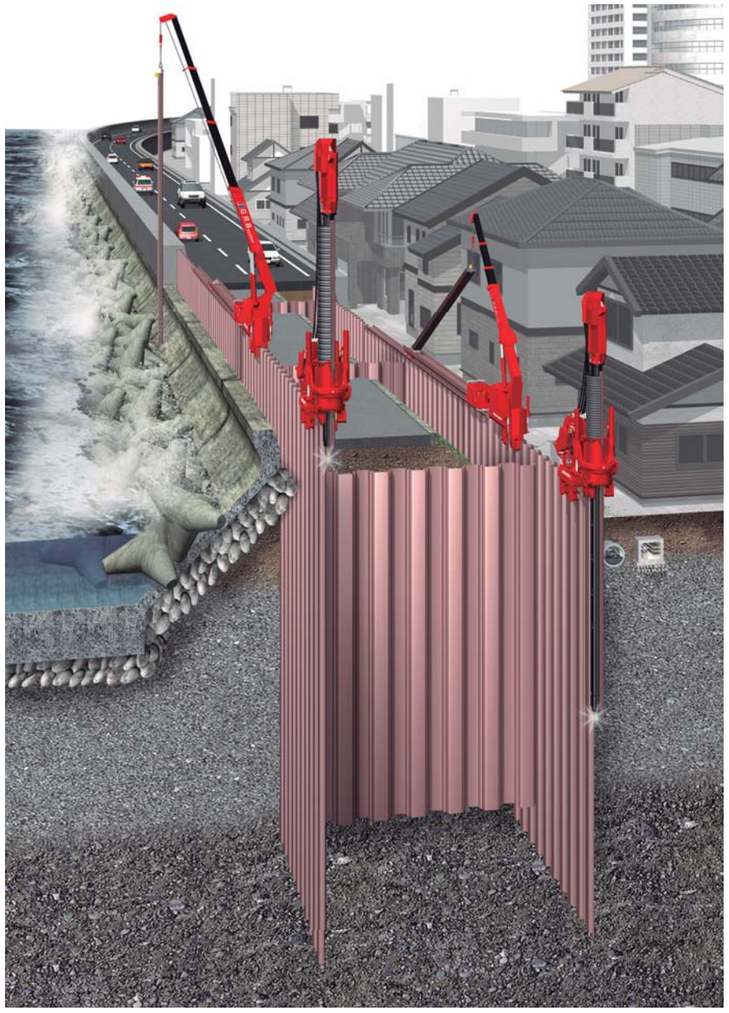
# IMPLANT LEVEE

## Highly Resilient Disaster Prevention Levee


Levee Upgrading Work in Japan

GIKEN

# Implant Levee



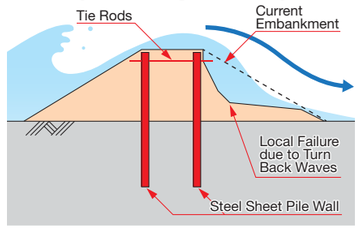
## Twin Steel Sheet Pile Wall System

Steel sheet piles are installed into the embankment to a depth determined for proper stability and/or cut-off of flow.
Also, liquefaction of the levee can be prevented by enclosing it with twin sheet pile walls.
Thus, the levee can withstand large external loading and the levee crest can remain in place, even in catastrophic events.

### ■ Advantages of Implant Levee

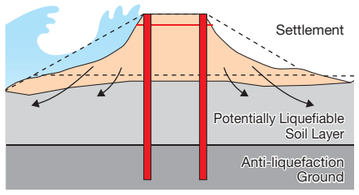
**Flood, Storm Surge and Tsunami Protection**

