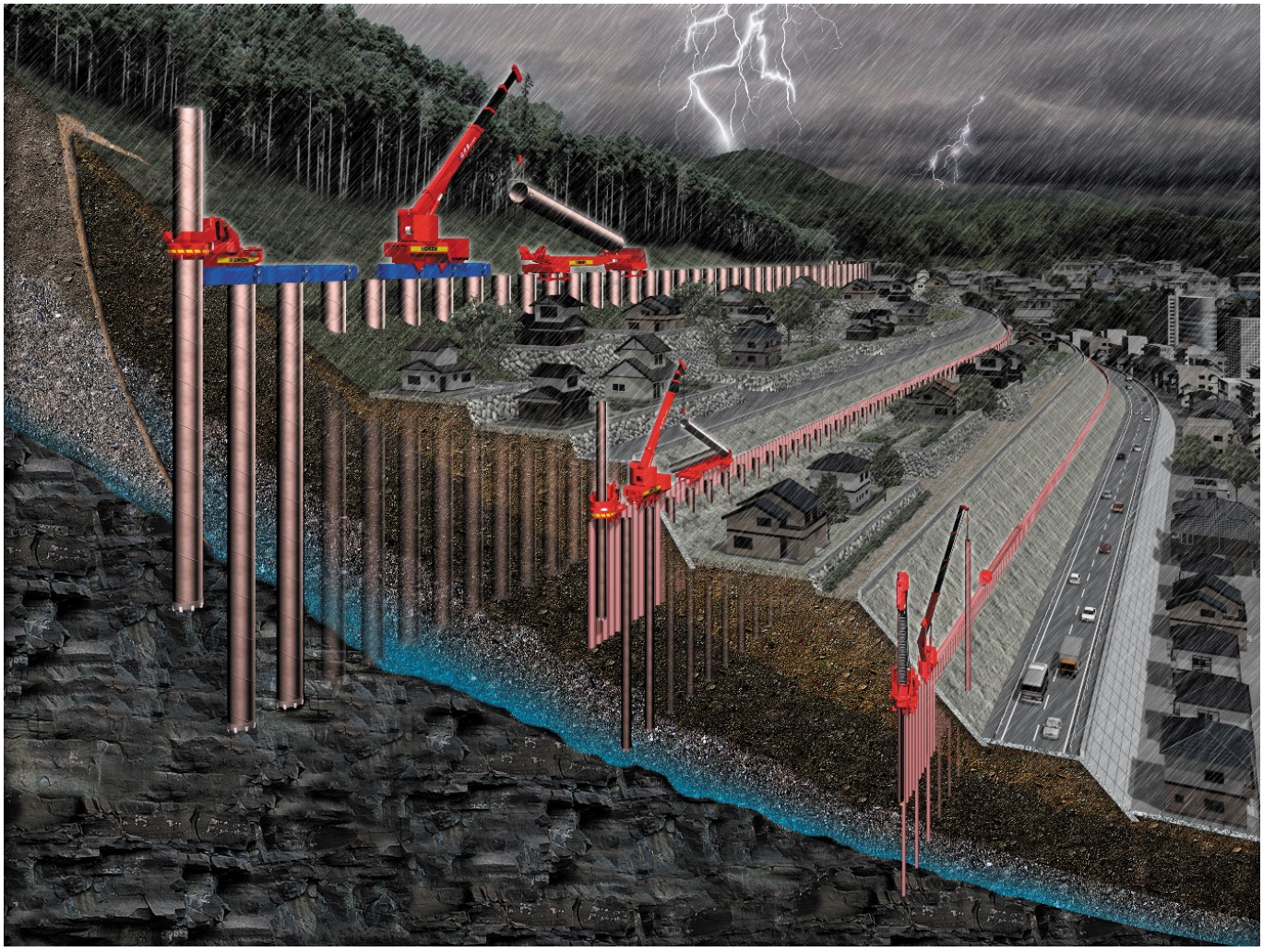
Bosai Solution ID : JBP00004

# Implant☒ Landslide Prevention

## Highly Resilient Restraining Wall for Landslide Prevention



## Hazard

Earthquake Land Slide Cyclone

## Solution Purpose

Prevention & Mitigation Response Recovery

## Solution Theme

Infrastructure Technology

## Technology Subject

Sabo Road Railways Essential Utilities Urban

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## Advantages

The combination of the Implant Deterrence Piles and Implant Retaining Walls will prevent landslide caused by massive earthquakes and torrential downpour. The piles embedded into stable ground hold soils and allow excessive ground water to flow down through pile gap. All construction procedures are rapidly carried out on top of the piles without disturbance of daily lived and surrounding environment.

## Solution Illustrated



**Prevention of Landslide**
Deterrence piles embedded into the stable ground hold soils and effectively allow excessive ground water to flow down through pile gaps. At the same time, continuous sheet piles holds slope collapsing. They are pressed-in from the top of pile wall without disturbance of daily lives and surrounding environment.

