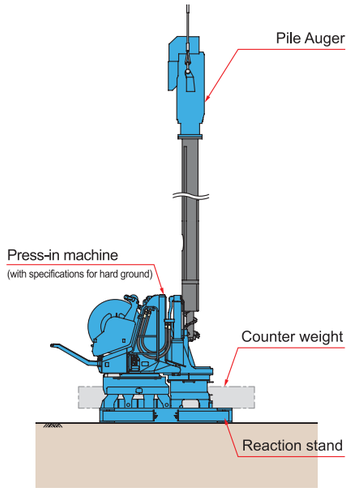


Assemble the pile auger and mount it to the main body.

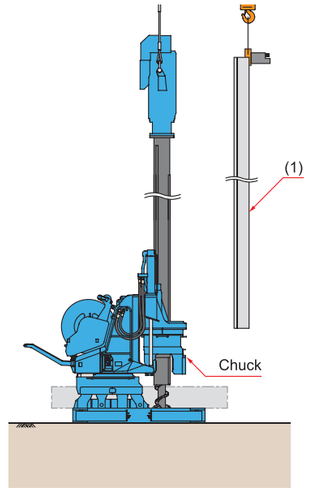


Start the press-in process.

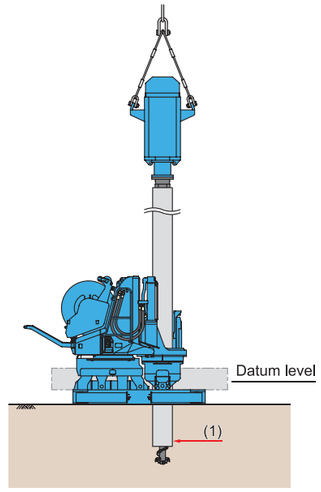
Simultaneous press-in with coring (initial press-in sequence diagram)



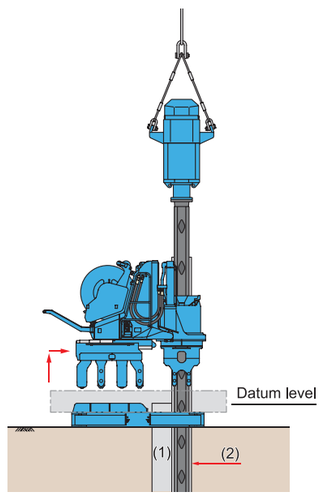
1. Set the reaction stand horizontally on the datum line and install the press-in machine main body, counter weights, and pile auger in that order.



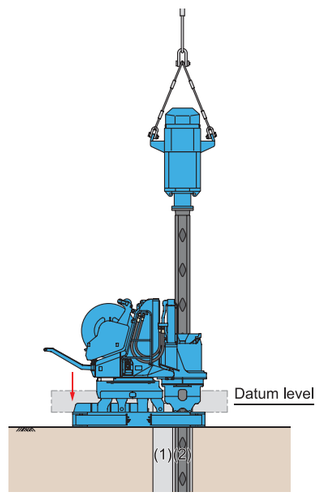
2. Set a steel sheet pile (1) and hold it with the chuck.



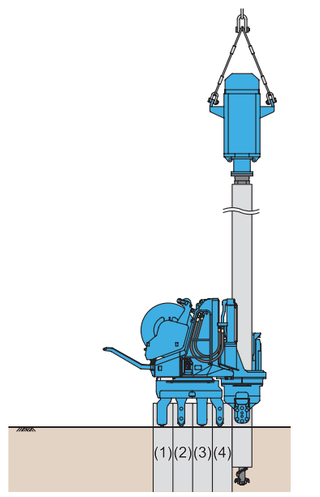
3. After checking the datum line and verticality, start the press-in process



4. Press in the steel sheet pile (1) to the datum level. After extracting the pile auger, repeat steps 2 and 3 and press in the steel sheet pile (2) until the bearing capacity is obtained. Then, perform self-moving of the press-in machine main body.