**Functions of the levee can be maintained by increasing its stability.**



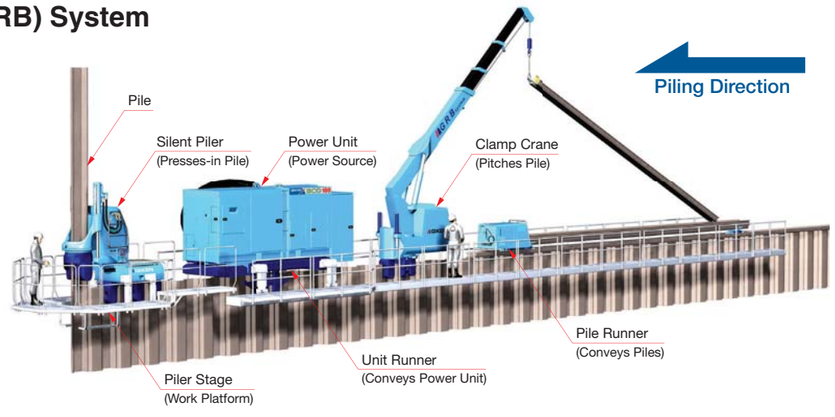

**Liquefaction Protection**

**Functions of the levee can be maintained by the ground enclosure effect.**




## Giken Reaction Base (GRB) System

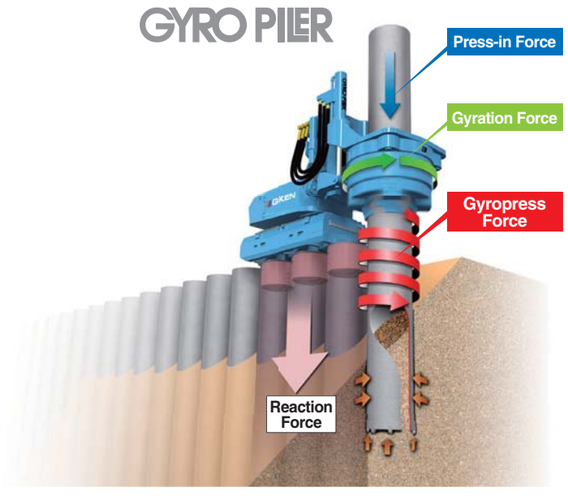
The press-in machine utilises reaction force from previously installed piles and performs piling work on top of the piles. With further development based on the principle of "reaction based mechanism", "the GRB System" was developed as a press-in system which performs all piling procedures such as; pile transportation, pile pitching and press-in work, on top of installed piles.
The GRB System consists of a Silent Piler in the front, a Power Unit as a power source, a Clamp Crane to pitch piles and a Pile Runner to convey piles from storage site.

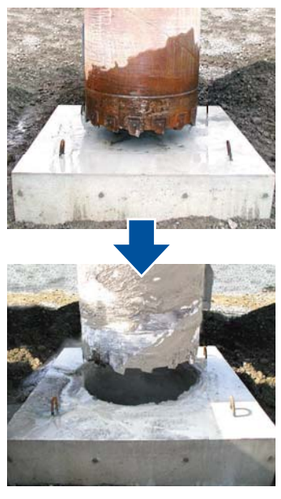



# Embedded Resilient Structure

## Contiguous Tubular Pile Wall

Steel tubular pile wall is a vertical barrier and can be installed in locations where space is scarce, such as urban environments or where the construction of a wide levee is not feasible.
The piles are installed into the embankment to a depth determined for proper stability to withstand large dynamic and hydraulic loading.



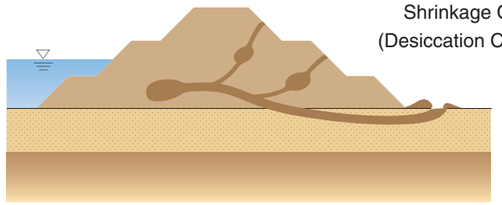
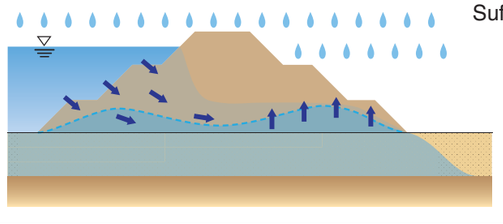
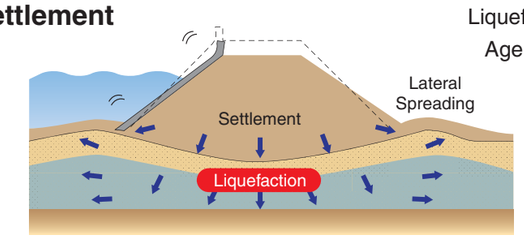
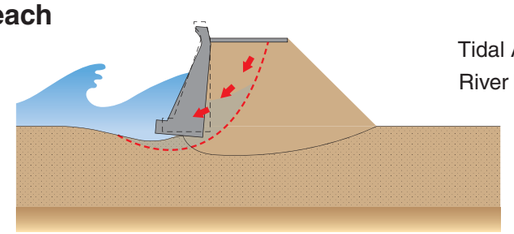
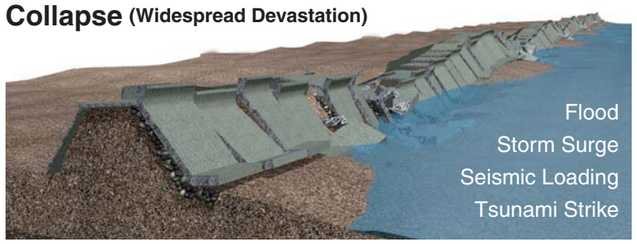
## Gyropress Method

