THE FIVE CONSTRUCTION PRINCIPLES

If we analyse all the parties involved in any construction work, we can categorise them into three main groups: the client, the contractor and the general public. The ideal situation is when all three parties are in agreement and satisfied with the successful outcome of the construction work. Problems arise when one of the parties becomes a victim of imbalance in this relationship. The conventional construction methods based upon principles that "more is paid for less efficient work" are no longer appropriate to present-day society. Universally acceptable construction methods must embody the Five Construction Principles.

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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Construction Revolution

Press-in Method Variations

SILENT PILING TECHNOLOGIES

GIKEN

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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 conditions 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. Since 1994, GIKEN has been conducting academic studies through collaborative research with the Engineering Faculty of Cambridge University in the U.K..

Environmental Protection

Vibration-Free, Noise-Free,
In 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
Minimisation of physical influence to the surrounding environment such as settlement and any damage on neighbouring 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.

Radio Control System
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 have respective self-walking functions which provide efficient and rational working condition.

No Working Hour Limitation
Since the Silent Piler is a pollution-free piling machine, it is possible to complete construction works in restricted areas where any consequential negative influence is eliminated and at night when high levels of noise emission are prohibited.

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 costeffectiveness of on-site works.

Construction Cost Reduction by KASETSU (Temporary Work)-Less
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
Construction works can be carried out with energy-saving equipment and 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
The Press-in Method for pile installation results in high quality implant structures.

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

Constructing press-in continuous pile walls which are suitable for construction purposes, structural function, structural quality and surrounding scenery

U Sheet Pile

H Sheet Pile

Z Sheet Pile

Concrete Sheet Pile

Hat Sheet Pile

PC Pile

Zero Sheet Pile (Hat)

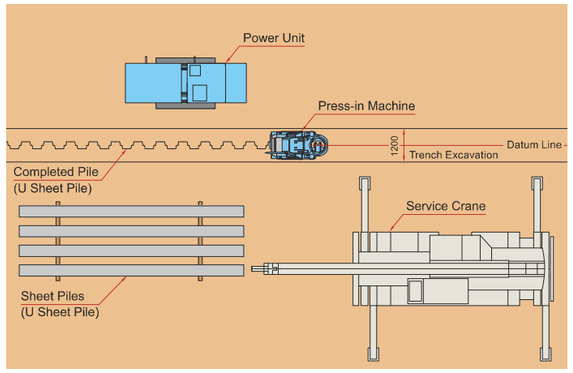
Straight Web Sheet Pile (Ring Method)

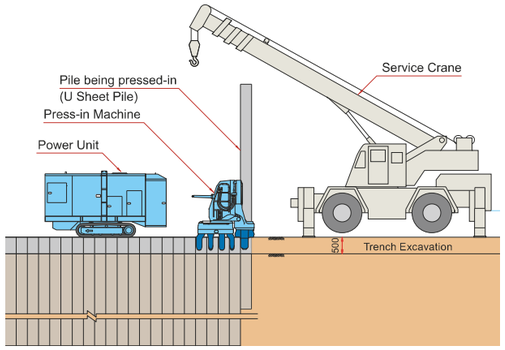
Tubular Sheet Pile

Trench Sheet Pile

Standard Machine Layout

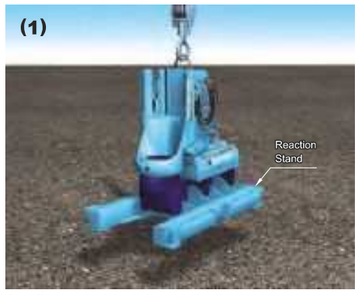
The Press-in Principle utilises the reaction force derived from fully installed piles, which are anchored to the ground and are regarded as a united part of the Earth to install subsequent piles with a hydraulic system. Hence, the Silent Piler is small and light weight, and can self-walk on top of piles. For sheet piling work, it requires just one service crane to pitch sheet piles.



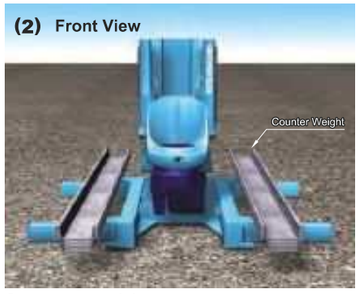


Initial Press-in

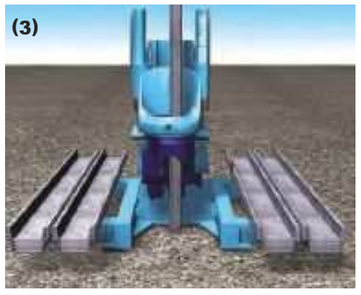
At the beginning of any press-in work if there are no completed piles, then a "Reaction Stand" is usually used for initial piling work. The Press-in Machine is horizontally set onto the Reaction Stand and then counter weights are loaded onto the Reaction Stand. Counterweight mass is dependent on soil 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.



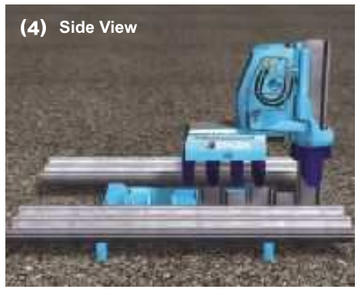
Set Press-in Machine Main Body and Reaction Stand horizontally



Set counter weights



Pitch the first pile and start pressing-in



Install prescribed number of piles

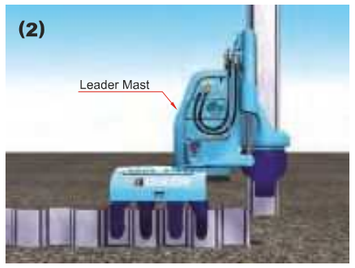
Remove counter weights

Remove Reaction Stand and the initial piling is completed

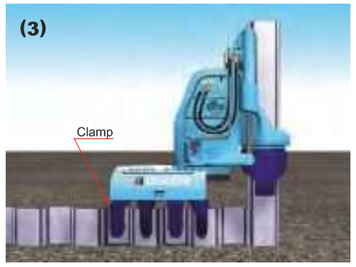
Press-in Working Procedure / Self-Walking

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 and then uplift the press-in machine. Move the Saddle forward. Place the press-in machine downward, then close the Clamps after confirming machine position to secure new reaction base. Then restart pressing-in the pile. These processes are repeated. The process to move Press-in machine forward is called "Self-walking".