5. After completing the self-moving, press in the steel sheet pile (2) up to the datum level.

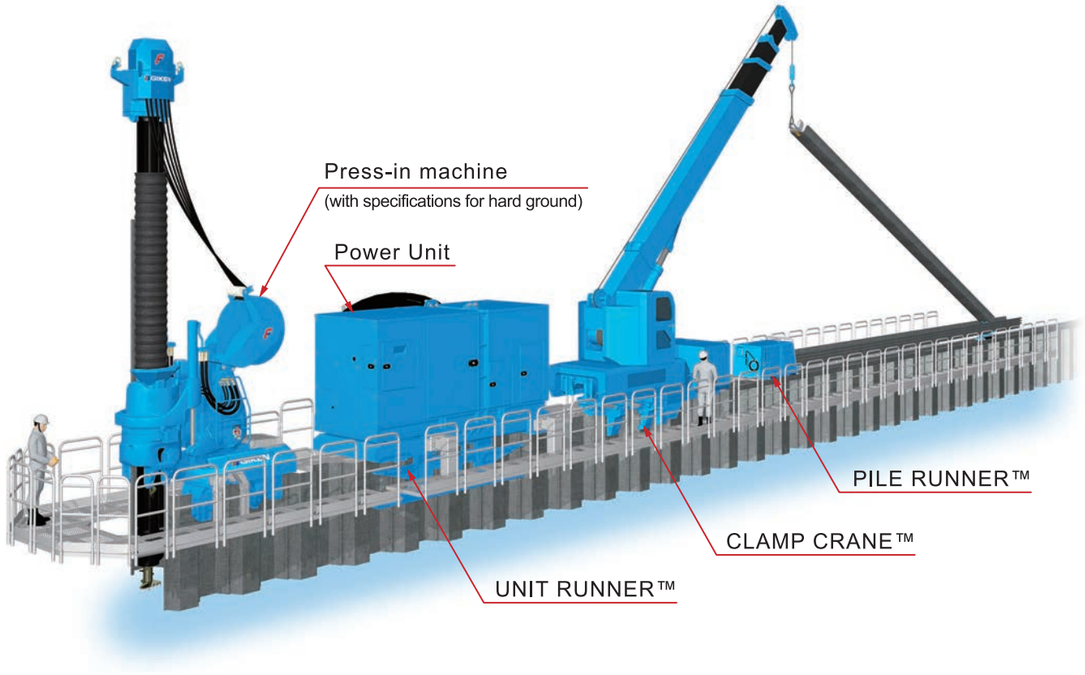


6. Sequentially press in four to five sheets following the previous procedure, remove the reaction stand and counter weights, and complete the initial press-in.

GRB System™

GRB System for Temporary Work-Free Construction

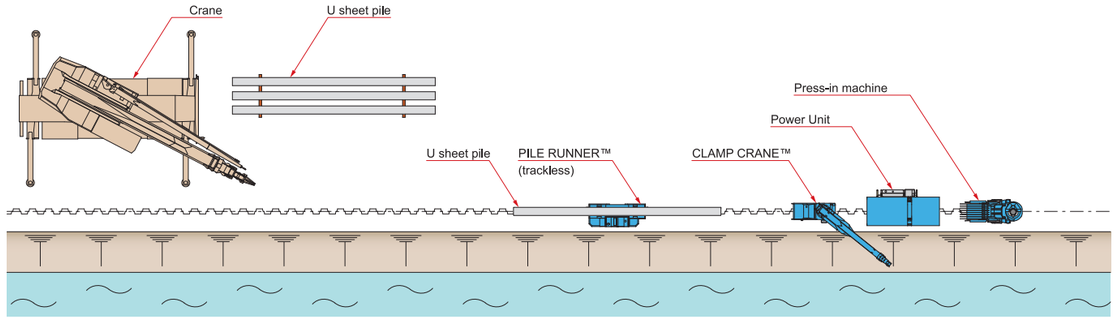
The GRB System is the construction technology that performs all piling works such as pile conveying, pile pitching, and press-in work on top of completed piles. The press-in machine is led by the Power Unit, which is the power source, the CLAMP CRANE™ that pitches piles, and the PILE RUNNER™ that transports piles from the work base, and they perform a series of press-in work on top of piles as a working orbit. All machines are self-supporting by gripping existing piles, eliminating any risk of overturning. Temporary piers or detour roads are not required even on waterfront areas, slopes, uneven terrain, narrow areas, or areas with low overhead clearance since the area necessary for work is minimized to the machine widths. The GRB System eliminates the necessity of temporary work free construction and enables the construction of only the wall structure, which is the original purpose of construction.



