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.

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Introduction

The Zero Clearance Method employs an especially designed press-in machine (the Zero Piler) and Zero Sheet piles (NS-SP-J) to press-in piles with zero "dead space" between the piles and the adjacent structure. Conventional approaches often fail to provide a solution in civil engineering works on narrow water courses, etc., or building projects requiring efficient utilization of the available land. But the Zero Clearance Method enables maximum use of the space in a way that was not possible before.

Also, the machinery is compact, so it doesn’t dominate the surrounding area, has no risk of overturning, and is very safe indeed. And by using the GRB system, which requires no temporary works, the construction time is shortened and costs are reduced. This path-breaking method is hugely beneficial in the development of underground spaces and antiseismic reinforcement work.

Contents

- Overview of Zero Clearance Method ........................................ 1
- GRB System ............................................................................. 3
  Standard Machine Layout ...................................................... 4
- Applications & Reference .......................................................... 5
  Water Course Repair Work ..................................................... 5
  Trackside Projects .................................................................... 6
  Retaining Walls for Highways ................................................... 7
  Architectural Bracing Projects .................................................. 8
- Zero Piler .................................................................................. 9
  Zero Piler JZ100A ................................................................. 9
  Power Unit .............................................................................. 9
  Zero Piler SCZ-ECO600S ...................................................... 10
- Auxiliary Equipment ................................................................. 11
  Zero Clamp Crane CB1-7 ...................................................... 11
  Pile Runner PR1 ....................................................................... 11
  Reaction Stand ....................................................................... 11
- Standard Press-in Procedures ................................................... 12
  Initial Press-in .......................................................................... 12
  Standard Installation .............................................................. 12
- Installation Properties .............................................................. 13
  Corner Installation ................................................................. 13
  Curve Installation ................................................................. 13
  Slope Installation ................................................................. 13
- Design and Sekisan ................................................................. 14
  Standard Shapes and Cross-Sectional Performance of Zero Sheet Piles (NS-SP-J) 14
  Interlock Thread Angle ......................................................... 14
  Range of Application of the Zero Clearance Method ................. 14
  Sekisan .................................................................................. 14
- Eco-Friendly Design ............................................................... 15
  Exhaust Gas Cleaning Compliant with "Offroad" Law .................. 15
  Meeting Ultra-Low-Noise Standards ....................................... 15
  Biodegradable Oils for Standard Specification ........................ 16
Overview of Zero Clearance Method

The press-in machine and piles are custom-designed to achieve zero clearance when working up against an existing structure, so efficient use can be made of limited work space.

The Zero Clearance Method uses especially designed equipment (the Zero Piler) and Zero Sheet Piles (NS-SP-J) to insert piles with zero "dead space" between the piles and the adjacent structure.

The Superiorities of the Press-in Method

- No Vibration / No Noise
- No Overturning
- Press-in Machine Light and Compact
- Pile Bearing Capacity can be Checked as Work Progresses
- High Working Precision

Features of the Zero Sheet Pile (NS-SP-J)

- Interlock joint on the outside means no need to reduce cross-sectional performance because of interlock efficiency
- Individual piles are very rigid and resistant to deformation, making them excellent to work with

Features of the Zero Clearance Method

- Respectful of the surrounding area
  Because the Press-in Method uses static load, and the Zero Sheet Piles (NS-SP-J) all face the same way, then it is possible to minimize the effects on the ground behind the piles when using driving assistance.
- Excellent Safety with No Risk of Overturning
  Because the press-in machine grips securely onto the completed piles, there is no risk of overturning.
- Outstandingly Economical
  The Zero Sheet Piles (NS-SP-J) have their interlock situated on the outside, which enables economical design with no need to lower cross-sectional performance on the grounds of interlock efficiency.
- Faster Completion
  The Zero Sheet Piles (NS-SP-J) have an effective width of 600 mm, and when compared with 400 mm-width sheet piles, this means fewer piles to install and shorter construction time.