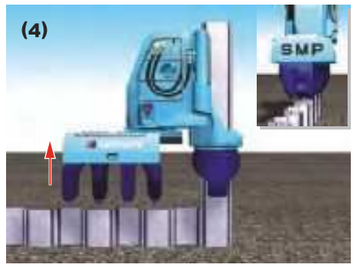
Press in pile to prescribed depth



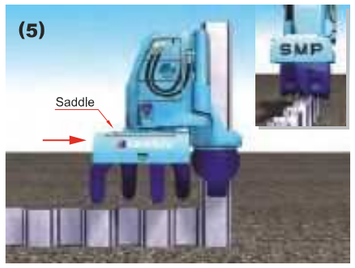
Pitch next pile and start pressing in



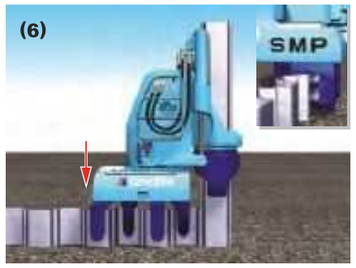
Press in pile until it is sufficiently stable



Open Clamps and then raise Silent Piler



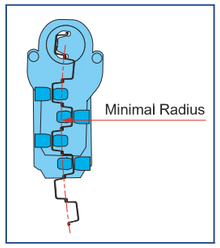
Move Saddle forward and change clamp positions



Lower Silent Piler and close Clamps

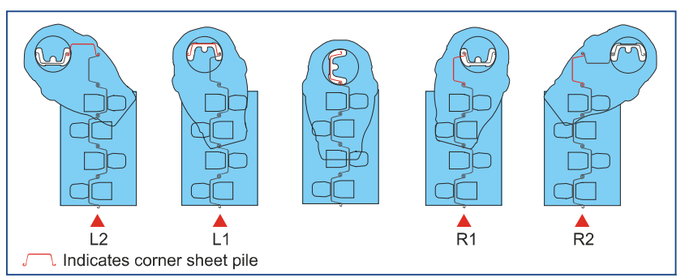
Curve Installation

Chuck rotation, mast revolution and clamp right-left mechanisms are equipped on the press-in machine' s 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 models.



Corner Installation

The press-in machine (U-Piler) has the "Corner Four (C4)" function which can install 2 piles on both sides on perpendicular alignment from the machine position. The 2 piles are installed on the pile alignment and another 2 piles are installed as dummy piles as reaction piles. This (C4) function makes piling work at narrow site conditions safe and efficient for cofferdams.



U Sheet Pile Press-in Method — U Piler

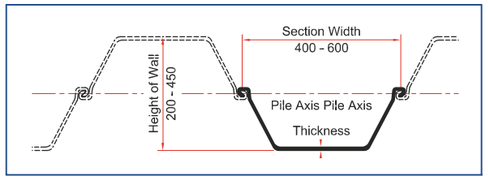
F101

F201A

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 are standard sheet piles (400 mm) wide, that are optimal for reuse. Widths increasing to 750 mm have higher section modulus per steel weight and hence have better cost performance.

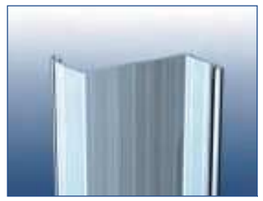
Standard Cross-Section



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 Press-in Method — Z Piler



F301-700

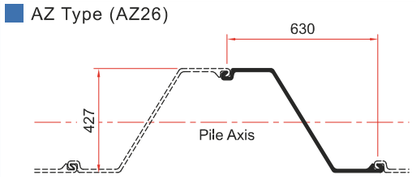
F401-1400

Z Sheet Pile

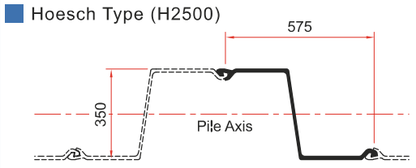
The Z sheet pile was developed in Germany in 1926 and has the shape in which its interlock part is located out of the neutral axis to the most exterior edge. In Europe, the design shifted to a fully-fledged, broad and wide configuration in 1990; allowing the cross section performance per steel weight to remarkably exceed the U sheet pile. Some Silent Pilers designed for European and US markets can install double Z sheet piles, up to a maximum width of 1400mm.

Standard Cross-Section

AZ Type (AZ26)



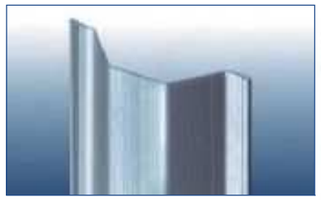
Hoesch Type (H2500)



Hat Sheet Pile Press-in Method

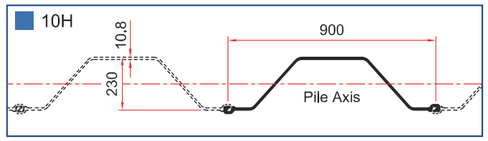
Hat Sheet Pile 900

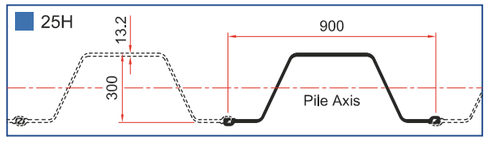
The section modulus of the Hat Sheet Pile 900 exceeds the U Sheet Piles which were mainly used for shore protection, pier and temporary retaining walls. It was developed for wider applications in permanent structures and has better drivability, structural reliability and economical impact. The F301 can install piles with better drivability and installation quality by generating a greater reaction base and dual press-in points.



F301

Standard Cross-Section

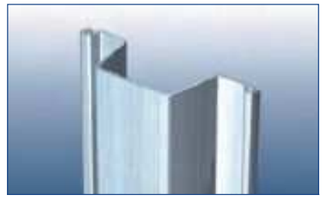




Model	Per 1 Sheet				Per 1 m of Wall			
	Mass per Unit Length	Sectional Area	Moment of Inertia	Section Modulus	Mass per Unit Length	Sectional Area	Moment of Inertia	Section Modulus
	kg/m	cm^2	cm^4	cm^3	kg/m^2	cm^2/m	cm^4/m	cm^3/m
10H	86.4	110.0	9430	812	96.0	122.2	10500	902
25H	113.0	144.4	22000	1450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

Zero Clearance Method

Zero Piler

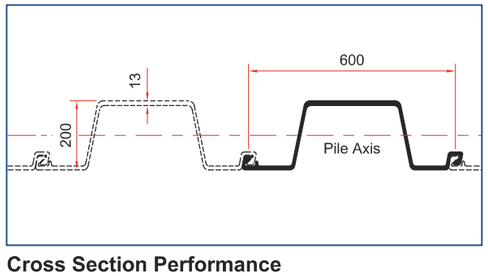


JZ100

Zero Sheet Pile

This zero pile was co-developed by Sumitomo Metal Industries, Ltd. 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, the interlock efficiency of Zero Sheet Pile is 100 % like The Z-Type Sheet Pile. Zero Clearance Method is carried out with the Zero Piler dedicated for Zero Sheet Pile.

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

Tubular Piler

F301-G1000
ϕ600,800,1000

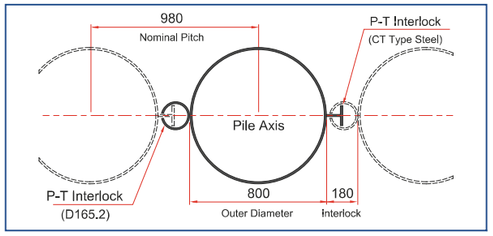
F401-G1200
ϕ800,1000,1200

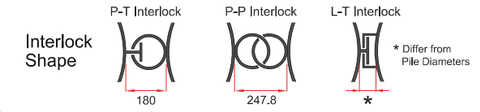
F501-G1500
ϕ1200,1500

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. Selection of the proper pile diameter and thickness will allow the design requirements to be met for construction of various structures for different purposes. Currently the Silent Piler can install tubular sheet pile sections from 600 to 2,500 mm diameters.