**Effective Design of Restraining Wall**
Resilient Implant Restraining Wall is flexibly designed by combination of large preventive piles (max. diameter 2500mm) installing with appropriate gaps and continuous retaining walls by sheet piles in order to prevent landslide caused by strong earthquakes and torrential downpour.

**Rapid Construction by Direct Installation**
Implant Restraining Wall is constructed by a single sequence of events due to direct installation of wall elements. Even if underground obstacles exist, restraining wall can be rapidly completed in the shortest possible time. Speed is one of the most important factors for disaster prevention work.

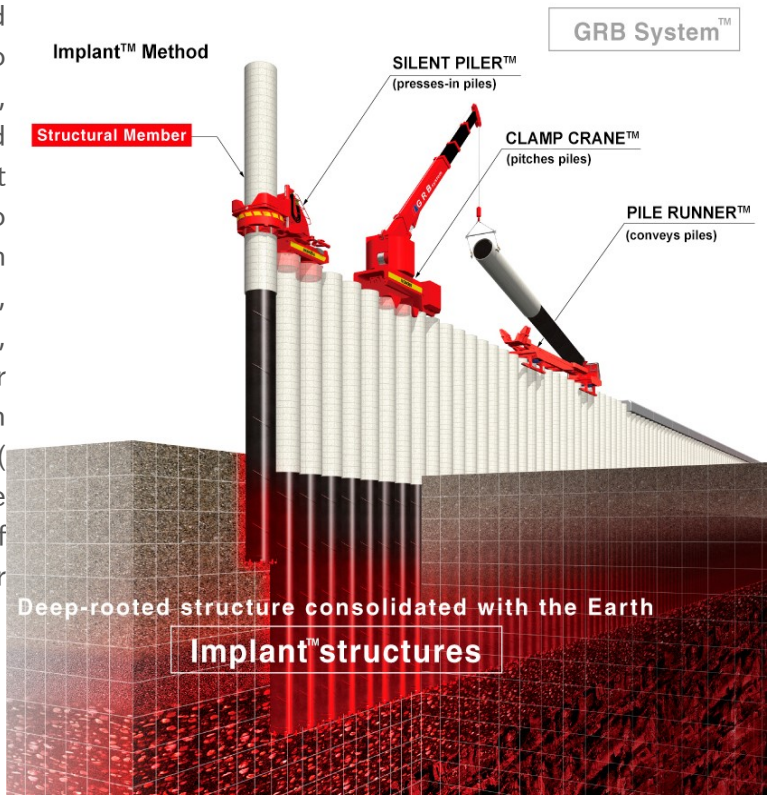
**Sustainable Infrastructure**
Implant Structure embodies a concept of “Functional Structure☒” that has a sustainable life cycle from design, development, construction, operation of function, review of function, removal, transfer to another place and re-use for another purpose at the end of its life. Implant Wall is the key to sustainable development for the future generations.

