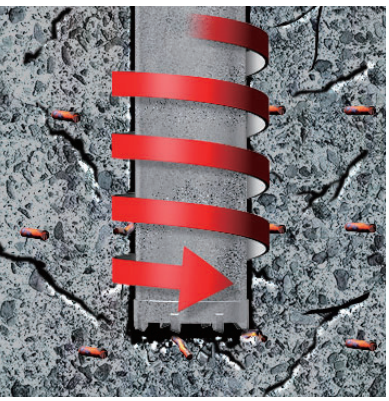
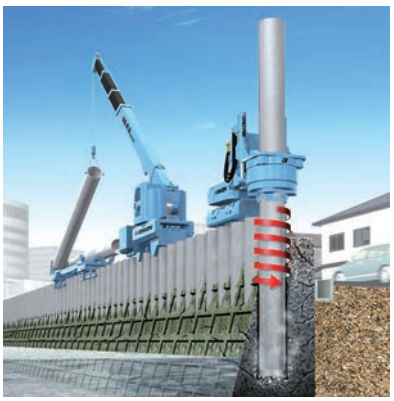
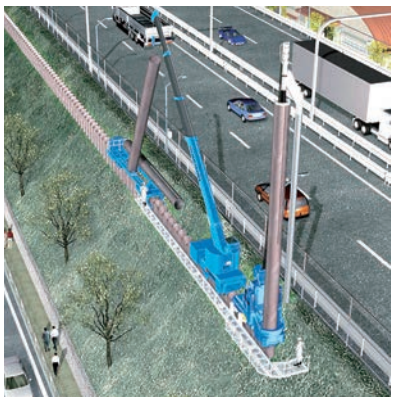
Construction Revolution

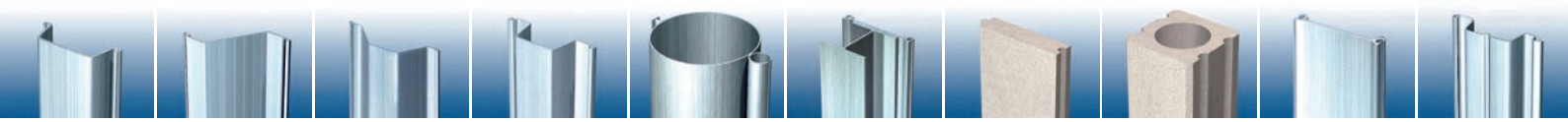
Press-in Method Variations

# SILENT PILING TECHNOLOGIES







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SILENT PILING TECHNOLOGIES

## Contents



## Features of the Press-in Method


When making a brief statement about the features of the Press-in Method, "Implant™ Structure can be constructed under any working conditions while preserving the Five Construction Principles". Features of the construction method are defined based on the "Five Construction Principles" and they are indicated in the following tables. The Press-in Method incorporates design features for evaluation of pile performance. This is a 'revolutionary' approach where structural design is directly based upon results of pile load tests at site according to the principles of the Press-in Method.

### Environmental Protection

**Vibration-Free, Noise-Free,**
In the Press-in Method, piles are installed by static load without noise and vibration so that construction work doesn't disturb neighbouring residents' daily life.

**Minimum Working Extent**
It is possible to minimise the influence range of construction works by utilising light-weight and compact press-in machines and well developed systemised equipment.

**No Physical Influence on Surrounding Environment**
The Press-in Method minimises the impact on the surrounding environment, such as ground subsidence and cracking in adjacent structures.

**Extreme Reduction of Environmental Burden**
The systemised equipment eliminates temporary works which are the cause of environmental destruction in construction works, so that environmental burden is significantly reduced.

### Safety

**Stable and Strong Wall Structures**
Highly reliable and strong wall structures are achievable, as factory produced high quality piles are continuously and directly pressed-in.

**No Machine Overturning**
There is no risk of machine overturning, since the press-in machine main body and system equipment grip piles which have been completely driven into the ground.

**Safety Mechanism with Hydraulic System**
The pile being pressed in is securely held at the bottom of pile with hydraulic jacking forces. This creates a safe construction environment as piles will not come into contact with surrounding structures.

**Remote Radio Control**
Since the press-in machine main body is operated by radio control, the operator and other workers can operate in safe working conditions even under physically restricted working conditions.

### Speed

**The Simplest Work Processes**
It is possible to complete construction works without ancillary equipment in the shortest possible duration, even if there are strict working restrictions or the piling alignment is very complicated.

**Self-Walking Machinery**
It is possible to significantly reduce construction duration, since all systemised machinery has respective self-walking functions which provide efficient and rational working conditions.

**No Working Hour Limitation**
Non-polluting press-in construction can be carried out anytime, even in areas with strict rules on the surroundings or at night when noise is not permitted. Rapid construction is, therefore, possible.

**Multiple Units Operations**
Since the system equipment is light weight and compact, it is possible to use multiple units at the same time. It can be used for emergency works, such as disaster recovery projects.

### Economy

**Standardisation of Pile Material**
The use of standardised pile types increases the efficiency and cost-effectiveness of on-site works.

**Cost Reduction by Temporary Work-Free Construction**
Construction cost is greatly reduced since it does not require ancillary facilities for conventional piling works, such as temporary platform, earth works, road diversion, scaffolding and other necessary works.

**Labour-Saving & Energy Saving**
Simple, systemised construction based on energy-saving set-ups with press-in machines and cranes for lifting piles requires minimum manpower.

**No Disturbance to Urban Function**
There is no disturbance to active traffic and existing bridges so that construction works never disturb urban function, as the Press-in Method can minimise working extent.

### Aesthetics

**Simple Systemised Construction**
Construction work can be carried out efficiently by selecting the most appropriate construction system to meet the requirements of the project.

**Easy Handling**
The pile top elevation and pile alignment can be controlled accurately and freely enough to successfully construct complicated wall structures such as curve alignments, corner alignments and cofferdams.

**High-Quality Pile Wall Structure**
Pressed-in piles, pushed through the soil and penetrated into the ground, become a high-quality, aesthetic Implant™ Structure wall body.

**Harmonised Appearance**
Structures can be harmonised into surrounding scenery to construct culturally acceptable structures by applying decorative panels on piles or wall structures after piling work is completed.

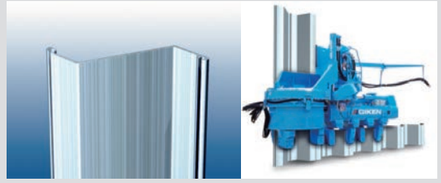
# Press-in Method

The appropriate use of press-in piles can create continuous pile walls suitable for construction purposes, structural function, quality, and scenery.

## U Sheet Pile

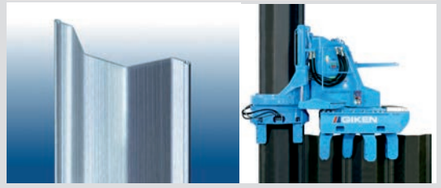
## H Sheet Pile

## Z Sheet Pile



## Concrete Sheet Pile

## Hat Sheet Pile



## PC Pile

## Zero Sheet Pile (Hat)

## Straight Web Sheet Pile (Ring Method)

## Tubular Sheet Pile

## Trench Sheet Pile

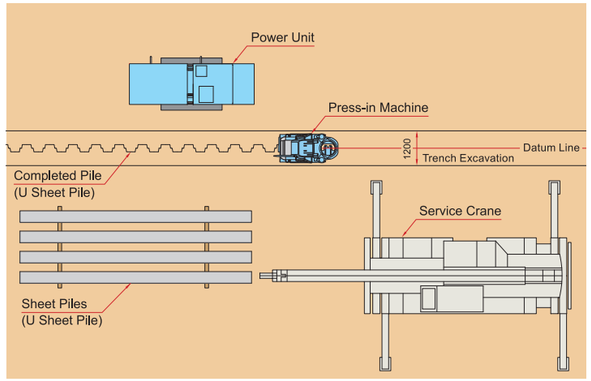


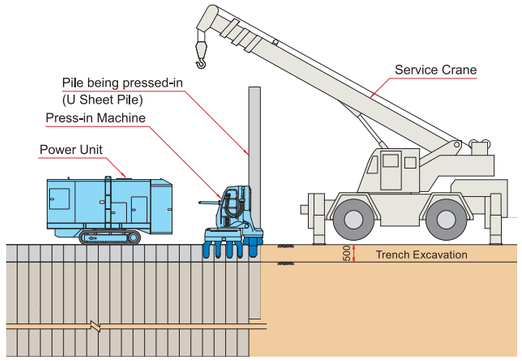




## Standard Machine Layout

The Press-in Principle utilises the reaction force derived from fully installed piles, which are anchored to the ground and are regarded as a united part of the Earth to install subsequent piles with a hydraulic system. Hence, A press-in machine is small and light weight, and can walk along the completed piles on its own while holding them. For sheet piling work, it requires just one service crane to pitch sheet piles.



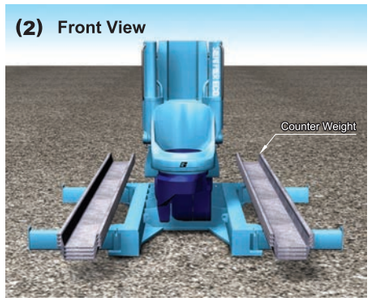

## Initial Press-in

At the beginning of any press-in work if there are no completed piles, then a "Reaction Stand" is usually used for initial piling work. The Press-in Machine is horizontally set onto the Reaction Stand and then counter weights are loaded onto the Reaction Stand. Counterweight mass is dependent on soil conditions and pile length. The first pile is then pressed-in utilising the combined weight of the machine and counter weight as a reaction force. After installing the first pile, the installed pile becomes the first reaction pile for installing the second pile. Once the press-in machine completely sits on top of the reaction piles, the Reaction Stand and counterweights are removed. The initial piling work is then completed.

**(1)**

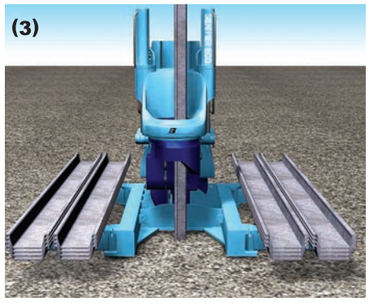

Set the press-in machine main body and the Reaction Stand horizontally.

**(2)** Front View



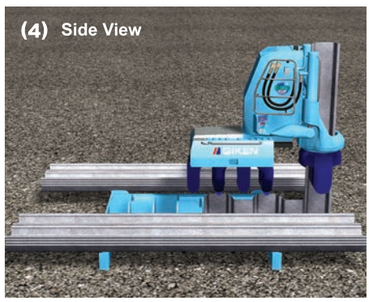

Set counterweights.

**(3)**



Pitch the first pile and start pressing-in.

**(4)** Side View



Install the prescribed number of piles.

**(5)**

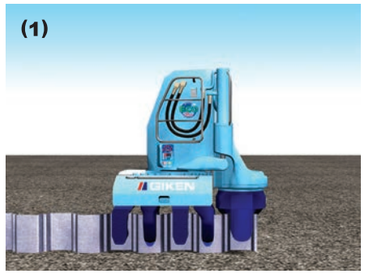
Remove the counterweights.