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

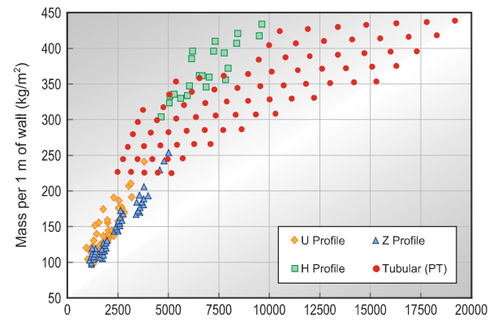




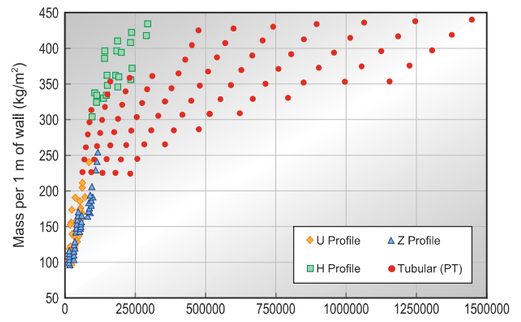
Cross Section Comparison with Major Piles

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. Even though the section performance of the tubular sheet pile is higher, the steel weight doesn't increase like the H sheet pile. The tubular sheet pile is the best pile in terms of cost, if there is no limitation in wall thickness. It is important to select the appropriate pile type depending on the purpose and the construction design.

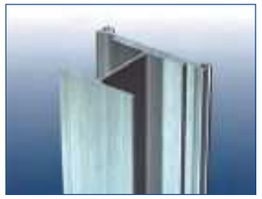
Section Modulus & Mass

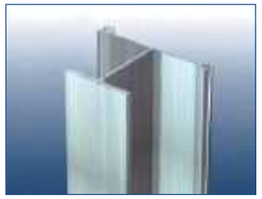


Moment of Inertia & Mass



H H Sheet Pile Press-in Method — H Piler



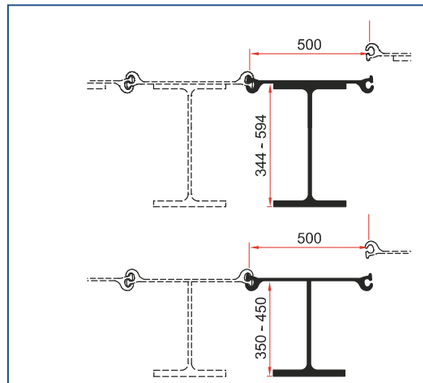


HP150

H Sheet Pile

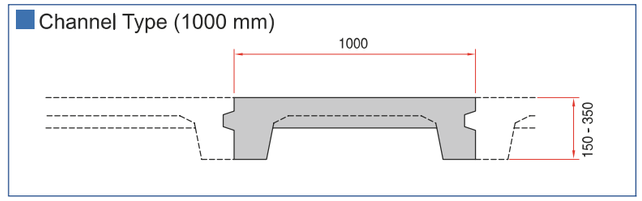
The H sheet pile is used for deep foundations in urban development projects. It has high strength and rigidity with thinner wall thickness. The double interlock type is superior in water cutoff performance, and the single interlock type is applicable for curve alignment installation. The current H Piler can install up to 600 mm height.

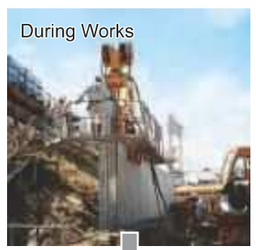
Standard Cross-Section



— Concrete Sheet Pile Press-in Method — Concrete Piler

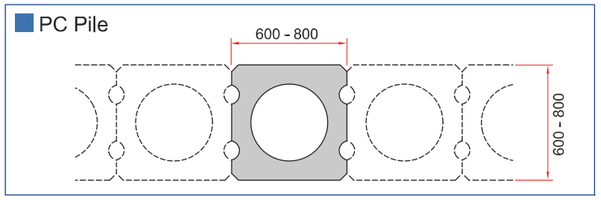
CP80



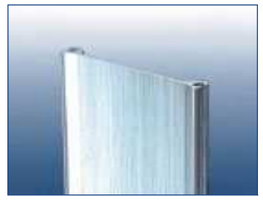


PC Pile Press-in Method — PC Piler

CHP130



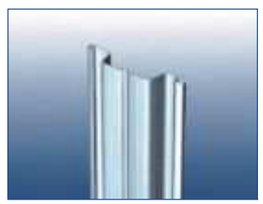
— Straight Web Sheet Pile Press-in Method (Ring Method) — Straight Web Sheet Pile Dedicated Press-in Machine



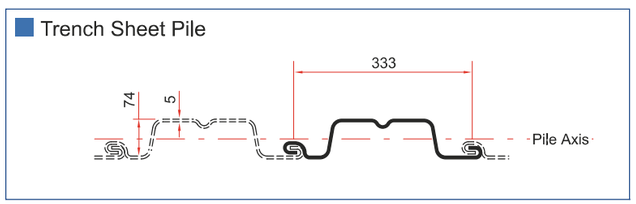
Straight Web Sheet Pile Dedicated Press-in Machine

Ring Method is described on Page 19

~ Trench Sheet Pile Press-in Method — Trench Piler



STP30

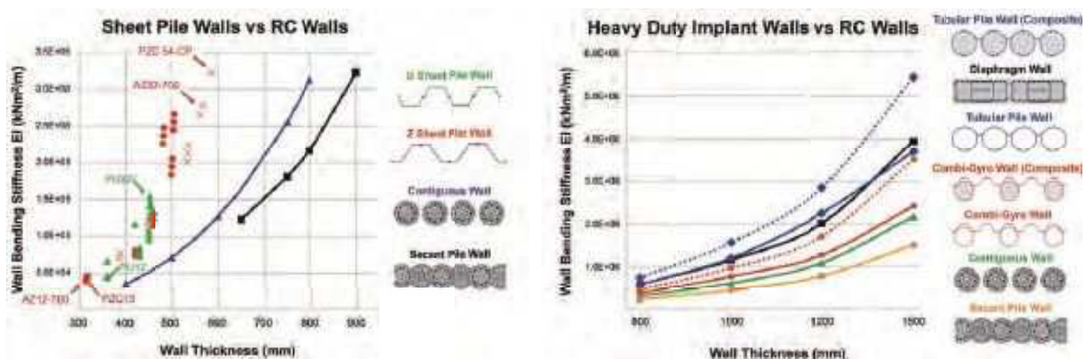


Silent Piler Models & Applicable Piles

Silent Piler Model	U Section (width : mm)				Hat Section (width : mm)	Z Section (width : mm)		Tubular Pile (diameter : mm)						
	400	500	600	750	900	575 - 708		600	800	1000	1200	1500	2000	2500
						Single	Pair							
F111	✔													
F201A		✔	✔											
F301-700*			✔	✔		✔								
F301-900					✔									
F301-G1000								✔	✔	✔				
F401-1400			✔**				✔							
F401-G1200									✔	✔	✔			
F501-G1500											✔	✔		
GRV2540													✔	✔

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

Wall Properties



Environmentally-Friendly Press-in Machine

Standard Adoption of Biodegradable Hydraulic Oil

In order for the Press-in Method to preserve the Five Construction Principles, biodegradable oil, "Piler Eco Oil" and "Piler Eco Grease" have been adopted for the new Silent Piler models as standard specifications since 2002. They are naturally dissolved and will not damage the ecological system if they are leaked out into the water or soil . GIKEN, in collaboration with a Japanese petroleum manufacturer, developed an oil that does not use petroleum as its base. It is proven to have high lubrication properties and longevity, as well as being environmentally safe The biodegradable performance has been approved by the Japanese Environment Association by the testing of Biochemical Oxygen Consumption Method by Bacterium (BOD Method): OECD301C, Rapid Toxicity Test: JIS K0120 by Japanese killifish, and received Eco-Mark certification. In addition, environmentally-friendly paint, TX-Free, which does not contain toluene, xylene and lead-based pigment, is also adopted for the machine body.