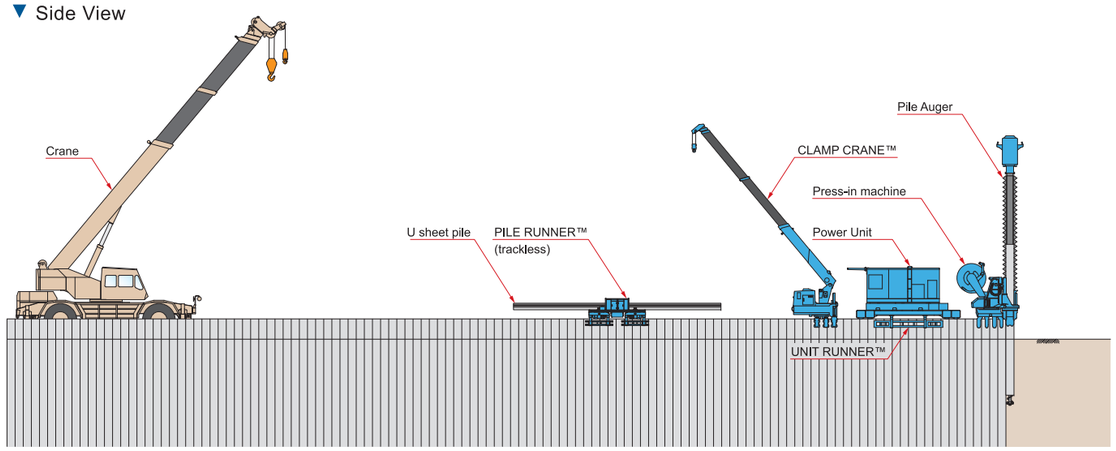
Standard machine layout diagram

GRB System™

▼ Plan View

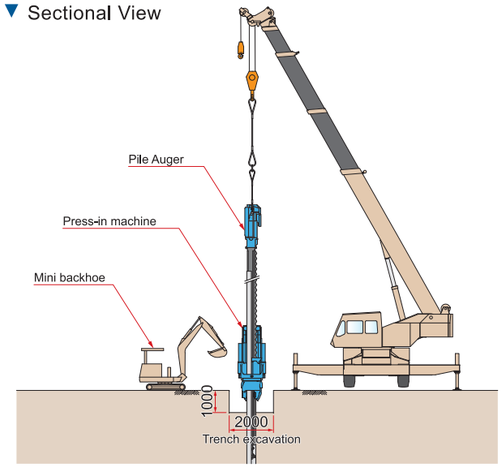


▼ Side View

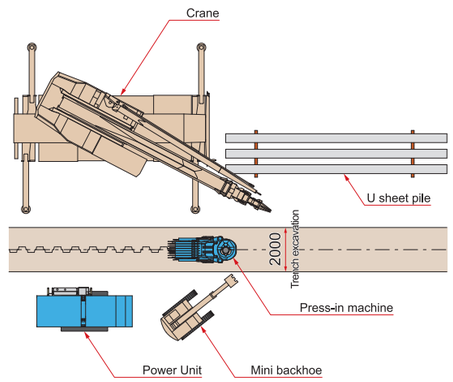


Standard constriction (SMP™)