Gyropress Method installs tubular piles with cutting bits attached on pile toe by rotary jack-in system, and travels on top of piles which are completely installed (completed piles).

Gyropress Method allows the installation of tubular piles without prior removal of existing structures and/or obstacles.

# Comparison of Implant Levee to conventional levees (Risk Analysis)

Failure of levees potentially results in devastating consequences, in both life and economic losses, around the failure. Therefore, risk analysis and evaluation is a key issue for levee operation and management.

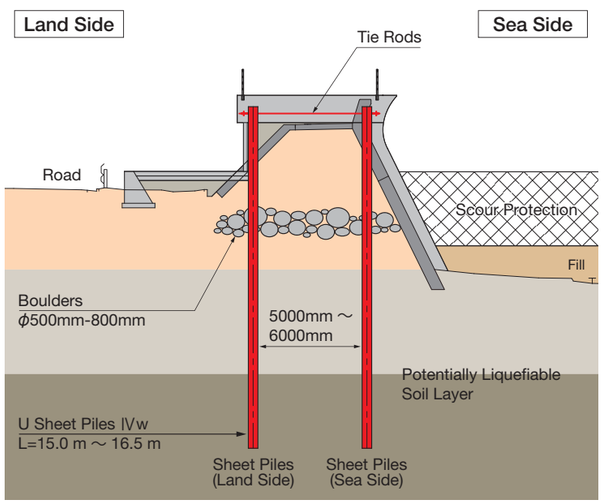
| Failure/ Deterioration Mode/ Risk Elements | Process | Risk Evaluation | |
|---|---|---|---|
| | | **Implant Levee** | Conventional Levee |
| **Instability**<br>Animal Burrowing<br>Shrinkage Cracks<br>(Desiccation Cracks)<br>  | Water entering the embankment through surface cracks or animal burrows could reduce the soil strength of the levee.This may compromise the stability of the embankment and, in turn, reduce the ability of the levee to perform as designed during high water events. | **Negligible** | **Moderate - High** |
| **Internal Erosion**<br>Seepage<br>Suffusion<br>  | The hydrostatic pressure against a levee slope increases significantly and can force water into the levee embankment and its foundation. This seepage will generally follow paths of least resistance. Depending on the geotechnical properties of the soil, internal erosion may then happen. | **Negligible** | **Moderate - High** |
| **Settlement**<br>Liquefaction<br>Age Effect<br>  | Large seismic accelerations cause settlement and loss of effective shear strength in water-saturated, unconsolidated sediment, leading to loss of bearing pressures and lateral spreading of levee. | **Negligible - Low** | **High** |
| **Breach**<br>Flood<br>Tidal Action<br>River Flows<br>  | Levees can breach before overflow/ overtopping if there are structural issues with the levee making it unstable under a hydraulic load. | **Negligible** | **Moderate - High** |
| **Collapse (Widespread Devastation)**<br>  | Large external cyclic loading due to these catastrophic events may lead to large parts of the levee collapsing or significant deformations. The levee failure occurs when the weakness of the levee reaches an unsustainable ultimate state. | **Negligible - Low** | **High** |