Construction works can be carried out with Environmentally-friendly considerations, lower cost and shorter work duration at any work conditions.
GRB System for "Temporary Work Less" Construction

The GRB system applies the Press-in Principle which states that a reaction force is obtained from completed piles. In this way, all of the steps of the process, from transporting and pitching the pile, to pressing it in, can be carried out from a position on top of the existing piles. And since all of the equipment is self-supporting and grips onto the completed piles, then there is no risk of overturning, and the area affected by the works is restricted to the width of the machinery on the piles. Even over water, on sloping or uneven ground, in narrow spaces, or locations with restricted headroom, the GRB system has no need for any temporary structures, like platforms or roadways, and can focus efficiently on the purpose of the project - building the main structure.

---

Standard Machine Layout

GRB System Working Layout

- **Plan View**

- **Side View**
**Water Course Repair Work**

The Zero Piler can install piles with zero dead space to adjacent structures, and provided that there is at least a space corresponding the pile wall thickness (200 mm) between the existing water course and the adjoining boundary, the equipment is capable of working safely without interrupting ongoing activities and functions, even in narrow sites where conventional methods are not applicable.

A space of just 200 mm (the wall thickness) between the existing water course and the adjoining boundary is sufficient to allow construction.

The existing water course is demolished and a simple temporary wall, etc., is required.

**Reference**  
River Restoration Project to Repair Earthquake Damage, Soeyamafurukawa  
Hokkaido

An extremely safe construction process, minimizing the gap to the houses and making efficient use of the available ground.

**Trackside Projects**

The Zero Piler is capable of working safely in strict observance of building restrictions, and respects the train safety gauge at all times. The machinery does not have to be assembled and removed every day, there is no impact on railway operations, and the construction time can be made much shorter.

The equipment encroaches into the safety gauge, so construction is limited to nighttime, and equipment must be assembled and dismantled every day.

**Reference**  
No. 1 Shimounabara B Reconstruction Project between Nonai and Yadamae on the Tohoku Main Line  
Aomori Prefecture

Piles could be built close alongside the tracks during train operating hours, without any effect on traffic, resulting in much faster completion.
Retaining Walls for Highways

The compact Zero Piler and the special piles used minimize the effects on the surrounding area and make it possible to construct retaining walls for roads alongside residential dwellings.

Zero Clearance Method

Conventional Method

(Press-in Machine for U Sheet Piles)

The existing roadway is partly demolished and a simple temporary wall, etc., is required.

A space of just 200 mm (the wall thickness) between the existing roadway and the adjoining boundary is sufficient to allow construction.

Minimum 700-800 mm required

Distancing from adjacent structure is inevitable, so the surface area available for building is reduced. The compact Zero Piler and the special piles used minimize the effects on the surrounding area and make it possible to construct retaining walls for roads alongside residential dwellings.

Architectural Bracing Projects

The Zero Clearance Method is compact and safe, and permits highly efficient work in sites with very restricted lateral space. Using the Zero Sheet Piles helps to minimize the thickness of the retaining wall, so that the available building land can be used to the maximum.

Zero Clearance Method

Conventional Method

(Three-Point Pile Driver)

Maximum use can be made of the available land. (With a 20 m x 20 m plot of land, the available surface area is increased by about 10%.)

Distancing from adjacent structure is inevitable, so the surface area available for building is reduced.

Adjacent Structure

Reference

Specific Country Road Repair Works, Road Improvements on Urban Stretch between Shimbashi and Mure, Yamaguchi Prefecture

Retaining wall built with minimum clearance between sheet piles and adjacent structure. Safe and compact machinery means that work is completed without having to demolish nearby structures.

Reference

New Construction, Mitsui Life Matsue Building, Shimane Prefecture

Achieving zero clearance to the adjacent structure makes more land available for building. Project completed with no effects on the surrounding area.
**Zero Piler JZ100A (Standard / Water Jetting Mode Compatible)**

- **Press-in Machine Main Body**
  - Press-in Force: 980 kN
  - Stroke: 700 mm
  - Power Unit: EU200I3
  - Mass: 7900 kg
  - Compatible Piles: Zero Sheet Pile (NS-SP-J) 600 mm Width

- **Power Unit**
  - **EU200I3**
    - Model: EU200I3
    - Power Source: Diesel engine
    - Rated Output: 195 kW / 1800 min⁻¹
    - Fuel Tank Capacity: 400 L
    - Travel Speed: 1.4 km/h
    - Mass: 6800 kg