▼ Sectional View



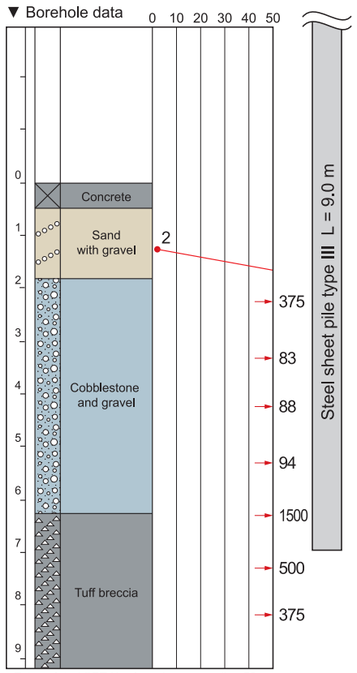
▼ Plan View



Example

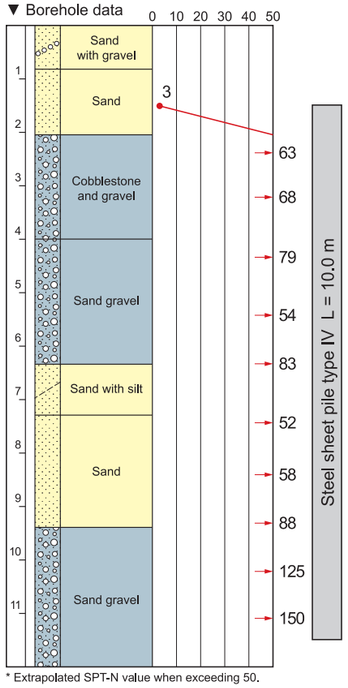
Standard Construction

Example Riverbank reinforcement work — Nagasaki, Japan



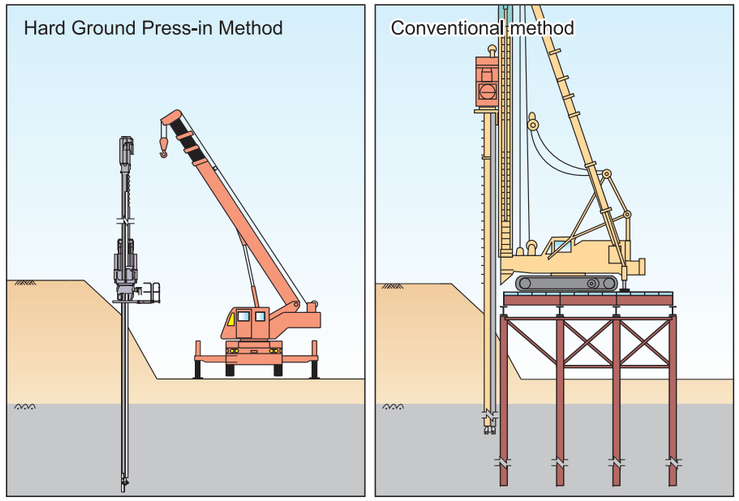
* Extrapolated SPT-N value when exceeding 50.

Example Expressway junction construction — Mie, Japan



* Extrapolated SPT-N value when exceeding 50.

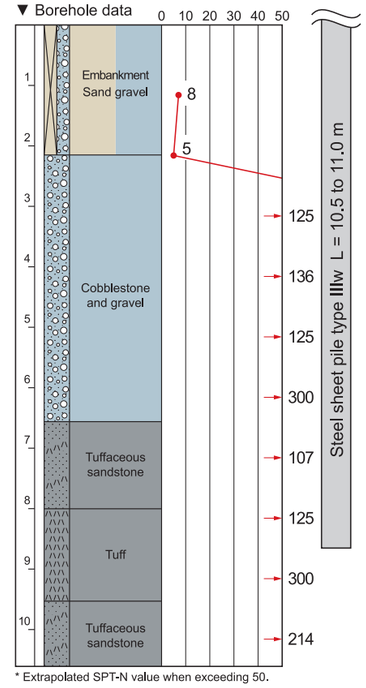
Piling on slopes



For piling on a slope during road improvement and other construction works, piling can be performed while self-moving on top of completed piles, thus eliminating the need for temporary piers and minimizing the effect on the surrounding environment.