GIKEN’s Genuine Products

- Developed only for the Silent Piler
- Excellent Biodegradability & Non Toxic Performance
- High Lubricity and Fire Retardant Properties

Label of Biodegradable Oil

Emission

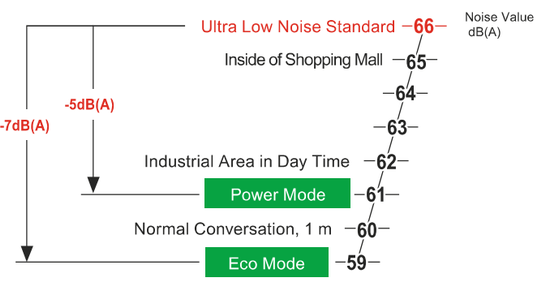
New Power Unit, Off-Road Law Compliant

The latest Power Unit models have a next generation engine. Full anti-pollution exhaust gas is achieved through high combustion efficiency. It conforms to the new exhaust emission standard EEC97/68EC Stage IV and EPA/CARB Tier 4f.

Ultra-Low Noise Design

The sound pressure level generated from the Power Unit is reduced down to 59 dB at Eco Mode that suppresses the engine speed. It is cleared with a higher level than the ultra low noise standard of Japanese MILT, 66 dB.

Photo shows EU300 engine unit of F series



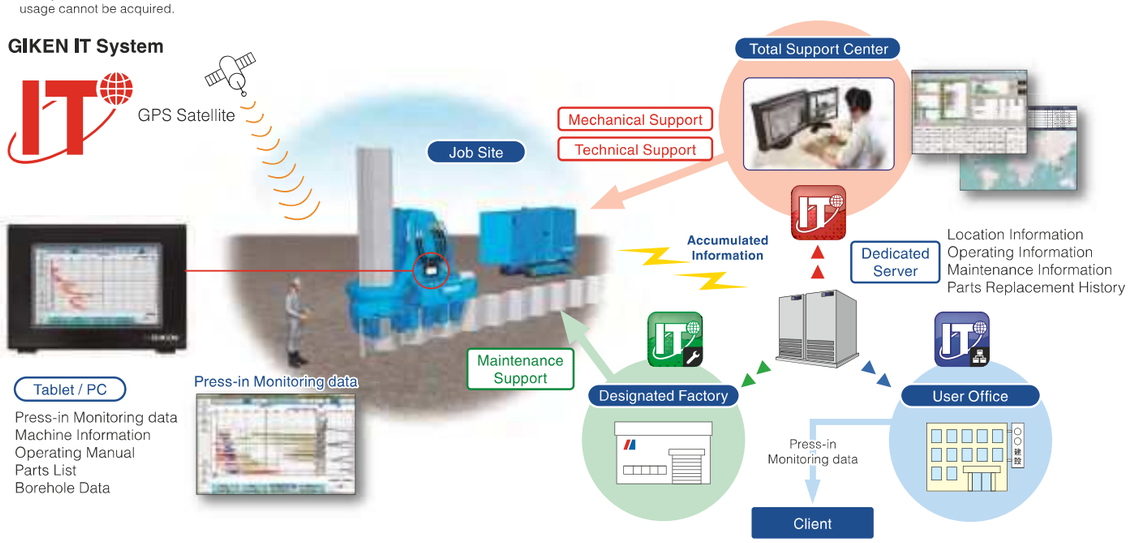
GIKEN IT System

GIKEN's engineers can monitor individual Silent Pilers for parameters such as operating conditions, maintenance records and location. Advice for any technical troubles is available promptly and further information can be provided to prevent technical issues.

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

Press-in Monitoring and Data Logging System

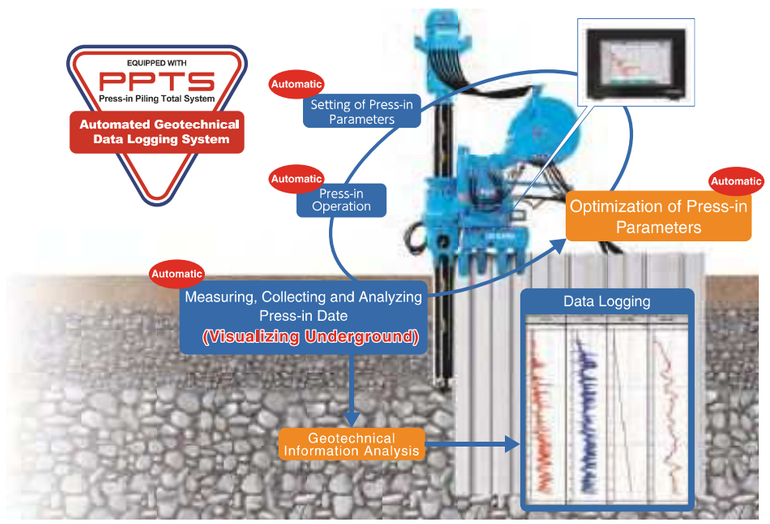
Press-in monitoring data can be used for quality control and information modelling of the foundation. Operators are able to keep working while checking data such as press-in force, auger torque, and working hours of press-in work, on a tablet or PC (both optional extras).

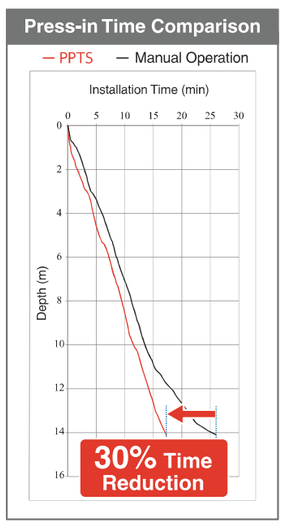


The PPT-System

Increasing piling productivity by decreasing operator workload

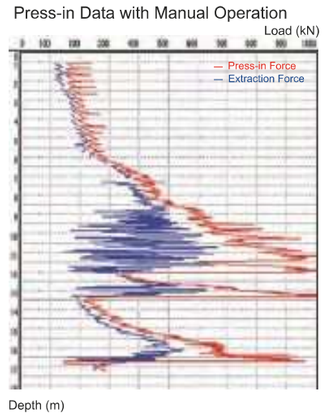
The PPT-System (Press-in Piling Total System) is an automatic operation system which optimises the press-in operation of the Silent Piler, in accordance with ground conditions.
This system can achieve a more efficient press-in operation, regardless of the operator's skills. As a result, installation time can be reduced by up to 30% (in-house comparison).

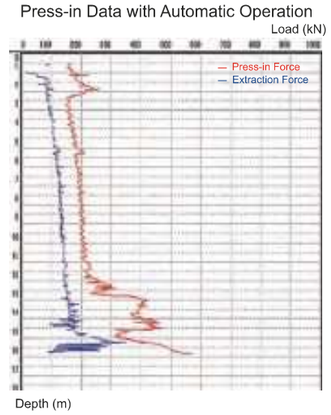




Automatic Press-in Operation System

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.