**(6)**

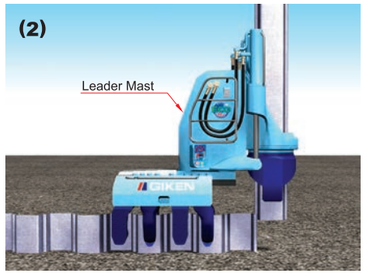
Remove the Reaction Stand, and the initial piling is completed.

## Press-in Working Procedure / Self-Moving

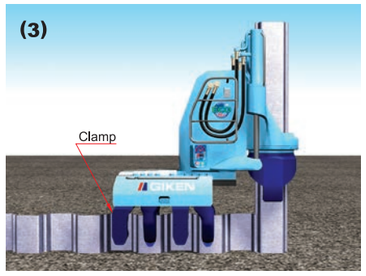
After pressing-in the pile into the prescribed depth, move the Leader Mast forward and hold the next pile, and then start pressing-in. When the pile is installed enough to support the press-in machine main body, open the Clamps, uplift the press-in machine, and move the Saddle forward by several piles. Lower the press-in machine main body at the next reaction pile position, check the levelness, close the Clamps to secure a new reaction base, and continue to press-in the pile into the ground. This is repeated in the press-in process, and the process of moving the press-in machine main body forward is called "Self-moving".



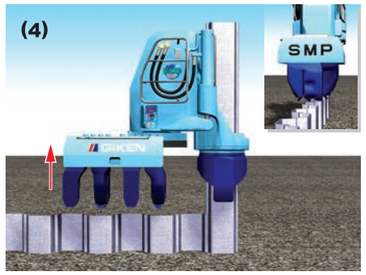
Press-in a pile to prescribed depth.



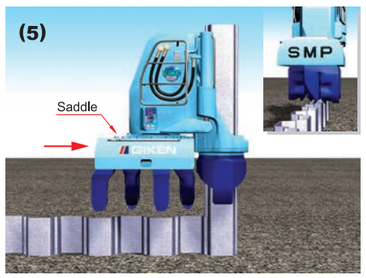
Pitch the next pile and start pressing in.



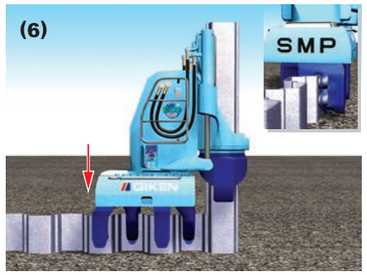
Press-in the pile until it becomes sufficiently stable.



Open the Clamps and then raise the press-in machine main body.



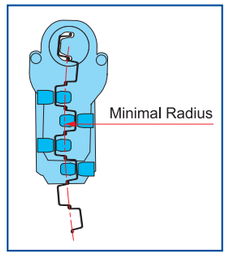
Move the Saddle forward and change the Clamps positions.



Lower the press-in machine main body and close the Clamps. Then, self-moving is completed.

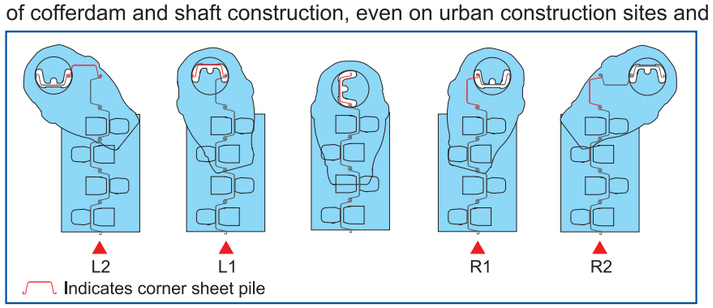
## Curve Installation

Chuck Rotation, Mast Rotation, Clamp Left/Right mechanisms are equipped on the press-in machine main body. These functions enable installation of piles for curved or complicated alignments. The minimal piling radius differs from the pile sections and press-in machine specifications.




## Corner Installation

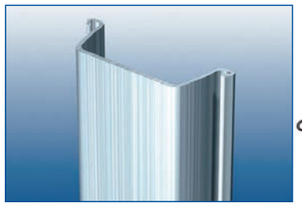
The press-in machine has "Corner Four (C4)" mechanism as standard, which allows continuous press-in and extraction of two steel sheet piles on each side at right angles to the piling direction from a single position. The press-in machine remains in the same position and can press in up to a second sheet pile (L2/R2) in the piling direction around the corner. Additionally, when changing direction, two sheet piles can be pressed in as reaction piles on the trailing side (opposite the piling direction). This C4 mechanism allows for safe and efficient construction of cofferdam and shaft construction, even on urban construction sites and narrow sites.

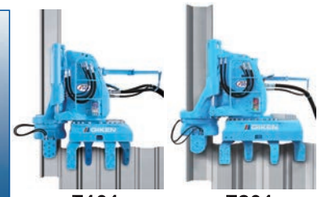







## U Sheet Pile Press-in Method

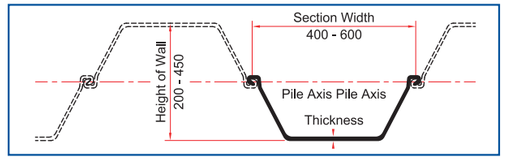





### U Sheet Pile

The U Sheet Pile was the world's first rolled sheet pile developed in Germany in 1902 and has been utilised for over a century. There is a range of U sheet piles available, starting from ordinary 400 mm ones for diversion purposes to wider 600 mm ones with higher sectional performance per steel weight for better economy. Specialised press-in machines are available for both domestic and foreign U sheet piles ranging from 400 mm to 600 mm.

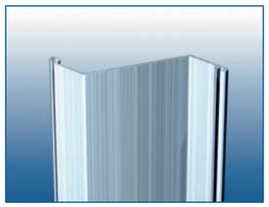
**Standard Cross-Section**

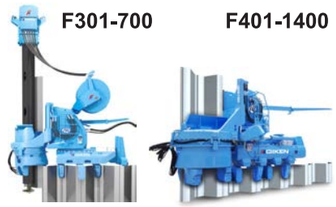



**Sectional Performance**

| Model | Section Width | Height of Wall | Thickness | Per 1 m of Wall | | | |
|---|---|---|---|---|---|---|---|
| | | | | Mass per Unit Length | Sectional Area | Moment of Inertia | Section Modulus |
| | mm | mm | mm | kg/m² | cm²/m | cm⁴/m | cm³/m |
| II | 400 | 200 | 10.5 | 120 | 153.0 | 8740 | 874 |
| III | | 250 | 13.0 | 150 | 191.0 | 16800 | 1340 |
| IV | | 340 | 15.5 | 190 | 242.5 | 38600 | 2270 |
| VL | 500 | 400 | 24.3 | 210 | 267.6 | 63000 | 3150 |
| VIL | | 450 | 27.6 | 240 | 306.0 | 86000 | 3820 |
| IIW | 600 | 260 | 10.3 | 103 | 131.2 | 13000 | 1000 |
| IIIW | | 360 | 13.4 | 136 | 173.2 | 32400 | 1800 |
| IVW | | 420 | 18.0 | 177 | 225.5 | 56700 | 2700 |

## Z Sheet Pile



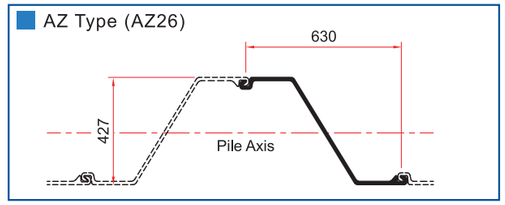



### Z Sheet Pile

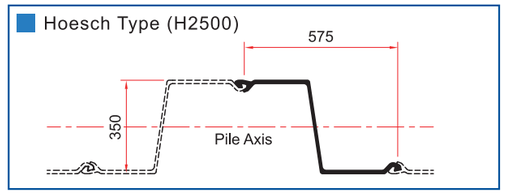
The Z sheet pile was developed in Germany in 1926 and has the shape in which its interlock part is located out of the neutral axis to the most exterior edge. In Europe, the design shifted to a fully-fledged, broad and wide configuration in 1990; allowing the cross section performance per steel weight to remarkably exceed U sheet piles, and today it has become a mainstream use for constructing permanent structures. Some models of press-in machines can install double Z sheet piles, up to a width of 1416 mm.

**Standard Cross-Section**

AZ Type (AZ26)



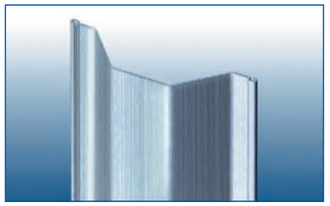

Hoesch Type (H2500)

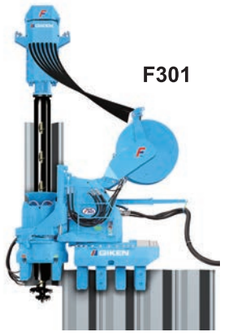


## Hat Sheet Pile Press-in Method

### Hat Sheet Pile 900

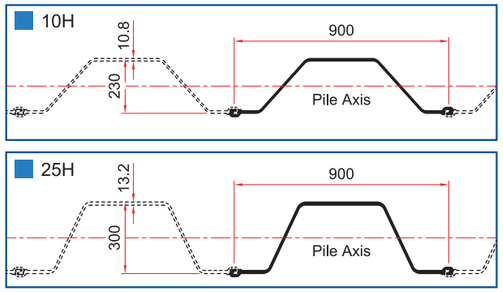
The section modulus of the Hat Sheet Pile 900 exceeds the U Sheet Piles which were mainly used for shore protection, pier and temporary retaining walls. It was developed for wider applications in permanent structures and has better drivability, structural reliability and economical impact. Dedicated press-in machines can install piles with better drivability and installation quality by generating a greater reaction base and dual press-in points.





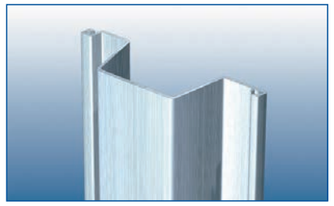
F301

**Standard Cross-Section**




| Model | Per 1 Sheet | | | | Per 1 m of Wall | | | |
|---|---|---|---|---|---|---|---|---|
| | Mass per Unit Length | Sectional Area | Moment of Inertia | Section Modulus | Mass per Unit Length | Sectional Area | Moment of Inertia | Section Modulus |
| | kg/m | $cm^2$ | $cm^4$ | $cm^3$ | $kg/m^2$ | $cm^2/m$ | $cm^4/m$ | $cm^3/m$ |
| 10H | 86.4 | 110.0 | 9430 | 812 | 96.0 | 122.2 | 10500 | 902 |
| 25H | 113.0 | 144.4 | 22000 | 1450 | 126.0 | 160.4 | 24400 | 1610 |

## Zero Clearance Method

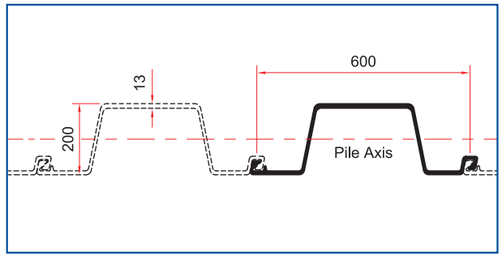


JZ100

### Zero Sheet Pile

This sheet pile was co-developed by NIPPON STEEL CORPORATION and GIKEN LTD. in 1996 for sheet piling with zero clearance to existing structures or boundaries. The Zero Sheet Pile has an asymmetrical Interlock and has the Hat shape. Hence, its interlock efficiency is 100 % like Z sheet piles. Specialised press-in machines can carry out piling with zero clearance called "Zero Clearance Method".