Example Road improvement construction on slope — Hokkaido, Japan

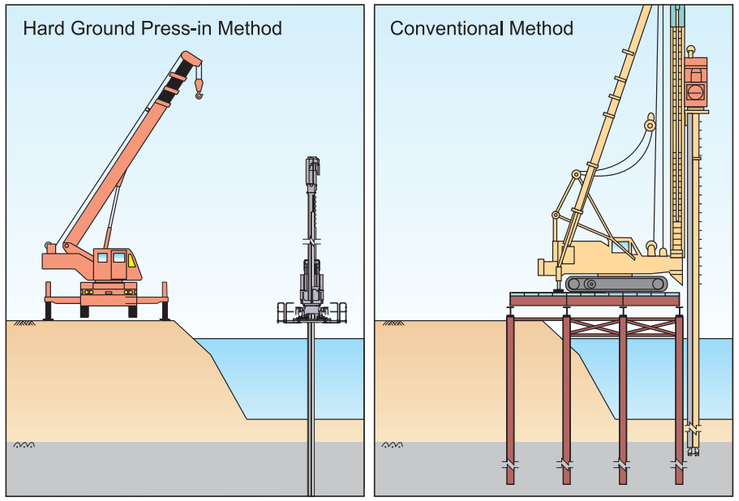
Completed construction at a minimum piling yard with limited effect on the existing transportation and surrounding environment



* Extrapolated SPT-N value when exceeding 50.

Example

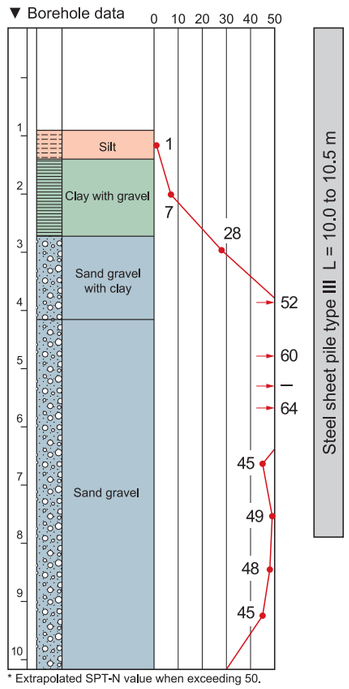
Piling on water



For riverbank reinforcement, temporary cofferdam, and other riverbank construction works, the adoption of the GRB System, which applies system machines that self-drive on completed piles, will eliminate the necessity of temporary piers and significantly reduce the construction period and cost.

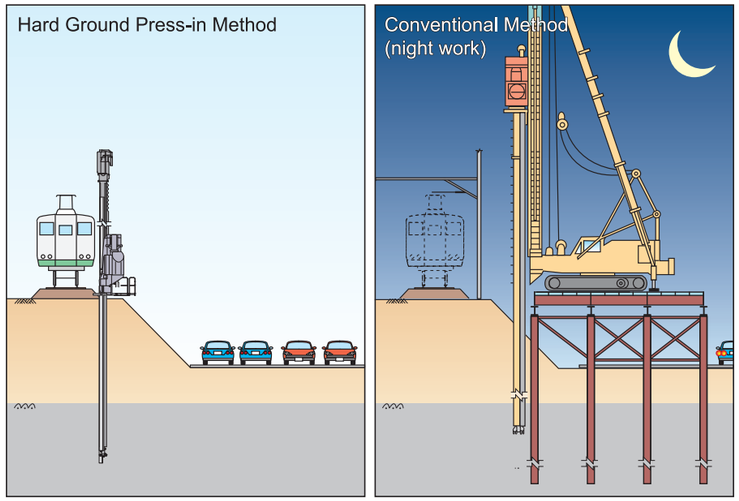
Example Riverbank reinforcement work Hyogo, Japan

By adopting the GRB System, the construction work was completed at a site where heavy equipment could not enter.



* Extrapolated SPT-N value when exceeding 50.