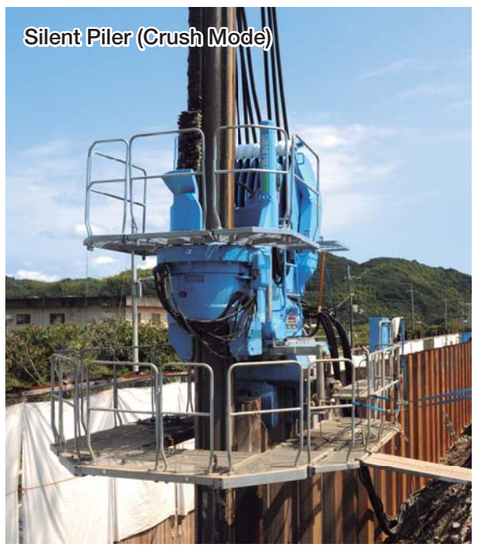
# Costal Levee Upgrading Work, Japan

## Twin Sheet Pile Walls installed with Press-in with Simultaneous Augering

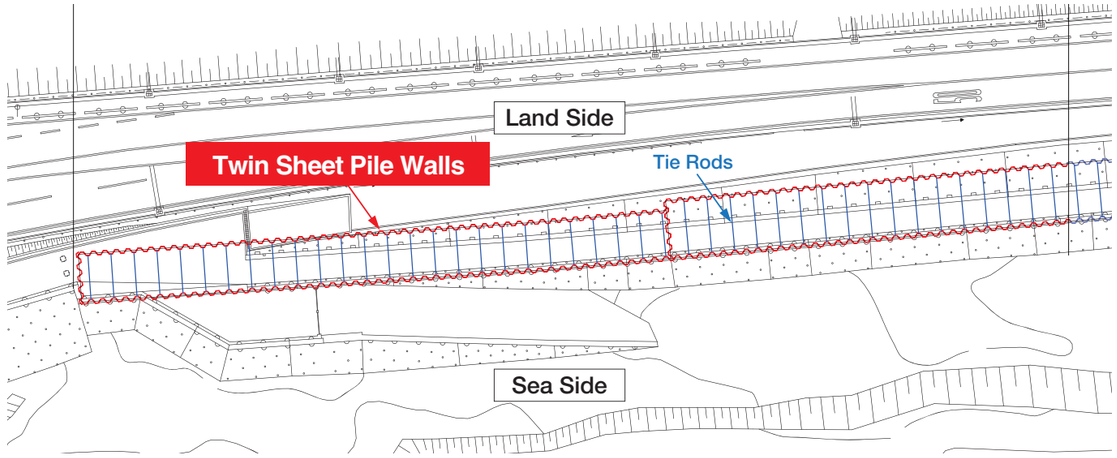
2,399no. U Sheet Piles ⅣW L=15.0m - 16.5m (700Lm)