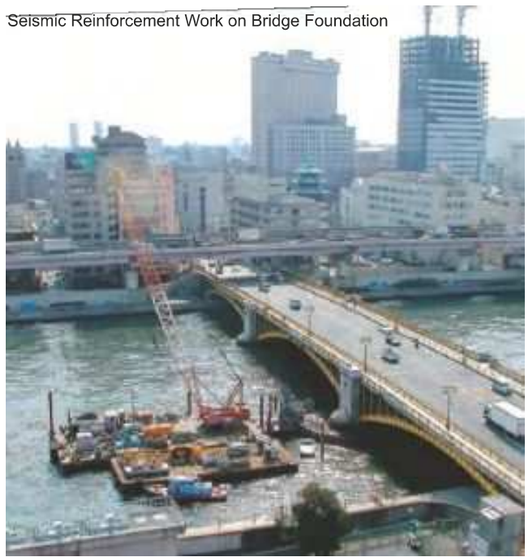


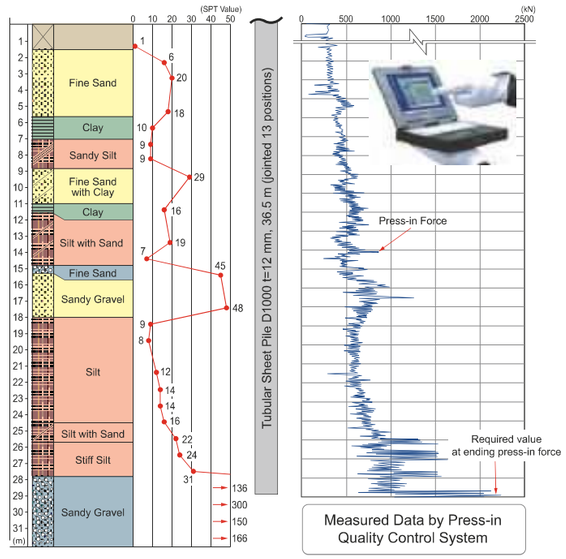
The press-in condition can be monitored in real time with a lap top computer connected to Power Unit.

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 the 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

Construction of Press-in Continuous Pile Wall methods overcoming site conditions and without the use of temporary works.

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 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 the Silent Piler at the front, Power Unit as a power source, Clamp Crane to pitch the piles and the Pile Runner to convey piles from the work base platform.

Standard Components of GRB System

Kasetsu-less Work

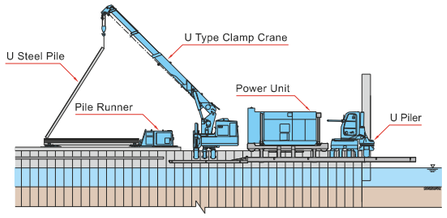
Since conventional piling methods require other heavy equipment in addition to the piling rig, massive temporary facilities are needed depending on site conditions. However, temporary works are not necessary in principle, because they are construction works for the permanent structure. If a construction method is costly and lengthy for temporary works, 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, on water, on slopes, and for other restricted site conditions, as it carries out all piling works on top of installed piles. The GRB System satisfies the Five Construction Principles at all levels by providing solutions to construct only the permanent structures.
Accordingly, the GRB System achieves fundamental purposes of construction works without any negative effect 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

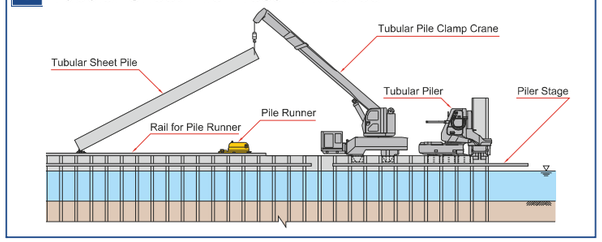
Non-Staging Method

Conventional construction works at waterfront locations usually require signficant temporary works, such as construction of working platforms, which has cost and time implications for the project.. However, the GRB System can execute construction works for the main structure without disturbing active vessel traffic and vehicle traffic, and without requiring any temporary works.

U Sheet Pile Press-in Method

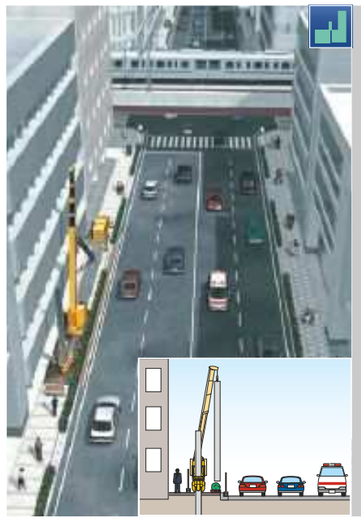


Tubular Sheet Pile Press-in Method



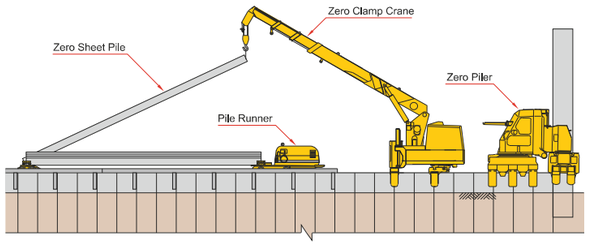
Narrow Access Method

During the progression of rapid urbanisation, narrow areas which construction machines are unable to enter and areas where the impact of traffic closure is too significant to start construction are not considered in development plans. Since the Narrow Access Method requires working space for only the machine width, construction works such as sewage and footpath can be carried out as scheduled even at very narrow locations.



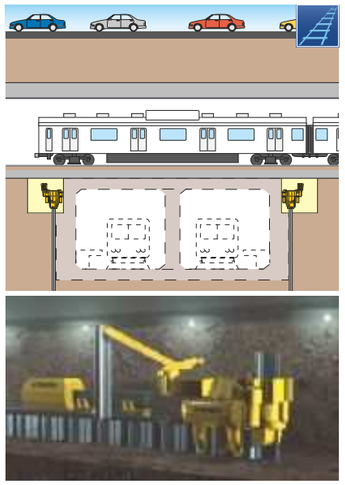
Conventional Method

Zero Clearance 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 dedicated Silent Piler, Clear Piler, can be used for this application.