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## Background

### Frequent Occurrence of Natural Disaster

Because of geographical, topographical and meteorological conditions, Japan is subject to frequent natural hazards such as typhoons, torrential rains, landslides, earthquakes and volcanic activities. Every year there is a great loss of people's lives and property due to such disasters. Countermeasures are taken based on disaster management related laws, for example Erosion Control Act (1897), Landslide Prevention Act (1958), Disaster Countermeasures Basic Act (1961), Act on Prevention of Steep Slope Collapse Disaster ( 1969), Act on Special Measures for Active Volcanoes (1973) and Act on Promotion of Sediment Disaster Countermeasures for Sediment Disaster Prone Areas (2000).




### Environmentally Friendly Press-in Method

Restraining wall is one of effective countermeasures to prevent landslides, but construction work with large conventional rigs is not practical on slope, unlevelled ground and very confined site. In 1975, GIKEN invented the world's first reaction-based press-in machine "SILENT PILER" that utilises reaction force derived from fully installed piles and hydraulically jacks subsequent piles. Since all piling procedure is systematically carried out on the top of pile wall, restraining wall can be rapidly constructed silently and vibration-free without temporary platforms. This "Press-in Method" enables restraining wall to be implemented over all phases of landslide prevention from mitigation to recovery.

## Exposition of the Solution

### Implant Structure (Principle)

Implant Structure consists of an allowable structural member that is combined with structural and foundation elements that are pressed deep into the ground where they are securely supported by the Earth. The structure carries horizontal and vertical loads, using the "size of section" and "depth of penetration". As a result, it is highly resistant to ground displacement caused by external forces, serving as a "resilient" disaster-prevention infrastructure.

### Implant Restraining Wall for Prevention and Mitigation (Guard Method☒)

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Implant Wall constructed by “Press-in Method” performs as restraining wall of “Guard Method” that is developed to carry out protective work in advance of the occurrence of landslides. As all necessary press-in machinery systematically works on the top of pile wall, it minimises working space down to just contacted area of piles on the ground and eliminates a need for temporary platform even on slope, unlevelled ground and above water.





**Implant Restraining Wall for Response and Recovery (Rescue Method☒)**
Implant Wall is also applied to "Rescue Method" that is developed to minimise the damage by taking immediate action with simple press-in procedure at the occurrence of unpredictable natural disasters. When situation is changed after recovery, the wall can be removed for other purposes or replaced to other places.

## Achievements of Examples

As GIKEN has been contributing to disaster management and risk reduction since 1975, an enormous number of Implant Wall has been constructed over 36 countries worldwide by 420 users of the Silent Piler. It has been implemented to river revetment, road retaining wall, railway embankment wall, landslide restraining wall, bridge foundation, reinforcement of structures and so on. One example of various difficult projects is introduced as follows.





**Urgent Construction of Implant Training Wall in Izu-oshima Island, Tokyo**
In October 2013, the season’s 26th typhoon attacked Izu-oshima Island and recorded the maximum ever rain fall in the area. Especially the Okanazawa district was suffered from a large scale erosion and landslide. According to urgent countermeasures to minimise further risk planned by Tokyo Metropolitan Government, GIKEN provided Implant Wall as use of temporary training wall to protect residential area. Because of volcanic island, there were very hard lava beds underlying in the ground and the sloping surface was irregularly unlevelled and unstable. Under such difficult site conditions, press-in work was carried out by two units of “CRUSH PILER☒” that was specially developed for penetration into hard ground and successfully completed the required construction work accurately and swiftly.

## Corporate Profile

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**GIKEN LTD.**

16F Ariake Central Tower, 3-7-18 Ariake, Koto-ku, Tokyo 135-0063, Japan

Tel. :

E-mail : international@giken.com

Website : https://www.giken.com/en/

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