**Standard Cross-Section**




**Cross Section Performance**

| Model | Per 1 Sheet | | | | Per 1 m of Wall | | | |
|---|---|---|---|---|---|---|---|---|
| | Mass per Unit Length | Sectional Area | Moment of Inertia | Section Modulus | Mass per Unit Length | Sectional Area | Moment of Inertia | Section Modulus |
| | kg/m | $cm^2$ | $cm^4$ | $cm^3$ | $kg/m^2$ | $cm^2/m$ | $cm^4/m$ | $cm^3/m$ |
| NS-SP-J | 87.3 | 111.2 | 7250 | 705 | 145 | 185.3 | 12090 | 1175 |





## Tubular Sheet Pile Press-in Method

**F301-G1000**
D600,800,1000

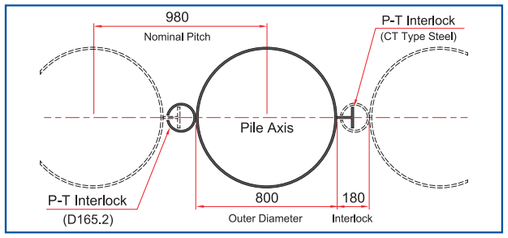
**F401-G1200**
D800,1000,1200

**F501-G1500**
D1200,1500

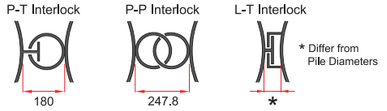
### Tubular Sheet Pile

Tubular sheet piles have high strength and increased durability. They are suitable for construction works to protect against floods/tidal waves, countermeasures for rivers, and reinforcement of bridge foundations. By selecting the appropriate pile diameter and thickness, it is possible to flexibly meet design requirements and efficiently and economically construct a wide variety of structures for different purposes. The current models of the press-in machines can handle 500-1500 mm pile diameter tubular sheet piles.

Standard Cross-Section (D800 mm, P-T Interlock )

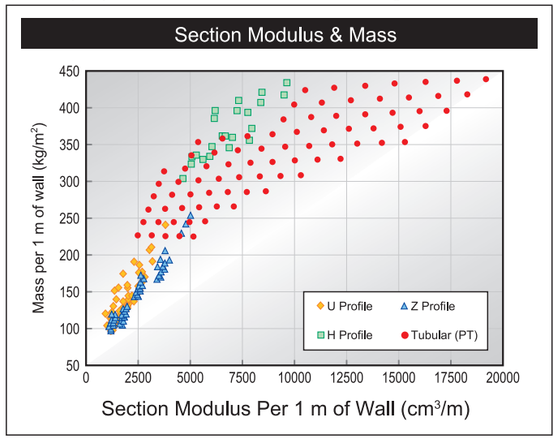


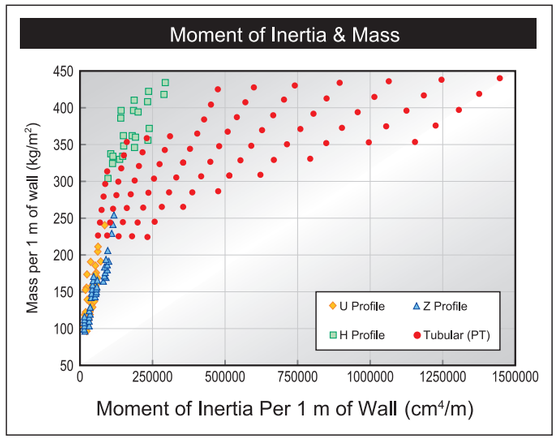

Interlock Shape



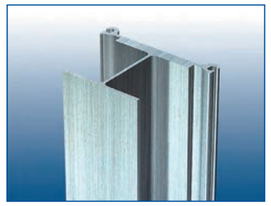

### Cross Section Comparison with Major Piles

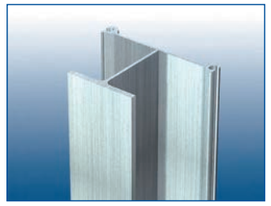
Four typical pile sections of major press-in pile types are presented according to section performance and steel weight in the following figures. In comparison to U sheet piles and Z sheet piles, H sheet piles and tubular sheet piles clearly demonstrate higher section performance. Tubular sheet piles, in particular, can be considered an economically superior piling material if wall thickness is not an issue, as the steel weight is hardly increased compared to H steel sheet piles, even with higher cross-sectional performance. It is important to select the appropriate pile type depending on the purpose and the construction design.



## H Sheet Pile Press-in Method



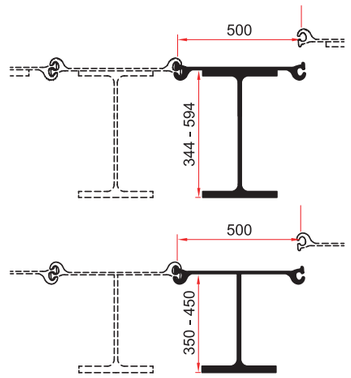


HP150

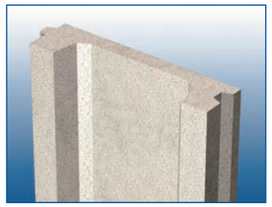
### H Sheet Pile

H sheet piles are used for deep foundations in urban development projects. It has high strength and rigidity with thinner wall thickness. The double interlock type is superior in water cutoff performance, and the single interlock type is applicable for curve alignment installation. The press-in machines for H sheet piles are currently available within a wall height of 600 mm.

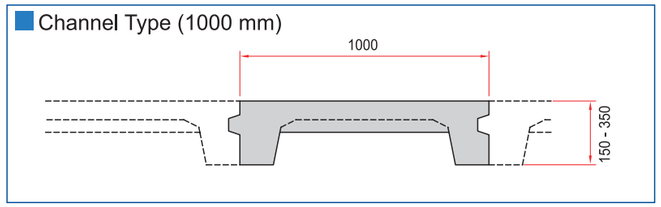
**Standard Cross-Section**




## Concrete Sheet Pile Press-in Method



CP80

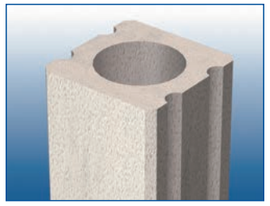




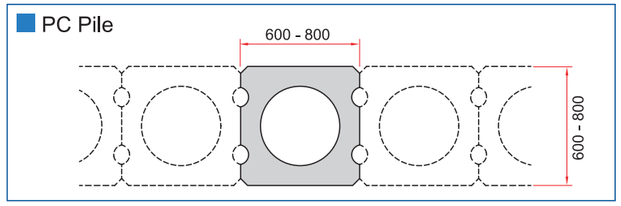




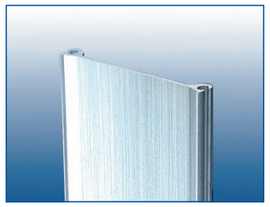
## PC Pile Press-in Method



CHP130



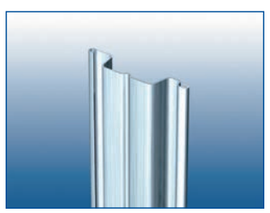

## Straight Web Sheet Pile Press-in Method (Ring Method)



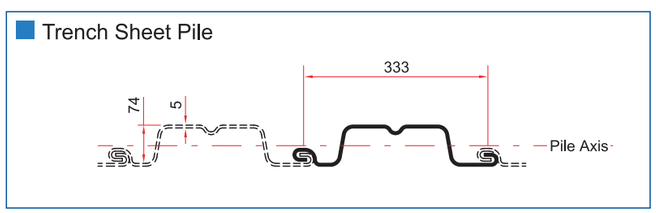
Straight Web Sheet Pile
Dedicated Press-in Machine

Ring Method is described on Page 19

## Trench Sheet Pile Press-in Method



STP30



## SILENT PILER Models & Applicable Piles

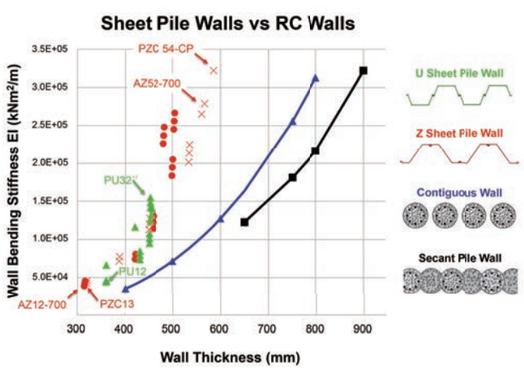
| SILENT PILER™ Model | U Section (width : mm) | | | | Hat Section (width : mm) | Z Section (width : mm) | |
|---|---|---|---|---|---|---|---|
| | 400 | 500 | 600 | 750 | 900 | 575 - 708 | |
| | | | | | | Single | Pair |
| F111 | ✔ | | | | | | |
| F201 | ✔ | ✔ | ✔ | | | | |
| F301-700* | | | ✔ | ✔ | | ✔ | |
| F301-900 | | | | | ✔ | | |
| F401-1400 | | | ✔** | | | | ✔ |

* : F301-700 is Capable of installing Universal Columns(20”×28”-30”×12”).
**: Paired sections only.

## GYRO PILER Models & Applicable Piles

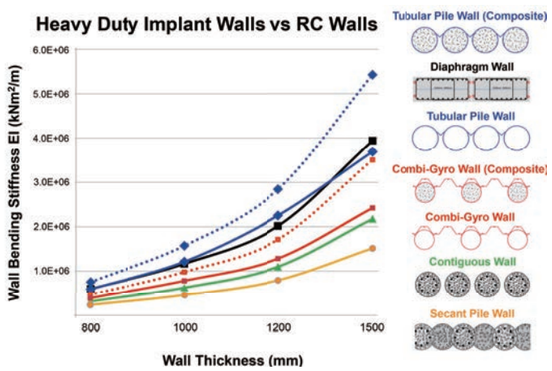
| GYRO PILER™ Model | Tubular Pile (diameter : mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 600 | 800 | 1000 | 1200 | 1500 | 2000 | 2500 |
| F301-G1000 | ✔ | ✔ | ✔ | | | | |
| F401-G1200 | | ✔ | ✔ | ✔ | | | |
| F501-G1500 | | | | ✔ | ✔ | | |
| GRV2540 | | | | | | ✔ | ✔ |

## Wall Properties

















## Environmentally-Friendly Press-in Machine

### Standard Adoption of Biodegradable Hydraulic Oil

The current models of GIKEN press-in machines adopt PILER ECO™ Oil, a biodegradable hydraulic oil designed for press-in machines, and PILER ECO™ Grease, jointly developed by GIKEN LTD. and a Japanese petroleum manufacturer. If biodegradable oil happens to be spilt into soil or water, it does not harm the surrounding ecosystem.