Clear Piler Models

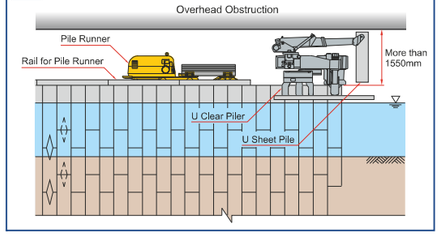
CL70

CLF120

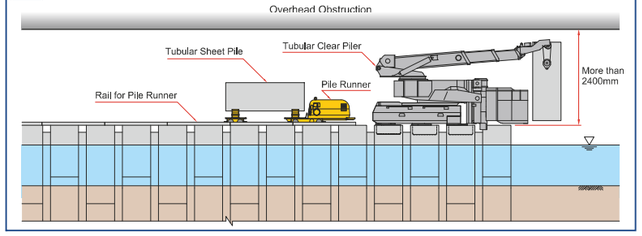
CLH150

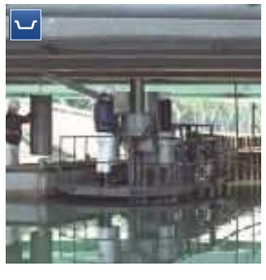
CLP200

U Sheet Pile Press-in Method



Tubular Pile Press-in Method

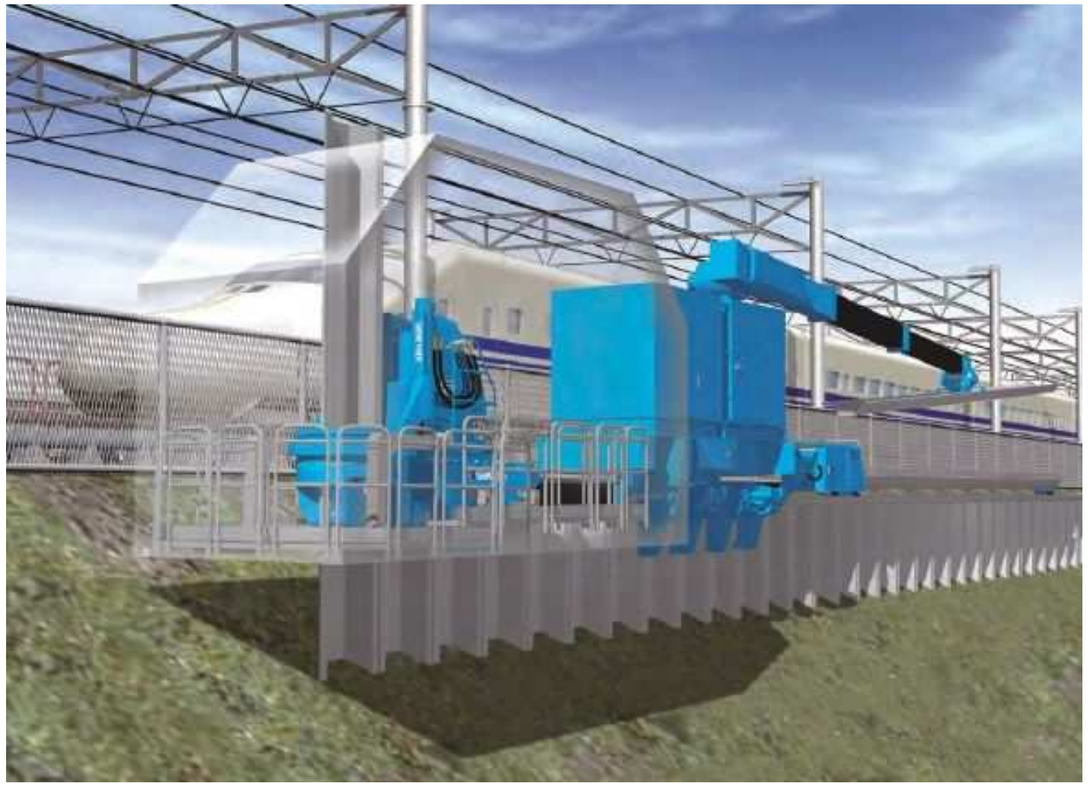




Rail Safe Method

Securing Railway Operations

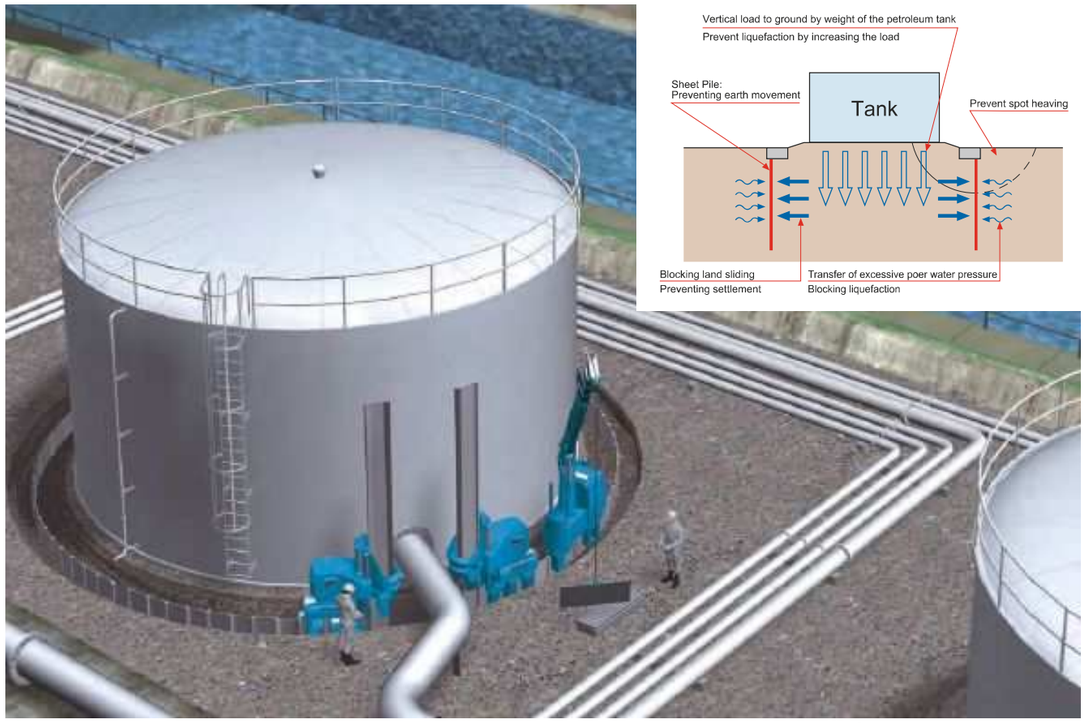
The role of railways as a public transportation system is still prominent, even now when the main urban traffic has shifted to automobiles. Railway is effective for long distance transportation and logistics, and is an everyday travel means for citizens in urban areas as well. Because of such demand, functions of active railways are often reviewed and improved. The Rail Safe Method can safely carry out piling works close to active railway lines without disturbing track schedules. Rapid construction and construction without temporary works is possible with this method.

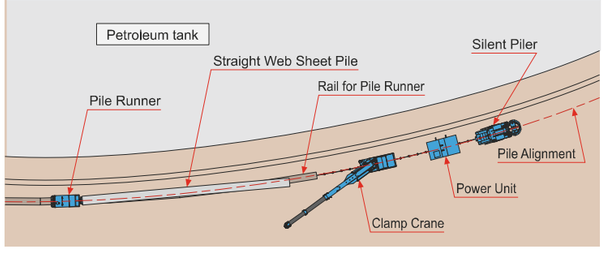


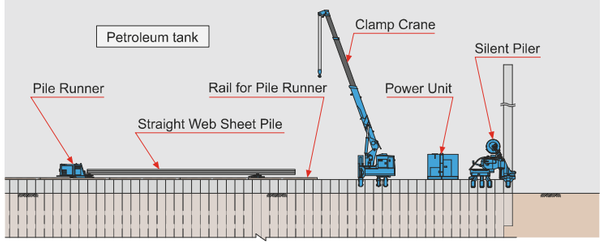
Ring Method

Anti-Seismic Reinforcement & Liquefaction Measures

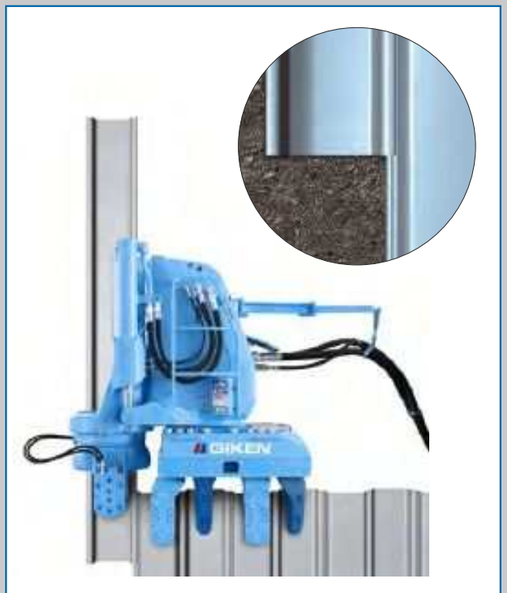
For facilities requiring urgent seismic countermeasures, there are storage tanks for gas and petroleum which are indispensable for daily life. However, the existing seismic reinforcement construction works are costly and lengthy for temporary removal of piping and ancillary facilities. Such methods cannot preserve 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 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