- **Press-in Machine Main Body**
  - Press-in Force: 770 kN
  - Stroke: 1000 mm
  - Power Unit: EU300G3
  - Mass: 12440 kg
  - 4-Clamp: 12840 kg
  - Compatible Piles: Zero Sheet Pile (NS-SP-J) 600 mm Width

**Zero Piler SCZ-ECO600S (Standard / Water Jetting / Hard Ground Mode Compatible)**

- **Super Crush Mode**
  - **Press-in Machine Main Body**
    - Press-in Force: 770 kN
    - Stroke: 1000 mm
    - Power Unit: EU300G3
    - Mass: 12440 kg
    - 4-Clamp: 12840 kg
    - Compatible Piles: Zero Sheet Pile (NS-SP-J) 600 mm Width

- **Water Jetting Mode**
  - **Press-in Machine Main Body**
    - Press-in Force: 770 kN
    - Stroke: 1000 mm
    - Power Unit: EU300G3
    - Mass: 12440 kg
    - 4-Clamp: 12840 kg
    - Compatible Piles: Zero Sheet Pile (NS-SP-J) 600 mm Width

- **Standard Press-in**
  - **Press-in Machine Main Body**
    - Press-in Force: 770 kN
    - Stroke: 1000 mm
    - Power Unit: EU300G3
    - Mass: 12440 kg
    - 4-Clamp: 12840 kg
    - Compatible Piles: Zero Sheet Pile (NS-SP-J) 600 mm Width

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* Product specifications may be changed without prior notice.
**Zero Clamp Crane CB1-7**

- **Model**: CB1-7
- **Crane Power**: 2.93 ton x 4.5 m
- **Max. Working Radius**: 12.0 m
- **Compatible Piles**: Zero Sheet Pile (NS-SP-J), U Sheet Pile 400-600 Pitch, Hat Sheet Pile 900 Pitch, Concrete Sheet Pile KF100-150H
- **Mass**: 4500 kg

**Pile Runner PR1**

- **Model**: PR1
- **Carrying Capacity**: 5.0 t
- **Mass**: 645 kg
- **Carriage**: 140 kg
- **Total Mass**: 785 kg
- **Compatible Piles**: Zero Sheet Pile (NS-SP-J), U Sheet Pile 400-600 Pitch, Hat Sheet Pile 900 Pitch, Concrete Sheet Pile KF100-150H

**Reaction Stand**

- **Model**: For JZ100A, For SCZ-ECO600S
- **Total Length**: 5720 mm, 5670 mm
- **Total Length (Arm Folded)**: 3450 mm, 4000 mm
- **Total Width**: 4310 mm, 4260 mm
- **Total Width (Arm Folded)**: 1970 mm, 1920 mm
- **Total Height**: 414 mm, 512 mm
- **Mass**: 1600 kg, 2100 kg

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**Initial Press-in**

1. Set the Reaction Stand horizontally on the press-in line, and install the Zero Piler and then the Counter Weight.
2. Pitch a Zero Sheet Pile (A) in the Chuck, check the verticality and alignment, and start press-in. The Zero Piler then self-moves.
3. Press-in Zero Sheet Pile (A) to prescribed height and press-in Zero Sheet Pile (B) to a position which allows safe self-moving. Installation of initial reaction sheet piles completed.
4. Press-in Zero Sheet Pile (C) until the prescribed height.
5. Press-in three piles by this same procedure.
6. Remove the counter weight and the Reaction Stand. Installation of initial reaction sheet piles completed.

**Standard Installation**

1. Pitch the Zero Sheet Pile and grip with the chuck.
2. Check verticality and alignment, and then start press-in work.
3. Press in Zero Sheet Pile (A) until bearing capacity is achieved.
4. Open clamp and start self-moving.
5. Close clamp and end self-moving.
6. Press in Zero Sheet Pile (A) to datum level. Pile complete.

*Product specifications may be changed without prior notice.*
Installation Properties

Corner Installation

Site Condition A: Hoisting possible
Site Condition B: Installation of sacrificial pile possible
Site Condition C: Hoisting and sacrificial pile both impossible

The press-in machine main body can press in up to three piles in the positions shown above. A fourth pile requires various approaches, depending on the site conditions A-C.

The press-in machine is hoisted and moved to the indicated position by crane, and then presses in the fourth pile.