**GIKEN Genuine Products**

- Developed only for SILENT PILER™
- Excellent Biodegradability & Non Toxic Performance
- High Lubricity and Fire Retardant Properties

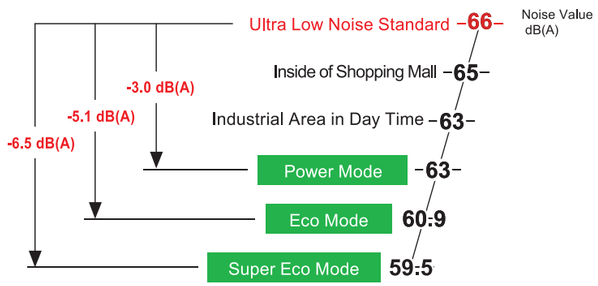
**Label of Biodegradable Oil**


### Environmentally-friendly Power Unit

**Low Emission Engine**
A new generation of ecofriendly engines with Urea-SCR system ensures a high level of environmental friendliness. In addition, a cooling fan hydraulic drive system has been adopted to reduce noise and improve fuel efficiency.

**Ultra-Low Noise Design**
It stays well below the sound pressure level of 66 dB, the ultra-low noise standard of Japanese MLIT.


Photo shows EU300 engine unit of F series




## New GIKEN IT System

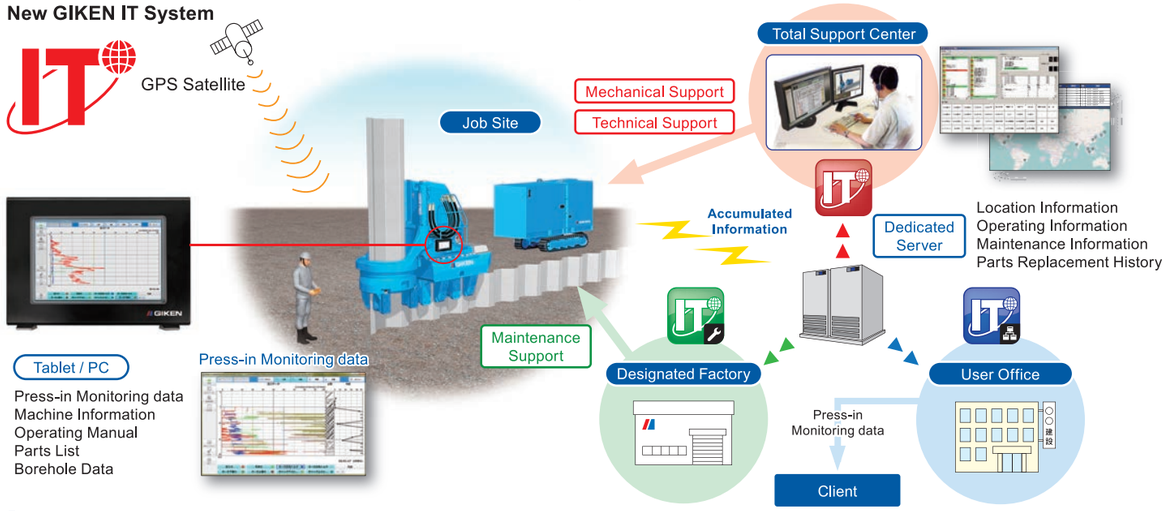
In this system, location, maintenance and operating information on press-in machines operating worldwide are automatically stored on a dedicated server. By analysing such information, it is possible to effectively receive technical and mechanical support as well as accurate decisions and responses to problems.

* The system is not available in the countries where authorisation for usage cannot be acquired.

### Establishing trust with Press-in Monitoring Data

The press-in monitoring system records the construction status of each steel sheet pile (press-in force, auger torque, and working hours of press-in work), which provides evidence of the press-in performance and facilitates scientific construction management. Additionally, with the newly adopted tablet G-terminal™, the operator can review the press-in monitoring data in real-time while installing piles.

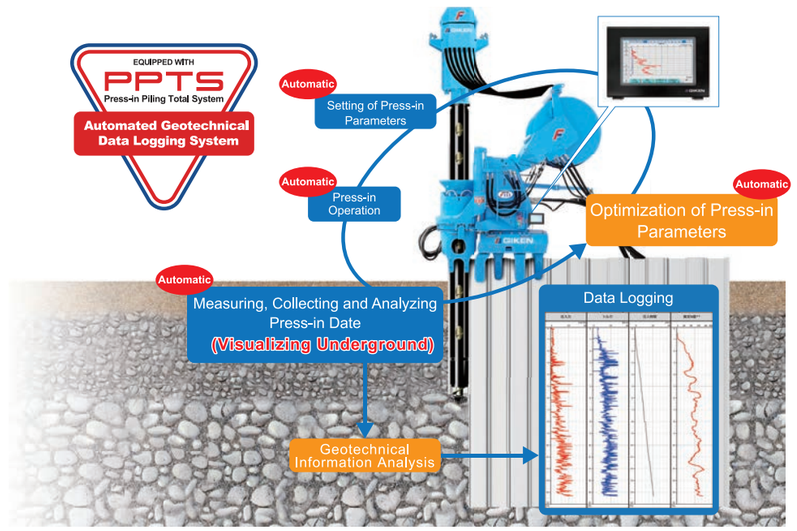
**New GIKEN IT System**

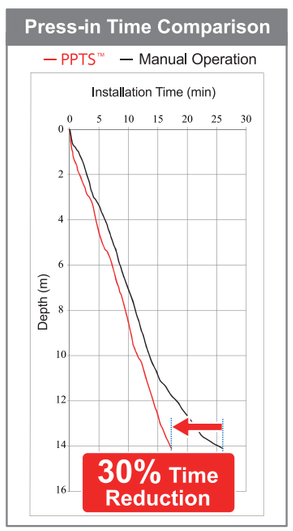



## The PPT System™

### Increasing piling productivity by decreasing operator workload

The PPT system™ (Press-in Piling Total System) estimates ground information from data collected during the installation of piles, and the press-in machine itself evaluates the state of construction and performs the optimum automatic operation. This feature ensures that the installation process is both accurate and efficient, regardless of the operator's level of expertise. As a result, press-in time can be reduced by 30% (in-house comparison). This not only lightens the load on operators but also contributes to greater productivity and lower labour costs at construction sites.



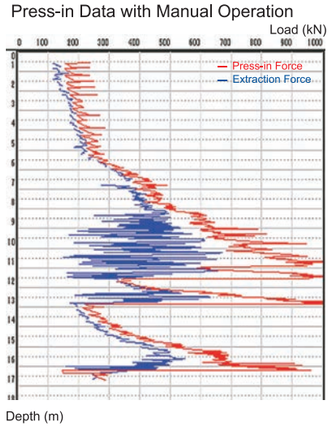




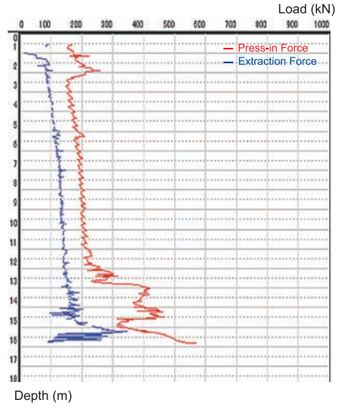

## Automatic Press-in Operation System

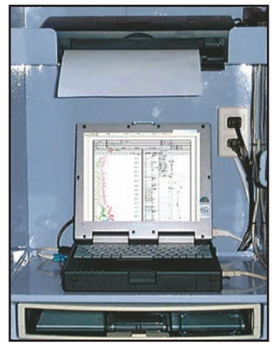
In the Press-in Method, piles are repeatedly pressed-in and extracted during installation in order to reduce penetration resistance. This installation procedure is necessary to construct high quality wall structures. It is important to determine the most effective combination of press-in stroke, extraction stroke and maximum press-in force in every ground condition and pile length. The scientifically optimal operation is available by using the Automatic Press-in Operation System, which can provide the best combination of operation variables. The data of the press-in operation below shows the difference between manual operation and automatic operation at the same ground condition.

Press-in Data with Manual Operation




Press-in Data with Automatic Operation



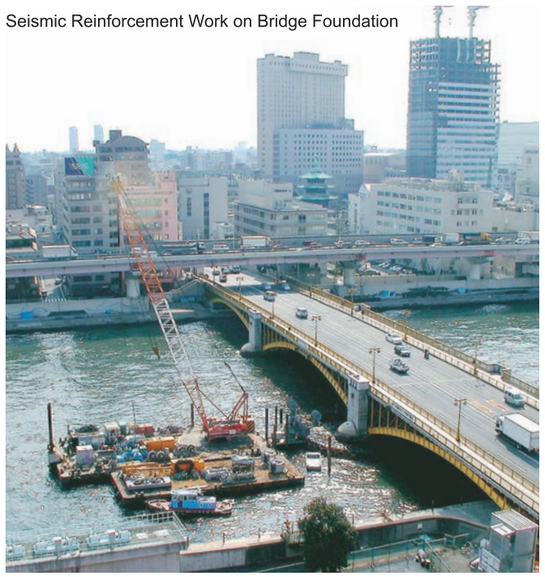



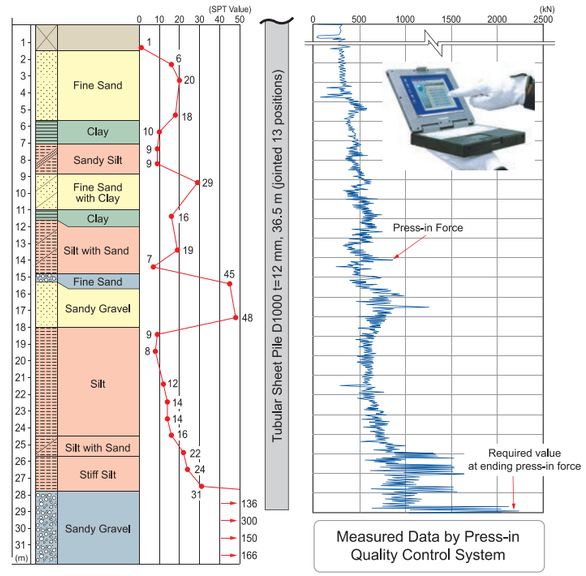
The press-in condition can be monitored in real time with a lap top computer connected to Power Unit.