【Cross Section】




【Plan】







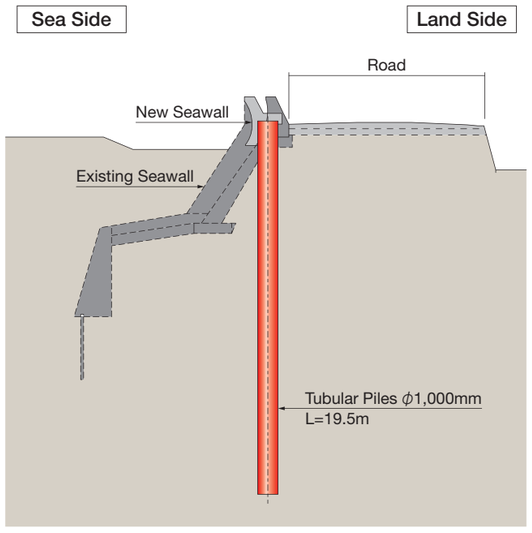
# Seawall Upgrading Work, Japan

West Area

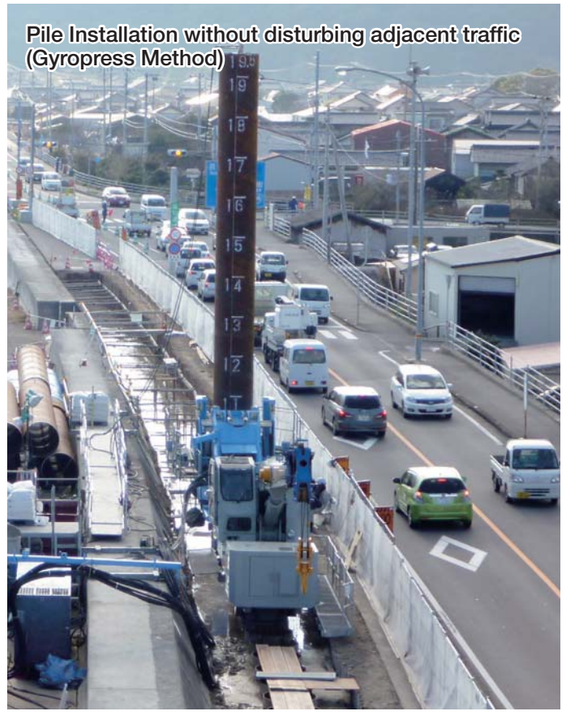
## Contiguous Tubular Pile Wall installed with Gyropress Method (Rotary Jack-in Method)

564no. Tubular Piles $\phi$1,000mm L=19.5m (670Lm)


【Cross Section】







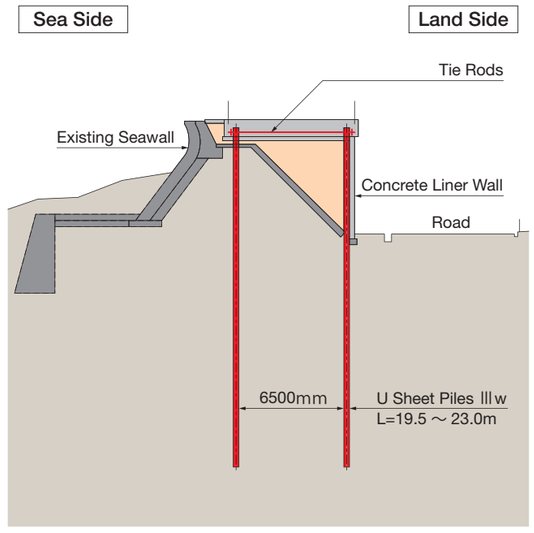


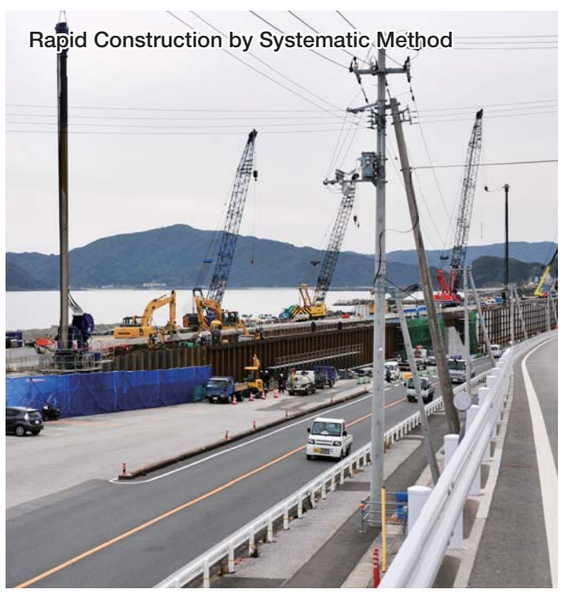

East Area

## Twin Sheet Pile Walls installed with Press-in with Simultaneous Augering

1,800no. U Sheet Piles Ⅲw L=19.5m - 23.0m (577Lm)