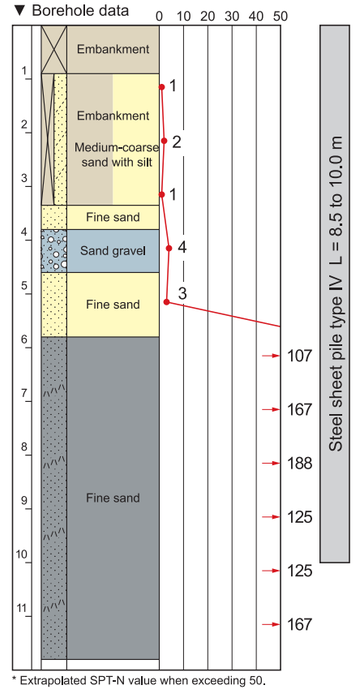
Piling near the railroad



For railroad construction that requires high safety, the Hard Ground Press-in Method using light and compact machines with no risk of overturning enables safe and secure construction work even when the railroad is used.

Example In-service railroad bridge reconstruction Fukushima, Japan

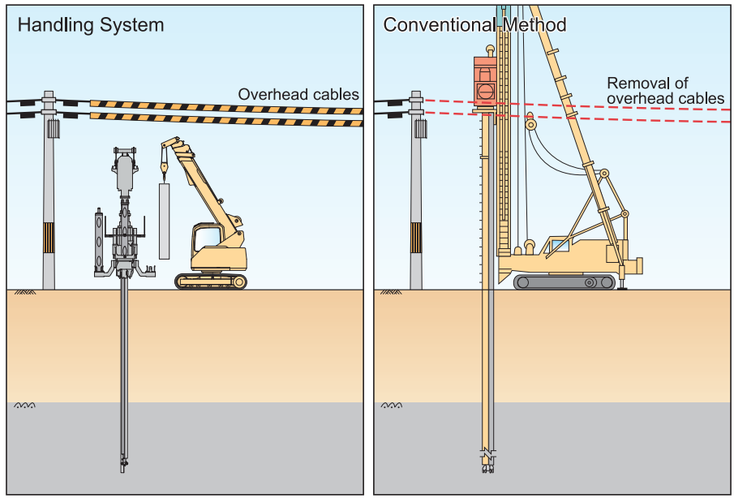
By adopting a method without any risk of overturning, the construction work was completed safely and securely without disrupting train operations.



* Extrapolated SPT-N value when exceeding 50.

Example

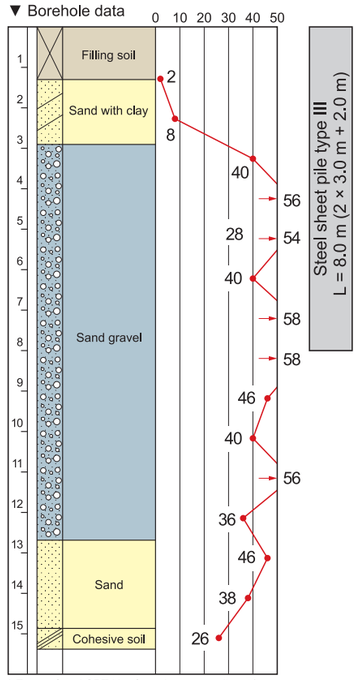
Construction under Overhead Clearance Restriction



By applying compact machines and a dedicated Handling System, the construction work can be performed without removing obstacles at areas with limited overhead clearance due to under girders or overhead cables.

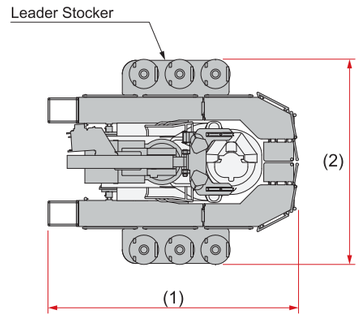
Example Temporary earth-retaining work for bridge construction — Shizuoka, Japan