Water Jet Press-in

Hard Ground Press-in

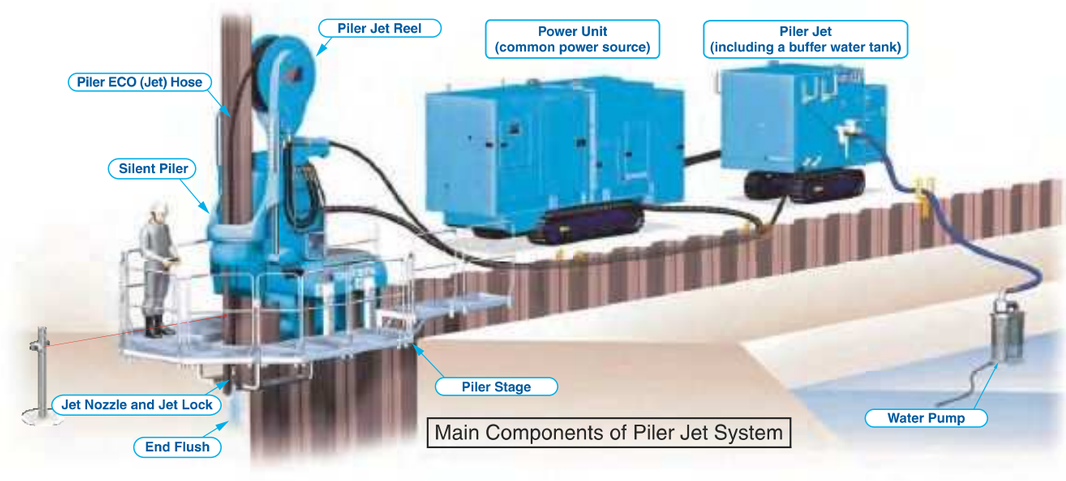
Gyropress

Water Jet Press-in System

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, and elements can obstruct the execution of 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 Jet Press-in System enables installation of piles with smaller press-in force, without damaging the pile.

Integration of Press-in Function and Water Jet Function

The Eco Jet System is a system in which the press-in function and water jet function are integrated in order to enhance the working efficiency of the Water Jet Press-in Method. A specially developed water jet pump, the Piler Jet, is used 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 multipurpose monitor of the Silent Piler. These are controlled by the radio controller of the Silent Piler.

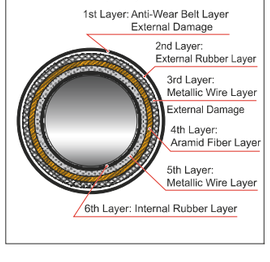


Main Components of Piler Jet System

System Equipment

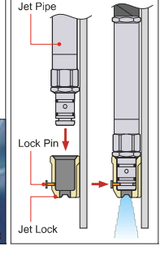
Piler Jet Reel

Piler ECO (Jet) Hose



Jet Nozzle

Jet Lock

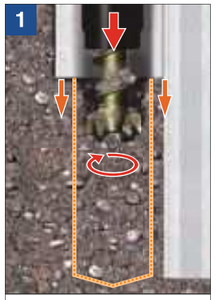


Piler Jet

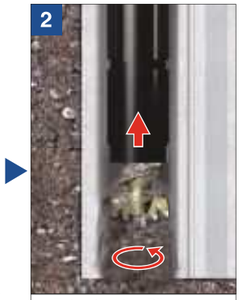
Hard Ground Press-in Method

F301

Ground conditions are a major restriction which must managed in addition to physical site conditions. The"Hard Ground Press-in Method" has been developed as driving assistance for press-in works in hard ground conditions such as sandy gravel, boulders and rocks without losing the benefits of the Press-in Method. With GIKEN's original concept, "Coring Theory", an augering attachment, which is simultaneously operated with the press-in machine, drills the hard ground layer to prevent generation of a pressure bulb at the pile toe, and the pile is pressed-in while the auger is pulled up. The augering diameter is minimised for pile installation and the amount of soil displacement is also reduced.



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?

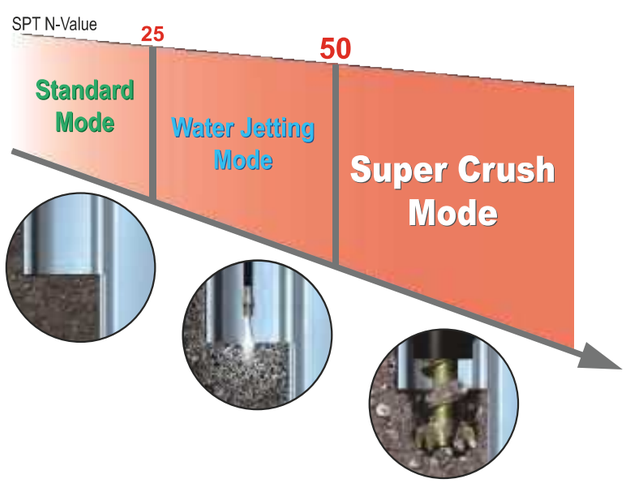
Gravel layers containing boulders and ground containing rock layers are generally called "Hard Ground". N value (SPT Value) more than 50 is generally considered hard ground. Regardless of piling methods, sheet piling into hard ground is difficult. However, the Hard Ground Press-in Method enables installation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

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

Conventional Method

Multi-function Press-in Machine

The Silent Piler has a wide range of functions, including Standard Mode, Water Jetting Mode and Super Crush Mode.