## Press-in Quality Control System

In the Press-in Method, each pile is pushed into the ground by static load, and forms a pile foundation. It can be beneficial to carry out load tests for superstructures during piling work. It is possible to monitor real time conditions of the press-in force, skin friction of pile, toe resistance of pile, penetration depth and operation time, because SILENT PILER controls pile behaviour by a hydraulic system. Since such records are pertinent to the finished quality of the foundation, it is possible to plan a "optioneered" design which emphasises actual performance of the pressed-in piles. This is a remarkable feature of the pressed-in pile and will be the major design trend of "Performance-Oriented Design". The Press-in Quality Control System can control piling performance based on such measured information and it can be the testament of pile quality.

Seismic Reinforcement Work on Bridge Foundation






Measured Data by Press-in Quality Control System

# Press-in System

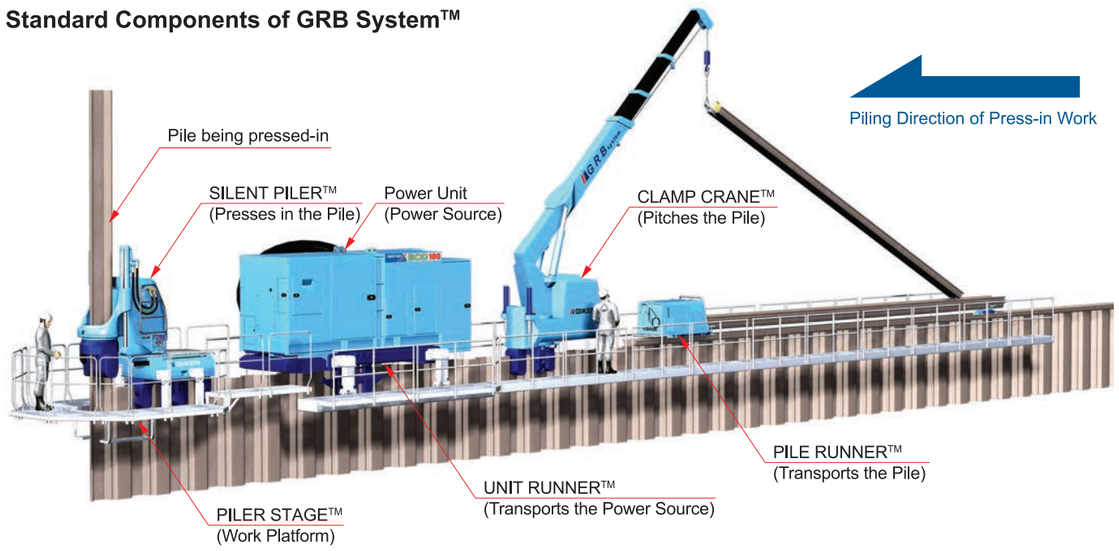
Temporary Work-Free Construction Constructs Press-in Pile Continuous Wall while Overcoming Various Site Conditions.

## GRB System™

### GIKEN Reaction Base System

The Press-in machine utilises the reaction force from installed piles integrated with the Earth to carry out piling work on top of the installed piles. With further development based on the principle of "reaction based mechanism", the "GRB System" was developed as a press-in system which carries out all piling procedures, such as pile transportation, pile pitching and press-in work on top of the installed piles.
The GRB System consists of a press-in machine at the front, Power Unit as a power source, CLAMP CRANE™ to pitch piles and PILE RUNNER™ to convey the piles from the work base platform.

**Standard Components of GRB System™**




### Temporary Work-Free Construction

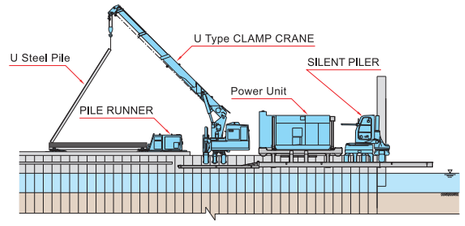
Since conventional piling methods require other heavy equipment in addition to the piling rig, massive temporary facilities are needed depending on site conditions. However, temporary works are not necessary in principle, because they are construction works for the permanent structure. If a construction method requires huge amounts of time and money for temporary work, then the method has a fundamental problem and it will never fulfil the Five Construction Principles. On the other hand, the GRB System doesn't require temporary working platforms or road diversions even for unstable ground conditions, narrow locations, onwater, on slopes, and for other restricted site conditions, as it carries out all piling works on top of the completed piles. The GRB System satisfies the Five Construction Principles at all levels by providing solutions to construct only the permanent structures. Accordingly, it achieves fundamental purposes of construction works without any negative effects on neighbours and active traffic even in emergency restoration works of river embankments or in very narrow site conditions.

**Build up Implant Structure Bank Protection with Kasetsu-less Construction**

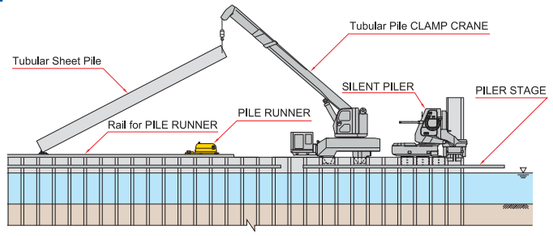
## Non-Staging Method

In conventional construction on water and sloping ground, large-scale temporary works such as temporary piers are essential. However, in the Non-staging Method, all the press-in piling equipment advances along the top of the completed pile as a working orbit, making it possible to carry out only the wall construction, which is the original purpose, in a beneficial manner. This approach is called "temporary work-free construction", and it does not disturb the water flow or the existing traffic at all.


### U Sheet Pile Press-in Method

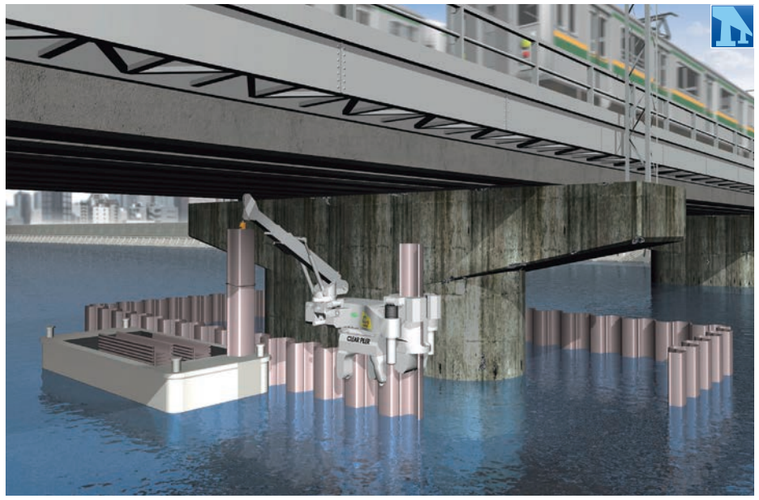


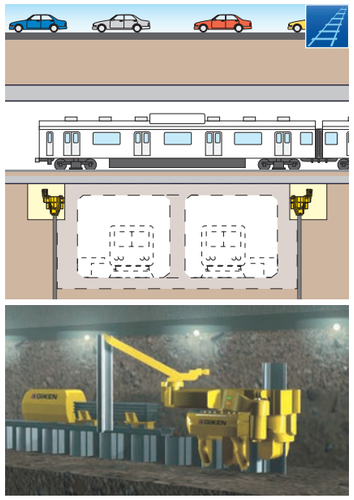

### Tubular Sheet Pile Press-in Method




## Overhead Clearance Method

In the Overhead Clearance Method, piling work can be carried out safely under any overhead obstructions without disturbing active traffic, because all machines are light weight and compact, and the SILENT PILER holds piles being pressed-in at close position to the pile top elevation of design. If the overhead clearance is very limited, a specially designed short model of press-in machine, can be used for this application.

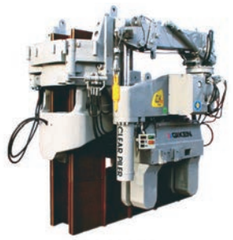




## Models

CL70

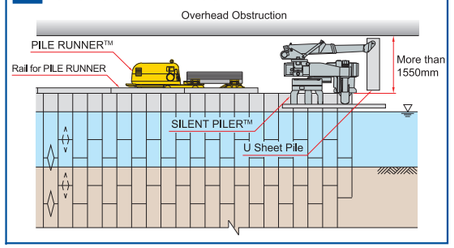
CLF120



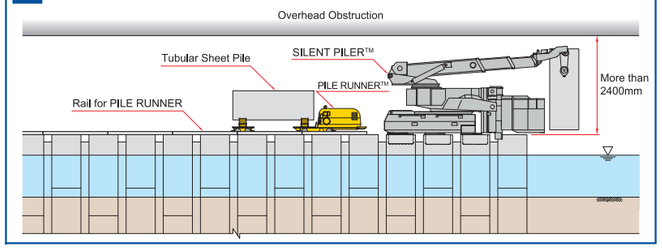
CLH150

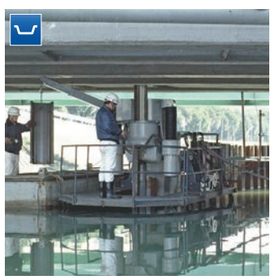
CLP200

### U Sheet Pile Press-in Method



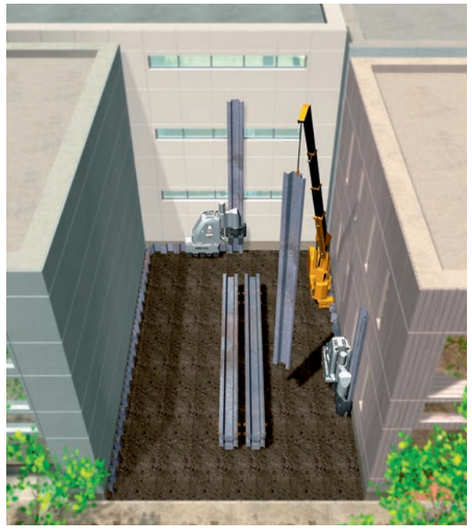

### Tubular Pile Press-in Method



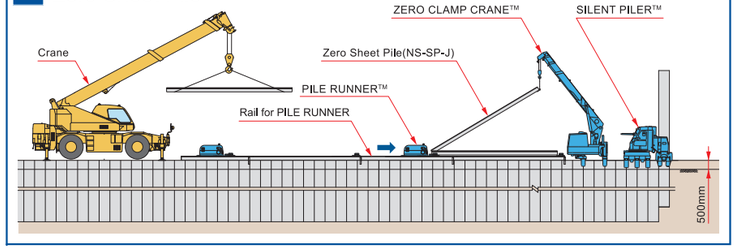
## Zero Clearance Method

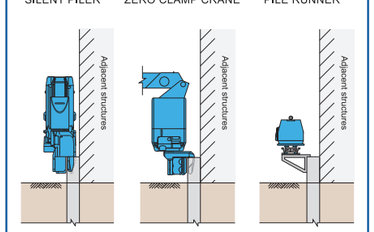
The Zero Clearance Method is a press-in method for pile installation with zero clearance to adjacent structures using dedicated piles "Zero Sheet Pile" and the specially designed model of "SILENT PILER™". With this method, canal works in a narrow area and building construction works that require effective use of the site can also be carried out economically and efficiently without affecting the surrounding environment.