One sacrificial pile A is pressed in on the opposite side to the piling direction, so that Clamp No. 3 can grip this pile A when self-moving. After moving, the fourth pile is pressed in.

The press-in machine is installed on the Reaction Stand, and the fourth pile is pressed in.

Curve Installation

Outward Curve
Inward Curve

Slope Installation

Upward Gradient
Downward Gradient

Design and Sekisan

Standard Shapes and Cross-Sectional Performance of Zero Sheet Piles (NS-SP-J)

Approved by Ministry of Land Infrastructure, Transport and Tourism (MSTL-0148).

Interlock Thread Angle

* NS-SP-J piles can be threaded with U Sheet Piles.

Range of Application of the Zero Clearance Method

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Press-in</th>
<th>Water Jetting Mode (Using 1 Unit)</th>
<th>Water Jetting Mode (Using 2 Units)</th>
<th>Press-in with the Pile Auger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. SPT-N Value</td>
<td>Nmax ≤ 20</td>
<td>20 &lt; Nmax ≤ 40</td>
<td>40 &lt; Nmax ≤ 50</td>
<td>50 &lt; Nmax ≤ 180</td>
</tr>
<tr>
<td>Compatible Model</td>
<td>JZ100A / SCZ-ECO600S</td>
<td>SCZ-ECO600S</td>
<td></td>
<td></td>
</tr>
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</table>

Sekisan

The technical data published by the Japan Press-in Association can be applied to the Zero Clearance Method.

Standard technical data can be downloaded from the Association’s website.

http://www.atsunyu.gr.jp
**Exhaust Gas Cleaning Compliant with "Offroad" Law**

The SCZ-ECO600S Power Unit is equipped with a new-generation environmentally friendly engine. The high combustion efficiency, allied with Giken’s independent hydraulic control technology, means that exhaust gases are cleaned thoroughly and effectively, and the equipment complies with the “Off-Road” Law regulating work vehicle emissions and Level 3 of the Ministry of Land, Infrastructure, Transport and Tourism’s exhaust gas measures for construction machinery.

**Meeting Ultra-Low-Noise Standards**

The Power Unit also meets the “ultra-low-noise standards” set by the MLIT.

- **Sound Pressure Level (LA)** - Acoustic Power Level (LwA)
  - 72 dB(A) "Low Noise Standard"
  - 70 dB(A) Noise Office
  - 69 dB(A) Normal Driveway
  - 68 dB(A) Phone Ring
  - 66-68 dB(A) "Ultra Low Noise Standard"
  - 64 dB(A) Power Unit
  - 63 dB(A) Daytime Industrial Area
  - 61 dB(A) Normal Conversation (1m)
  - 60 dB(A) Normal Conversation (16m)
  - -2 dB(A) 66 dB(A) (Required more than 60% degraded.)

**Biodegradable Oils for Standard Specification**

The press-in machinery uses special biodegradable hydraulic oil (Piler Eco Oil) and grease (Piler Eco Grease) developed by Giken in collaboration with oil manufacturers. In the event of any escape into the water or soil, the oil and grease is decomposed by natural bacteria and has no effect on the ecosystem.

- **Biodegradability**
  - Piler Eco Oil: Degraded 77.2% Meet the standard
  - Piler Eco Grease: Degraded 66.2% Meet the standard
  - 100% alive Meet the standard

- **Avirulence** is certified by Fish Toxicity Test.

**Result**

- **Biodegradability test: OECD*1 301C**
  - Activated sludge was used as microorganism source. Biochemical oxygen consumption (BOD) of specimen material (Piler Eco Oil & Piler Eco Grease 100mg/L) was continuously assayed by automatic assay system to valuate biodegradability (percentage of volume of degrade into carbon dioxide and water) after 28 days.
  - After 28 days (Required more than 60% degraded.)
  - Eventually 100% will degraded. Time differs from conditions for 100% degrade.

- **Acute Toxicity Test: JIS*2 K 0102**
  - This test is carried out to investigate the survival rate of 10 killifishes within 4 days in the water contains specimen material 100mg/L.
  - After 4 days (Survival rate needs to be more than 50%)

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THE FIVE CONSTRUCTION PRINCIPLES

Environmental Protection

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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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