【Cross Section】

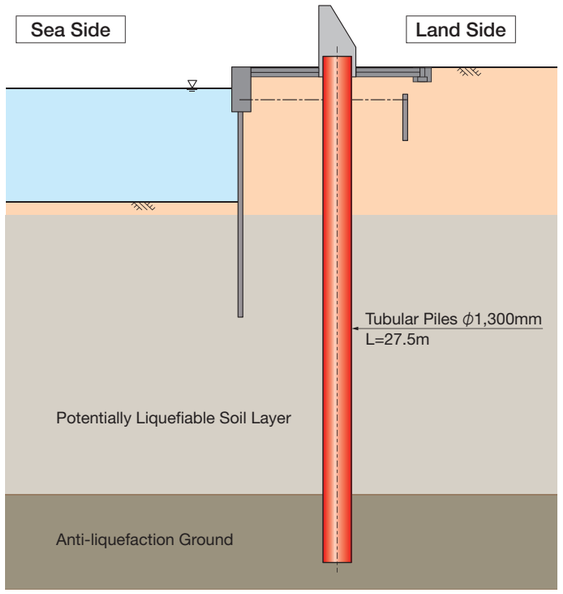


# Other Examples

## ■ Seawall Upgrading Work, Japan（Gyropress Method)

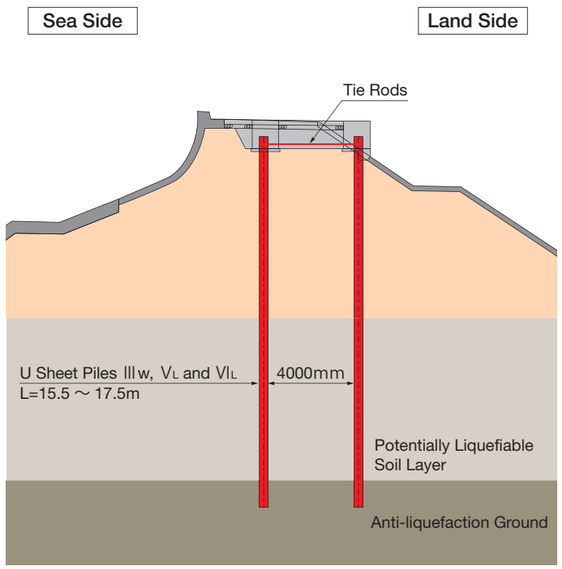
【Cross Section】






## ■ Levee Upgrading Work, Japan

【Cross Section】

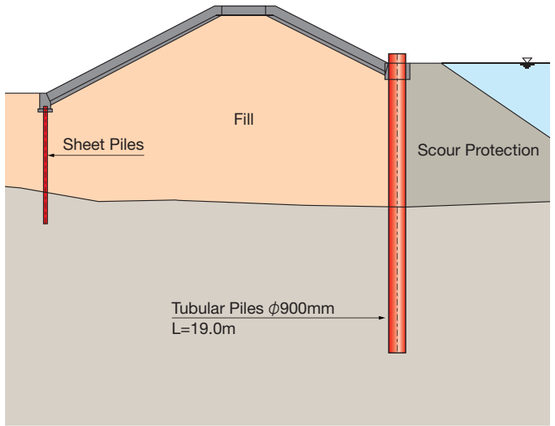






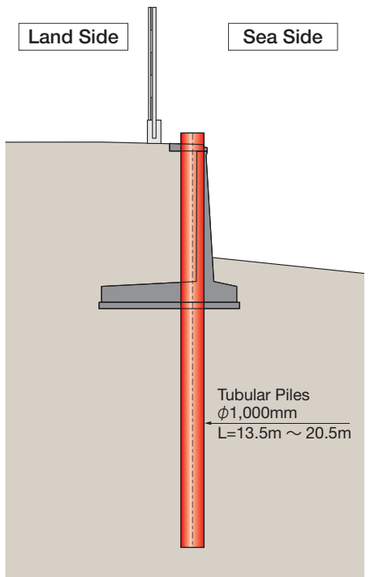

## ■ Riverine Levee Upgrading Work, Japan

【Cross Section】




## ■ Seawall Improvement Work, Japan

【Cross Section】




GIKEN **Construction Solutions Company** www.giken.com/en

GIKEN LTD.
**Global Network : Japan, USA, UK, Germany, Singapore, China**
Construction Design & Planning Group
1-3-28 Ariake, Koto-ku, Tokyo 135-0063, Japan
Tel. : +81-(0)3-3528-2633 Fax : +81-(0)3-3527-6055
Email : project@giken.com



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