Conventional Method

### Zero Sheet Pile

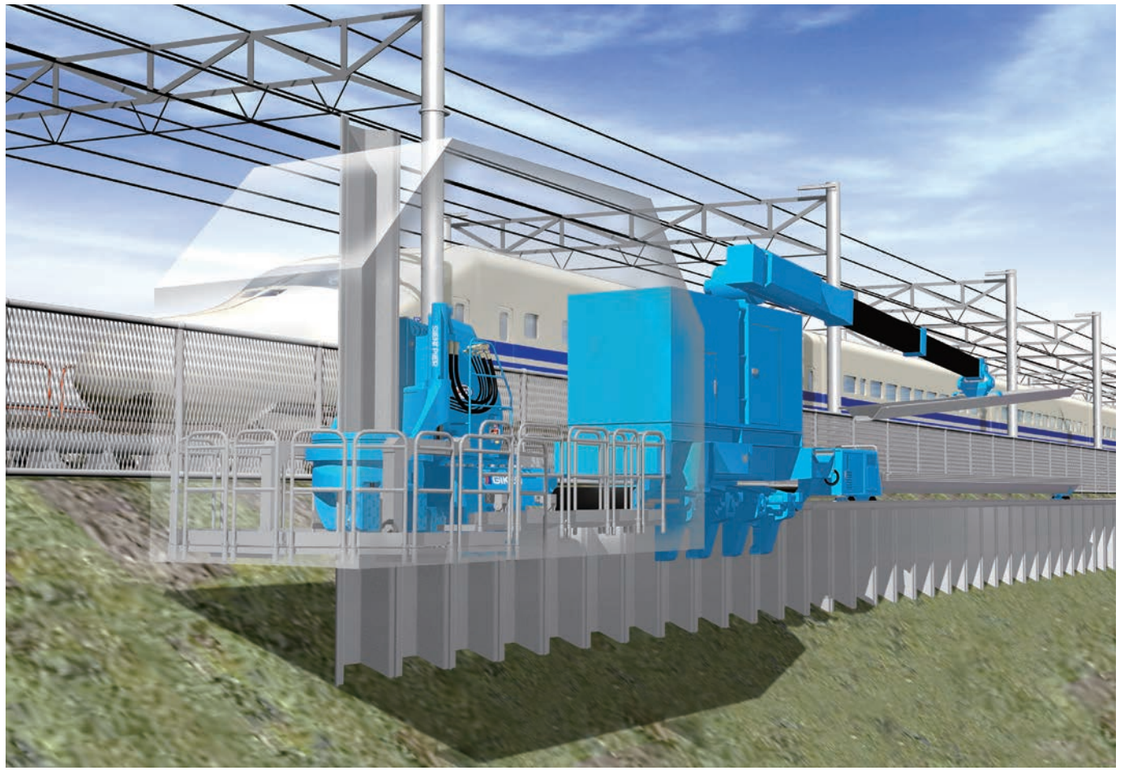



## Rail Safe Method

### Securing Railway Operations

The role of railways as a public transportation system is still prominent, even now when the main urban traffic has shifted to automobiles. Railway is effective for long distance transportation and logistics, and is an everyday travel means for citizens in urban areas as well. Because of such demand, functions of active railways are often reviewed and improved, and construction work is frequently carried out to reinforce facilities against earthquakes. The Rail Safe Method is a construction technique that allows for building structures near railway lines while ensuring safety for both the construction and the railway. This method is superior to other construction principles because it eliminates the need for temporary works, ensures rapid construction, and maintains the regular track schedule. Even where strict safety requirements are required, such as on bullet trains, thorough scientific environmental monitoring can be carried out.



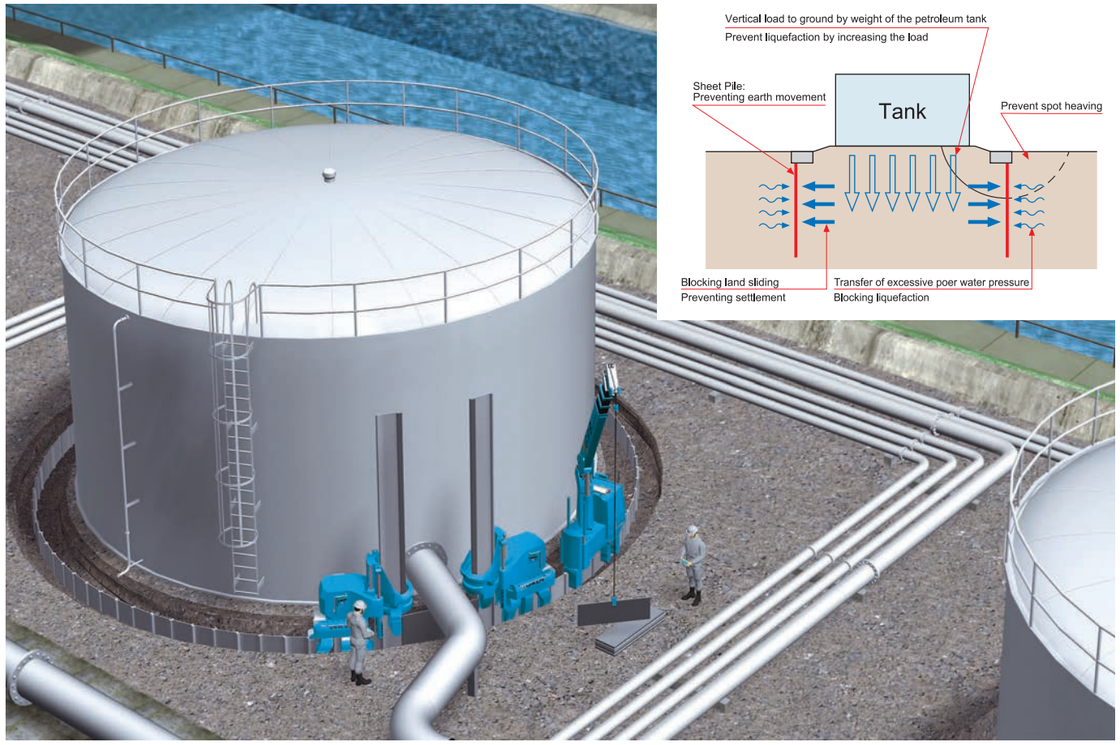


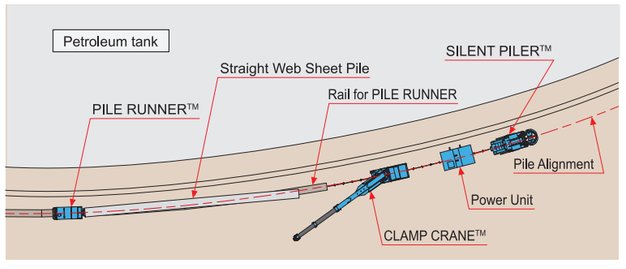


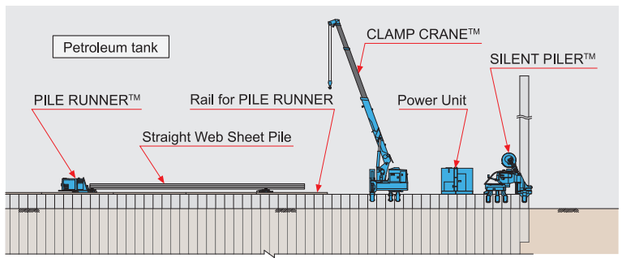
## Ring Method

### Anti-Seismic Reinforcement & Liquefaction Measures

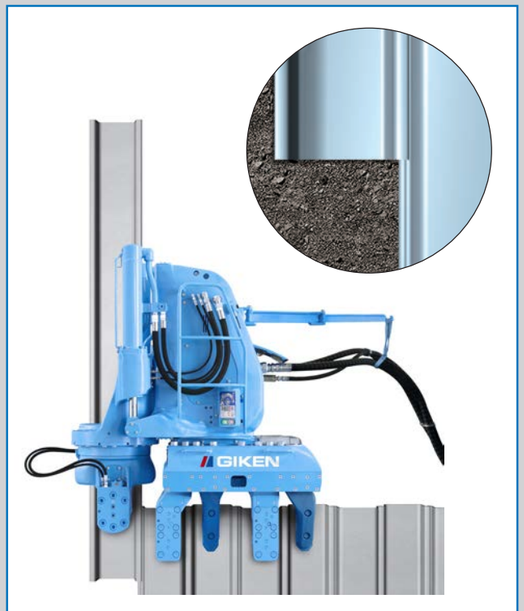
Among the facilities that urgently need seismic countermeasures are storage tanks for gas and petroleum, which are indispensable for daily life. indispensable for daily life. However, the existing seismic reinforcement construction works are costly and lengthy for temporary removal of piping and ancillary facilities. Such methods cannot observe the Five Construction Principles. The solution is the "Ring Method" by which straight web sheet piles are pressed-in in a circular shape and integrated with the ground, closing around a tank. If the surrounding ground becomes liquefied by an earthquake, the circular shape of the pressed-in pile continuous wall blocks liquefaction propagation and protects internal foundations from settlement and side flow, to prevent damage to the tank. The construction work does not require temporary works, is space-saving and work duration is extremely reduced, as well as cost.