F111

F201A

F301

F301-700

F401-1400

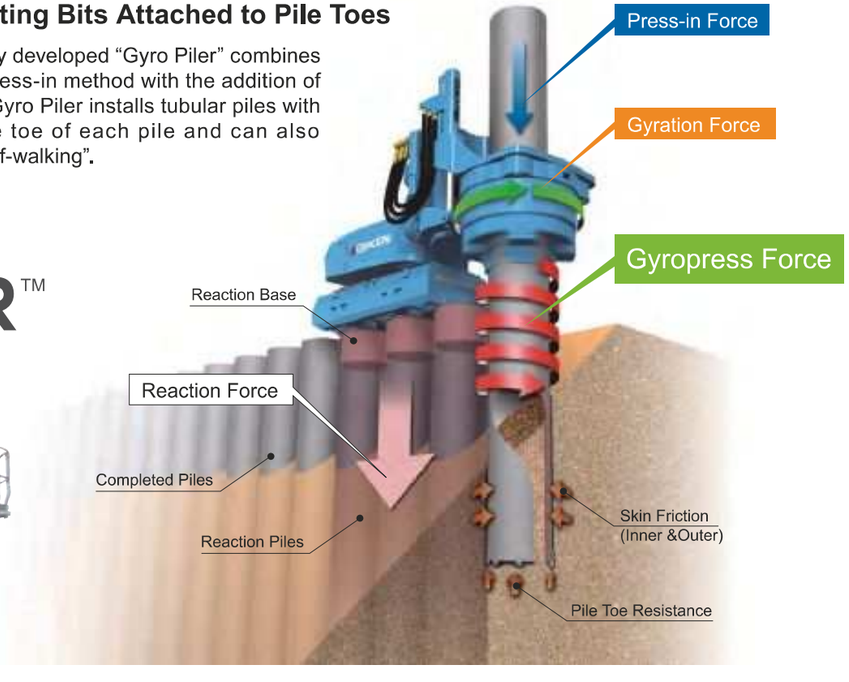
SCZ-600

Gyropress Method

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

The Gyropress Method’s newly developed “Gyro Piler” combines all of the advantages of the press-in method with the addition of the Gyropress function. The Gyro Piler installs tubular piles with cutting bits attached to the toe of each pile and can also advance on top of piles by “self-walking”.

GYRO PILER™



Penetrates 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.

Operates Under Physical Restrictions (GRB System)

With a small footprint, the equipment associated with the Gyropress Method is ideal for piling within horizontal and vertical clearance restrictions and without the need of 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.

Economical Construction with Large Diameter Tubular Piles

Various tubular pile diameter sizes, configurations, and combinations with batter piles are able to be used with the Gyro Piler, allowing a wide range of economically optimal structure designs.

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

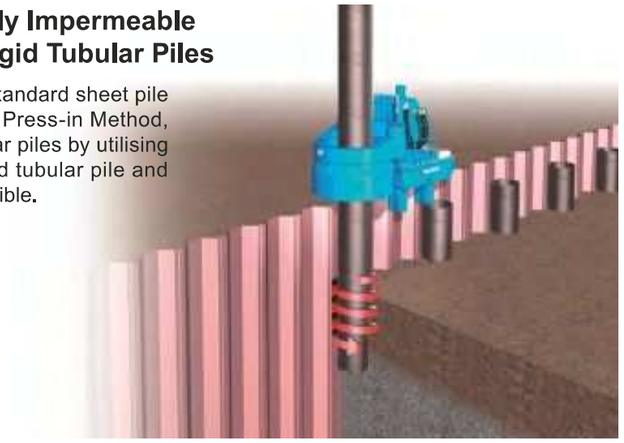
Quay Wall Reconstruction

Base Walls for Disaster Prevention

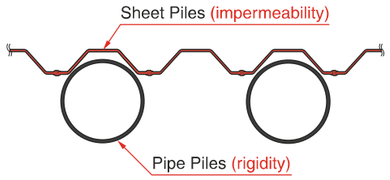
Combi-Gyro Method

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

With the Combi-Gyro Method's capabilities of standard sheet pile installation, water jetting, and the Hard Ground Press-in Method, together with rotary cutting installation for tubular piles by utilising the same press-in piling machine, a highly rigid tubular pile and highly impermeable sheet pile combi-wall is possible.



■ General Layout of Wall Structure



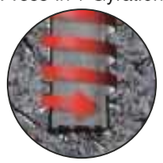
Steel Sheet Piles

Super Crush Mode | Water Jetting Mode | Standard Mode

+

Tubular Piles

Press-in + Gyration

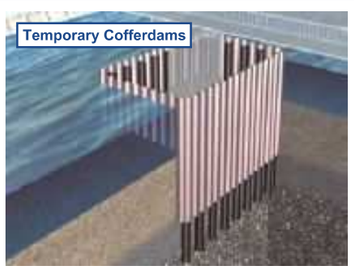


Combi-Gyro Method Features

- 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

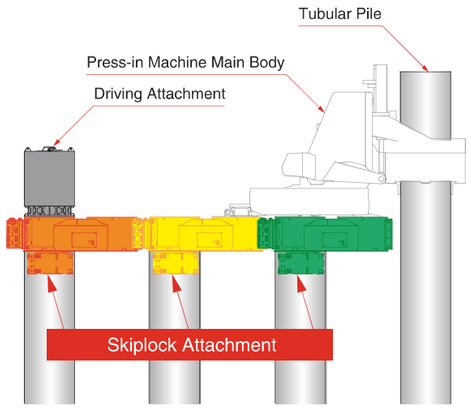
Road Retaining Wall Improvement

Cofferdams for Pier Repair

Skiplock Method

Use of the Skiplock Attachment Allows for Spaced Interval Installation of Pipe Piles

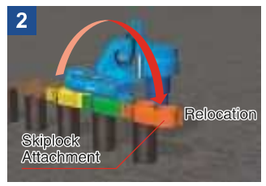
With the Skiplock Method, specially developed Skiplock Attachments allow steel tubular piles to be installed at a spacing of 2.5D with the Gyro Piler, while maintaining its press-in capabilities for various applicable structures such as for landslide prevention, coastal levees, etc.

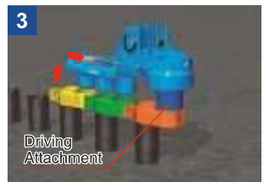



Example of Skiplock application installing Landslide Prevention Piles

Construction Procedure

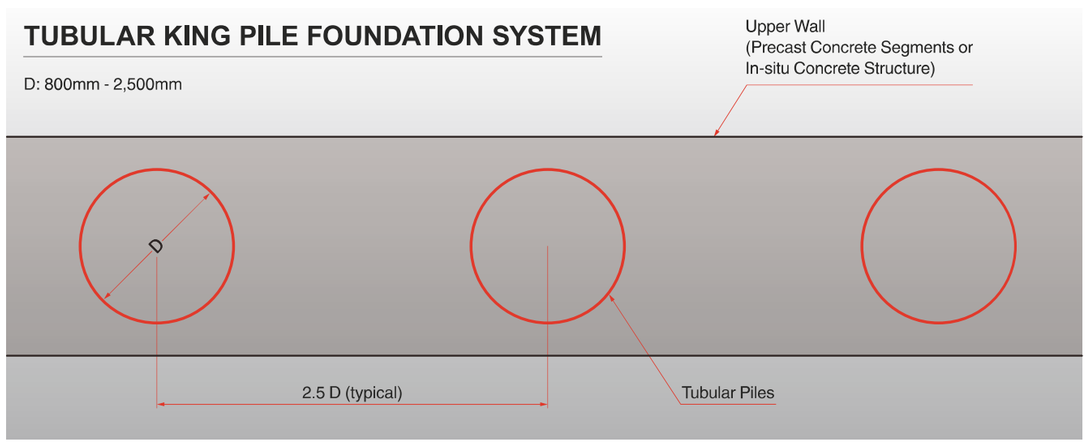
Pile pressed down to finished level





Machine self-moving procedure

Pitching and installation of subsequent pile



Achievements

Seawalls for Petroleum Stations

Tubular Foundation Piles for Seawalls

Tubular Foundation Piles for Buildings