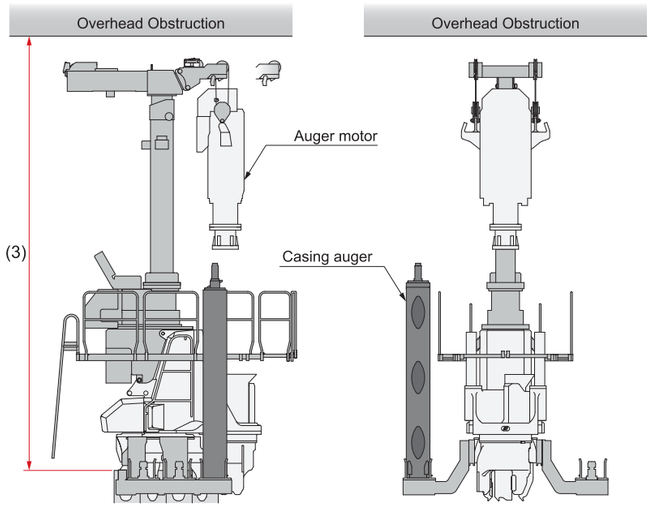
The construction work was completed without removing or relocating overhead cables at an area with low overhead clearance (about 7.5 m).



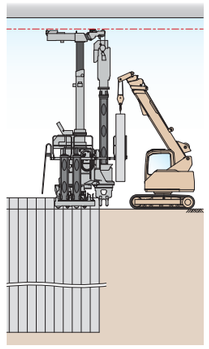
* Extrapolated SPT-N value when exceeding 50.

Handling System

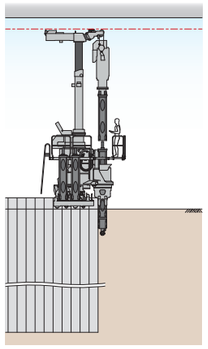




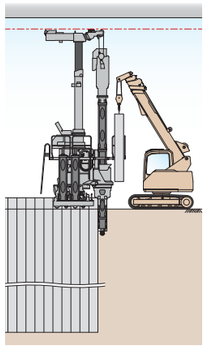
Model	AM95 (for 400 mm-width)	AM100 (for 500 and 600 mm-width)
(1) Total Length	3825 mm	4670 mm
(2) Total Width	3150 mm	3200 mm
(3) Minimum construction height	7000 mm	6700 mm
Mass	4050 kg	5135 kg



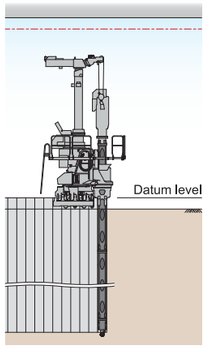
1. Set a steel sheet pile.



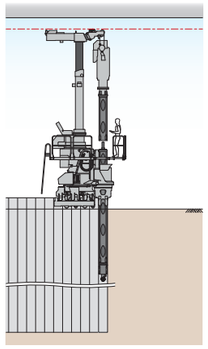
2. After press-in of steel sheet pile, connect the casing.



3. Set the steel sheet pile and perform joint welding.

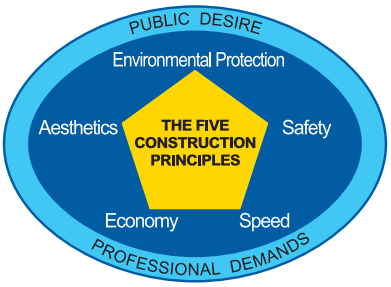


4. Repeat steps 2 and 3. After completing the self-moving, press in the steel sheet pile to the datum level.



5. After completing the press-in work, extract, separate, and remove the casing.

THE FIVE CONSTRUCTION PRINCIPLES



"The Five Construction Principles" are the universal criteria for the construction method selection and construction quality, by considering ideal situations for construction work under public perspective.
In any construction project, the five aspects i.e. Environmental Protection, Safety, Speed, Economy and Aesthetics, should be fulfilled in the form of equilateral pentagon.

Environmental Protection	Construction work should be environmentally friendly and free from pollution.
Safety	Construction work has to be carried out in safety and comfort with a method implementing the highest safety criteria.
Speed	Construction work should be completed in the shortest possible period of time.
Economy	Construction work must be done rationally with an inventive mind to overcome all constraints at the lowest cost.
Aesthetics	Construction work must proceed smoothly and the finished product should portray cultural and artistic flavour.

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Ver 1.0EN01 / 31 Oct 2024