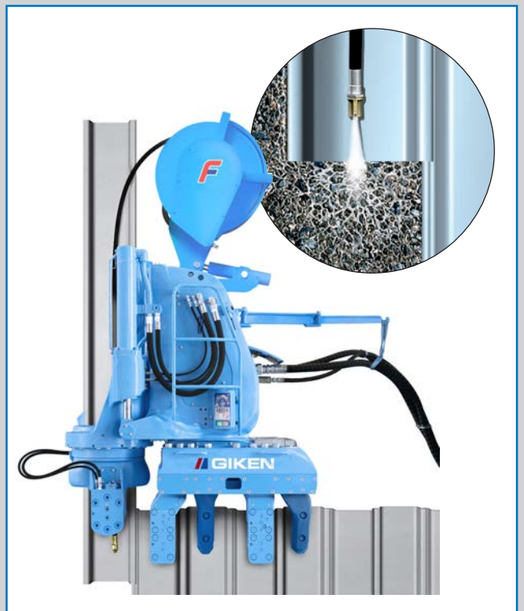




## Penetration Technology

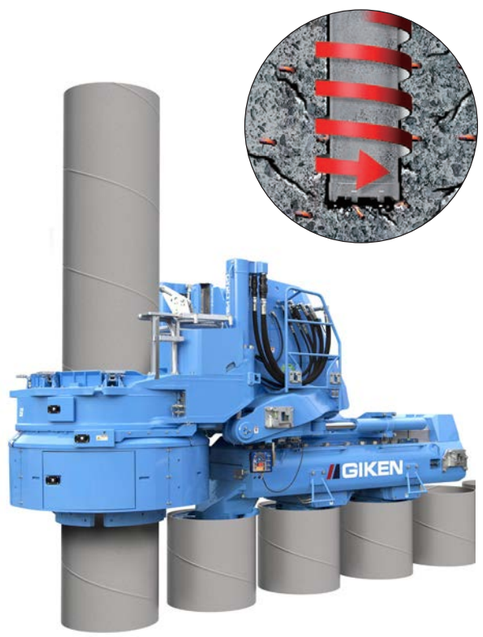



Standard Press-in




Press-in with Water Jetting


Hard Ground Press-in




Rotary Cutting Press-in

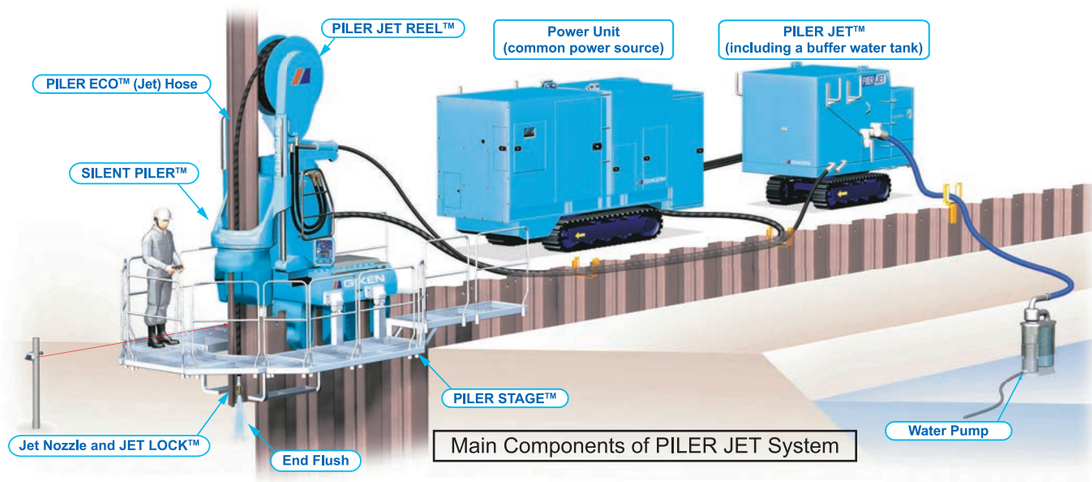
## PILER JET System

### Water Jetting Press-in Method

When applying static load onto a pile in sandy ground, pile toe resistance becomes large due to the consolidation of soil particles at the toe. Also, if fine soil gets into the gap between interlocks, interlock resistance increases due to the consolidation of soil particles as the penetration depth gets deeper. These aspects may result in damage to the pile toe and interlock, become a major factor that obstructs the press-in work, and eventually make the penetration of the pile difficult.
In order to prevent such issues from occuring, a high pressure water jet is attached for driving assistance. The water can increase pore water pressure around the pile toe and create a temporary status where soil particles are moved easily.
At the same time, upstream water flow reduces skin friction of the pile and reduces interlock resistance by washing out soil inside the interlock. This is how penetration resistance is reduced, and why the Water Jetting Press-in Method enables installation of piles with smaller press-in force, without damaging the pile.

### Integration of Press-in Function and Water Jetting Function

The PILER JET™ System is a system in which the press-in function and water jetting function are integrated in order to mitigate environmental impact while enhancing the working efficiency of the Water jetting Press-in Method. A specially developed water jet pump, the PILER JET, is linked with the SILENT PILER to control water flow automatically. It can minimise the influence on ground conditions and reduce water treatment works. The power source for the PILER JET is the Power Unit, and water flow and water pressure are displayed on the multifunction monitor of the press-in machine. These are controlled by the radio controller of the press-in machine.

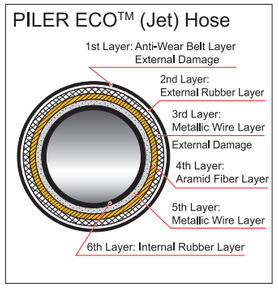



Main Components of PILER JET System

### System Equipment

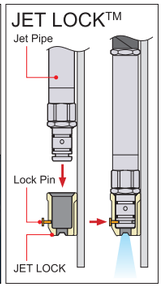
PILER JET REEL™

PILER ECO™ (Jet) Hose




Jet Nozzle


JET LOCK™




PILER JET™

## Hard Ground Press-in Method

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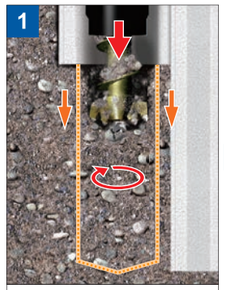
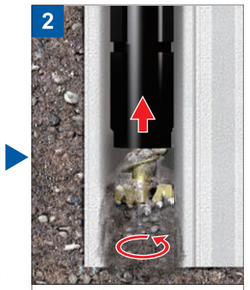
Ground conditions are a major restriction which must be managed in addition to physical site conditions. The "Hard Ground Press-in Method" is a newly developed penetration acceleration technology with the practical use of the unique GIKEN "Coring Theory" to enable pile installation on unfavourable ground conditions such as sandy gravel, cobblestone, boulders, or rock layers without losing the superiorities of the Press-in Method. In this theory, a pile auger, which is integrally controlled with a press-in machine, first excavates the ground just beneath the pile toe, and then the press-in machine installs the pile further into the ground to fill the gap made by the excavation at the same time as the pile auger is withdrawn. Therefore, the area to be excavated and the amount of soil discharged can be minimised, thus reducing penetration resistance force while taking the environment into consideration.

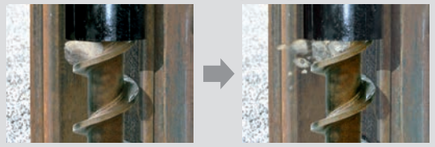



Press-in with the Pile Auger



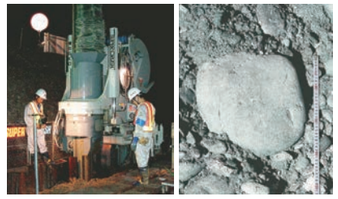

Extracting the Pile Auger after completion of sheet pile installation

Crushing cobbles / boulders by wedge effect

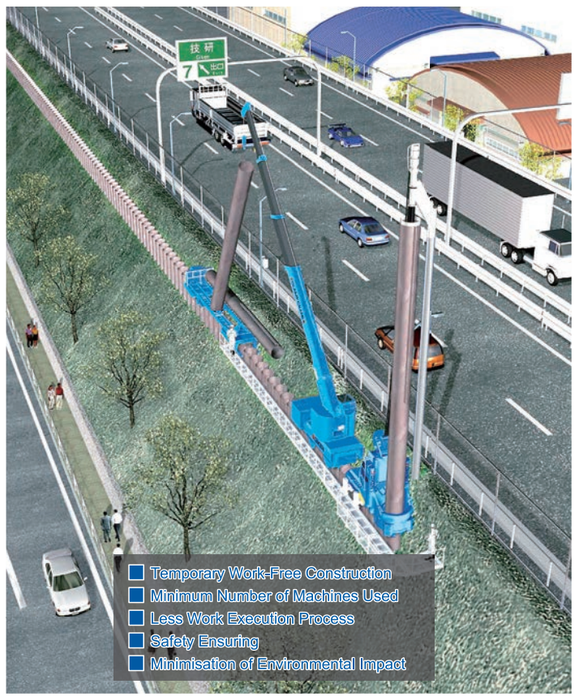


### What is Hard Ground?

Gravel layers containing boulders and ground containing rock layers are generally called "Hard Ground". N value (SPT Value) more than 50 is generally considered hard ground. Regardless of piling methods, sheet piling into hard ground was difficult. However, the Hard Ground Press-in Method enables installation of sheet piles into soft rocks such as, mudstone, sandstone and granite, and medium hard rocks.



Press-in into Boulder Layer(D100 - 300 mm)



- Temporary Work-Free Construction
- Minimum Number of Machines Used
- Less Work Execution Process
- Safety Ensuring
- Minimisation of Environmental Impact

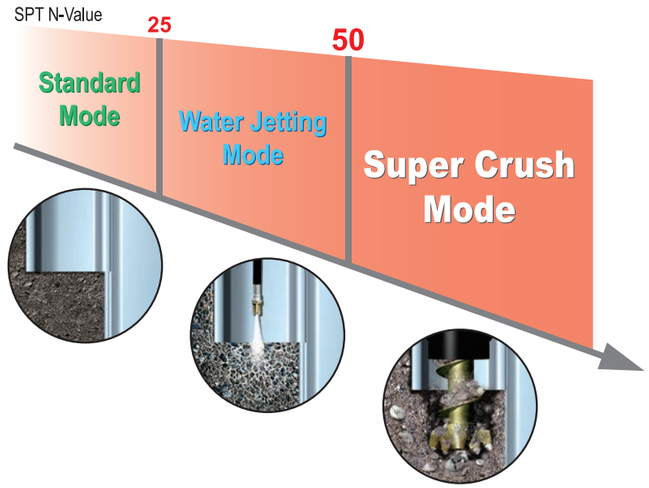
### Conventional Method





## Multifunctional Press-in Machine

The Multifunctional Press-in Machine is an environmentally-friendly press-in machine that can be applied to a variety of ground conditions, as it supports the multiple penetration modes of Standard mode, Water jetting mode and Super Crush mode, all in a single machine.





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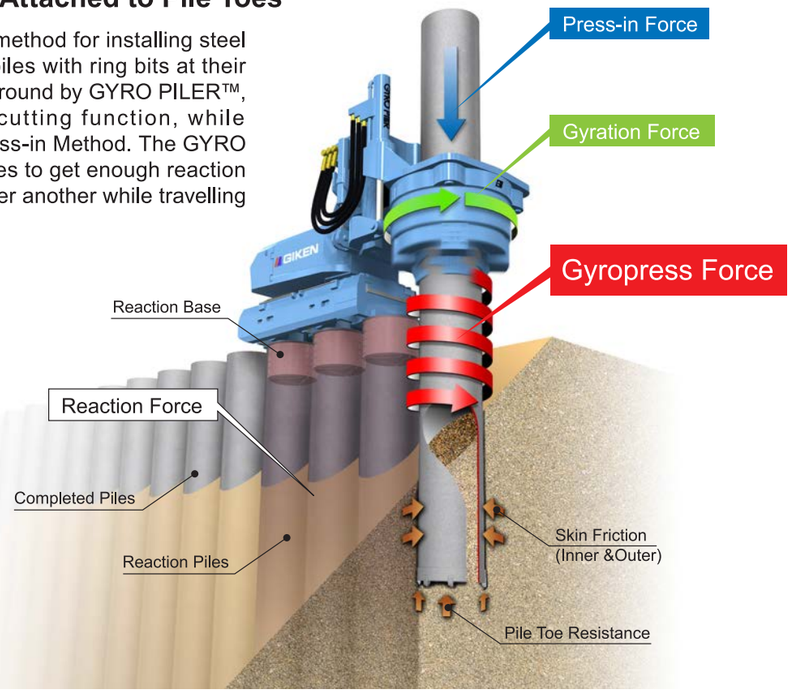
SCZ-600

## Gyropress Method

### Providing the Power of Press-in Force + Gyration Force as a “Gyropress Force” for Tubular Pile Installation into Hard Ground with Ring Bits Attached to Pile Toes

The "Gyropress Method™" is a piling method for installing steel tubular piles. In this method, tubular piles with ring bits at their toes are rotated and pressed into the ground by GYRO PILER™, a press-in machine with a rotary cutting function, while maintaining the superiorities of the Press-in Method. The GYRO PILER™ grips the already installed piles to get enough reaction force and installs the next piles one after another while travelling on top of the already installed piles.

GYRO PILER™




### Penetrating through Hard Ground and Concrete Obstructions

The Gyropress Method is suitable for ground conditions where conventional methods are less efficient or are restricted by underground obstacles, including concrete structures.

### Working Under Physical Restrictions (GRB System)

Since the Press-in Method allows for piling work in minimum working area, it is the best to be selected for working severe physical restrictions such as narrow locations and underneath overhead obstructions.
In addition, it does not require temporary working platforms.

### Environmentally Friendly Construction (soil displacement control)

Soil displacement can be minimised by employing a rotary cutting mechanism with special cutting bits at the pile toe, allowing more environmentally friendly piling work.In addition, GYRO PILER uses biodegradable hydraulic oil and grease, so if the oil and grease are split into soil or water, they do not harm the surrounding ecosystem.

### Economical Construction with Various Designs Available

The rotary cutting press-in does not apply undue stress to the pile material, thus reducing pile deformation and eccentricity. Construction designs, for example, batter pile, pile layout, etc., can be freely selected so that the most economical structural style can be adopted.

**Cutting Reinforced Concrete**

The images below show the cutting and penetrating into reinforced concrete (t = 800mm, σck = 24N/mm², D16@250 x 3 layers) with the Gyropress Method.

## Achievements

### Road Expansion Retaining Walls

### Rail Expansion Retaining Walls

### Seawall Expansion

### Levee Reinforcement

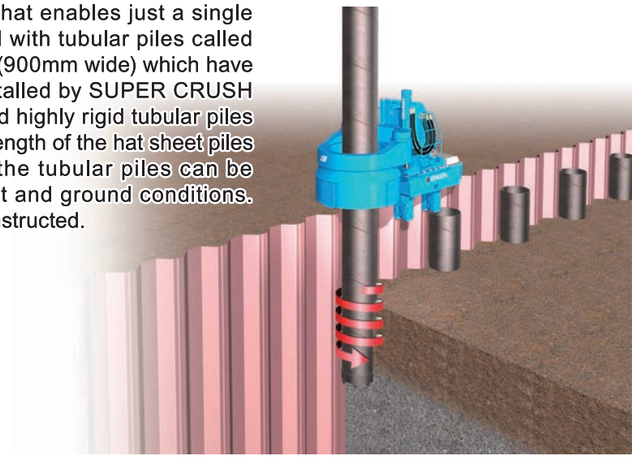
### Quay Wall Reconstruction

### Base Walls for Disaster Prevention

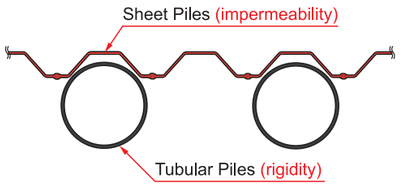
## Combi-Gyro Method

### Combi-wall Construction with Highly Impermeable Sheet Piles Together with Highly Rigid Tubular Piles

The "Combi-Gyro Method" is a piling method that enables just a single press-in machine to construct a wall combined with tubular piles called "Combi-Gyro Wall". It comprises hat sheet piles (900mm wide) which have outstanding water-blocking characteristics (installed by SUPER CRUSH mode / Water-jetting mode / Standard mode) and highly rigid tubular piles (installed by rotary cutting press-in). In addition, length of the hat sheet piles as well as diameter, length and intervals of the tubular piles can be adjusted, depending on the desired wall height and ground conditions. Thus, functional and economical walls can be constructed.

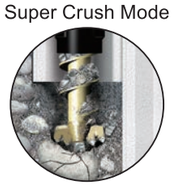


■ General Layout of Wall Structure



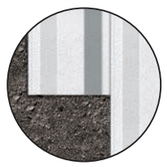

**Steel Sheet Piles**

Super Crush Mode



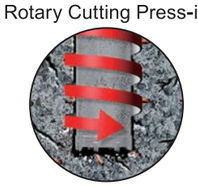
Water Jetting Mode

Standard Mode



**Tubular Piles**

Rotary Cutting Press-in

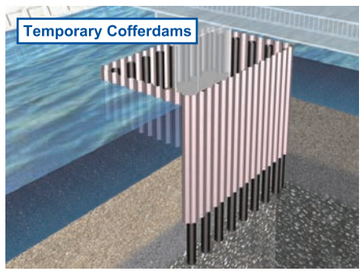


## Combi-Gyro Method Features

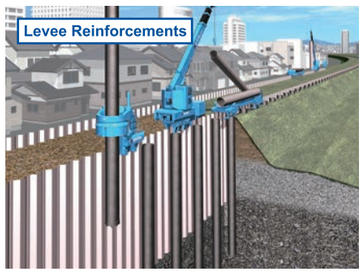
- Construction of a highly impermeable, highly rigid wall with 1 press-in machine
- Simple construction with the use of standard pre-fabricated piles
- Steel tubular pile diameters and installation intervals freely set for economically optimal design
- Press-in Method construction without noise, vibration, or ground displacement

## Applications


Simple Construction with Pre-fabricated Piles




Excellent Waterproofing that can Easily be Dismantled




Suitable for Anti-Seismic Reinforcement and Liquefaction Measures with Fast Construction



## Achievements

### Seawall Improvement

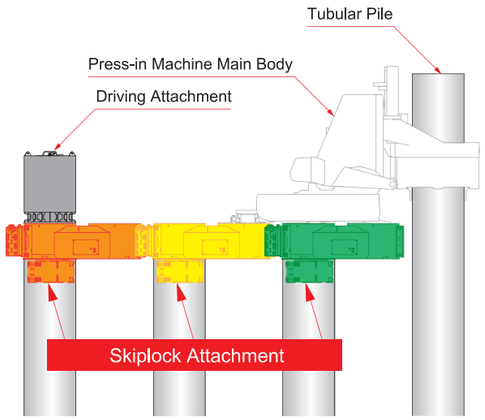
### Road Retaining Wall Improvement

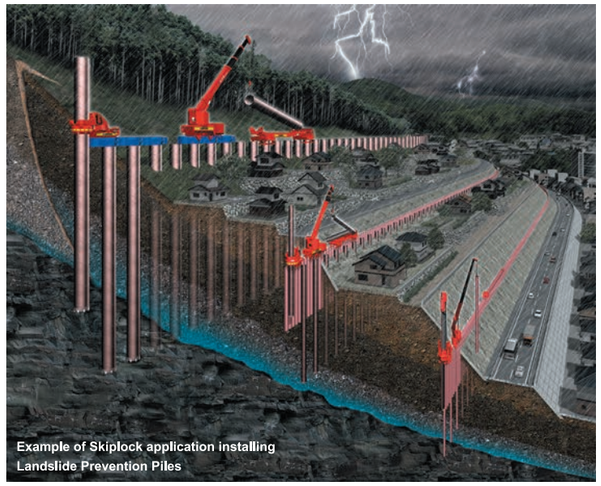
### Cofferdams for Pier Repair

## Skip Lock Method™

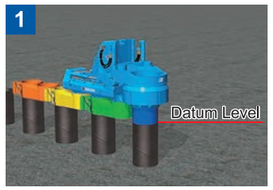
### Use of the Skiplock Attachment Allows for Spaced Interval Installation of Tubular Piles

With the Skip Lock Method, specially developed Skiplock Attachments allow steel tubular piles to be installed at a spacing of 2.5D with a press-in machine main body. It can be applied to a variety of structures, such as landslide protection and coastal embankments.

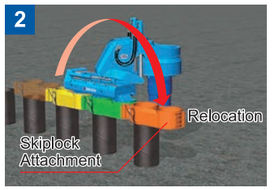




Example of Skiplock application installing Landslide Prevention Piles

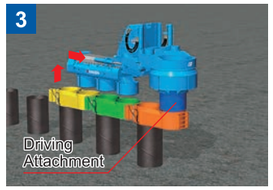
## Construction Procedure



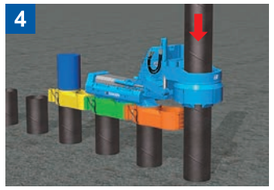
Install a tubular pile to the datum level.



Hoist and relocate the rearmost Skiplock Attachment.



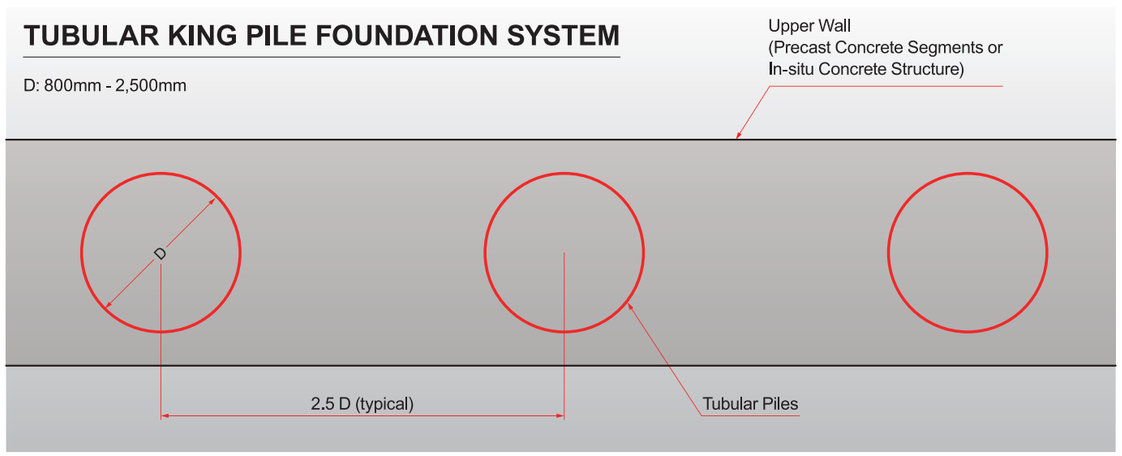
Move the press-in machine forward (Self-moving).



Pitch the next pile and start the installation again.

### TUBULAR KING PILE FOUNDATION SYSTEM

D: 800mm - 2,500mm



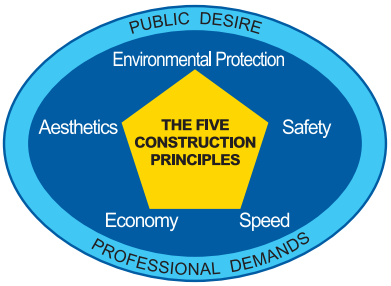

## Achievements

### Seawalls for Petroleum Stations

### Tubular Foundation Piles for Seawalls

### Tubular Foundation Piles for Buildings

# 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. |

GIKEN Construction Solutions Company

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