

**National
Resilience**

Earthquake, Tsunami

**Disaster
Prevention**

Flood, Landslide

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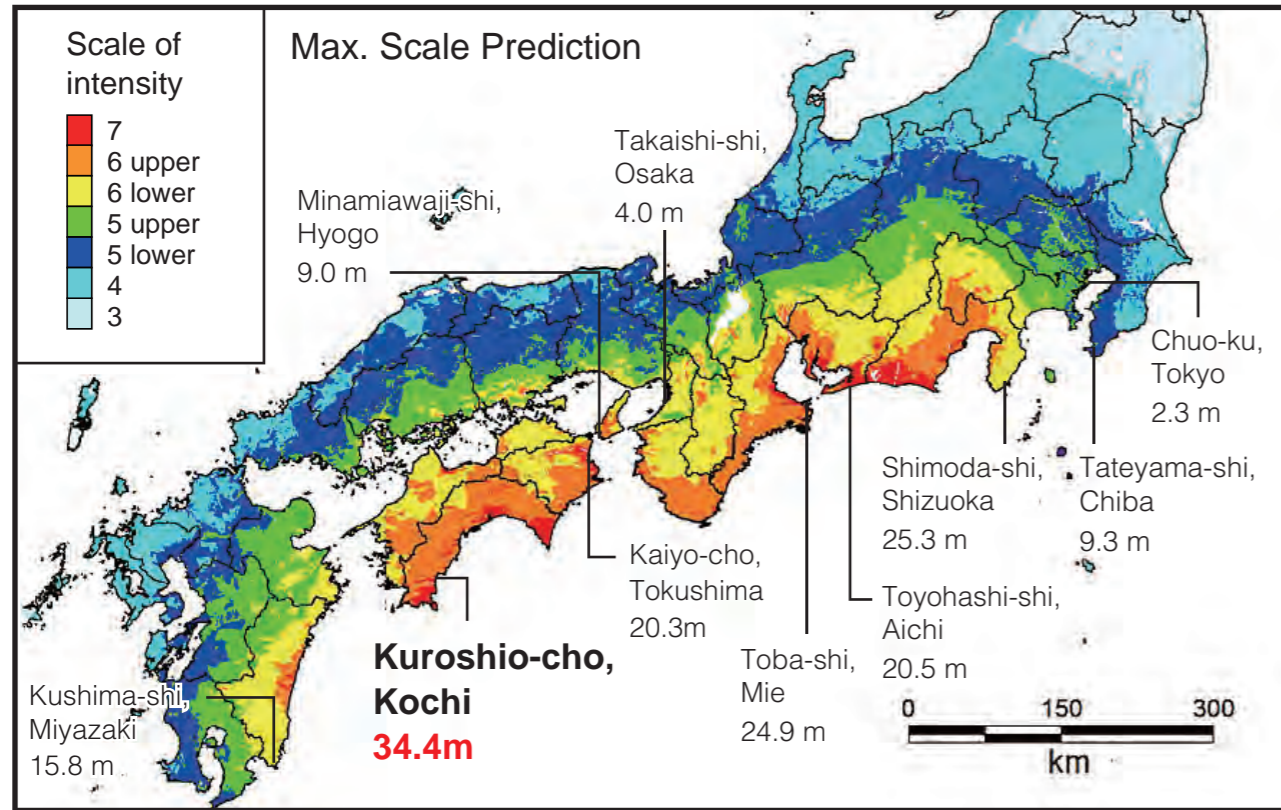
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Inevitable Reality in 20XX

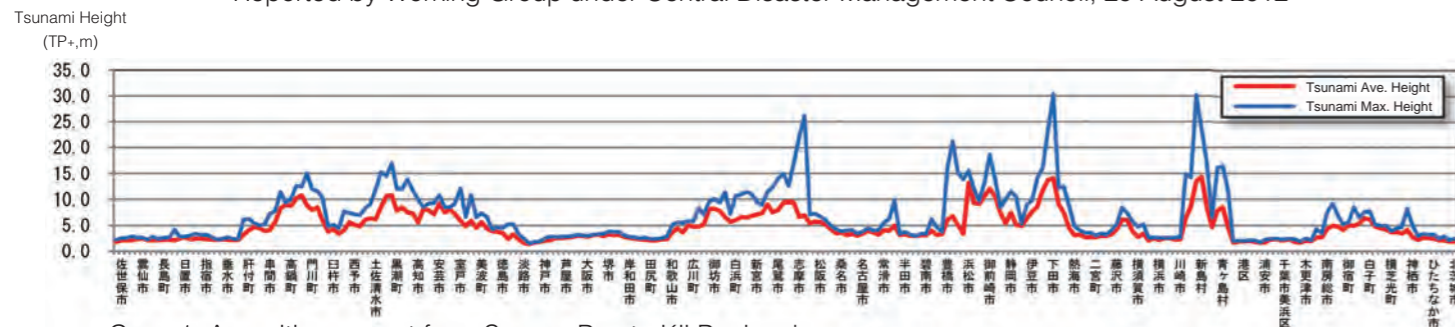
Seismic Hazard Map of Nankai Megathrust Earthquakes

Distribution of Seismic Intensity and Tsunami Height
Reported by Working Group under Central Disaster Management Council, 28 May 2013

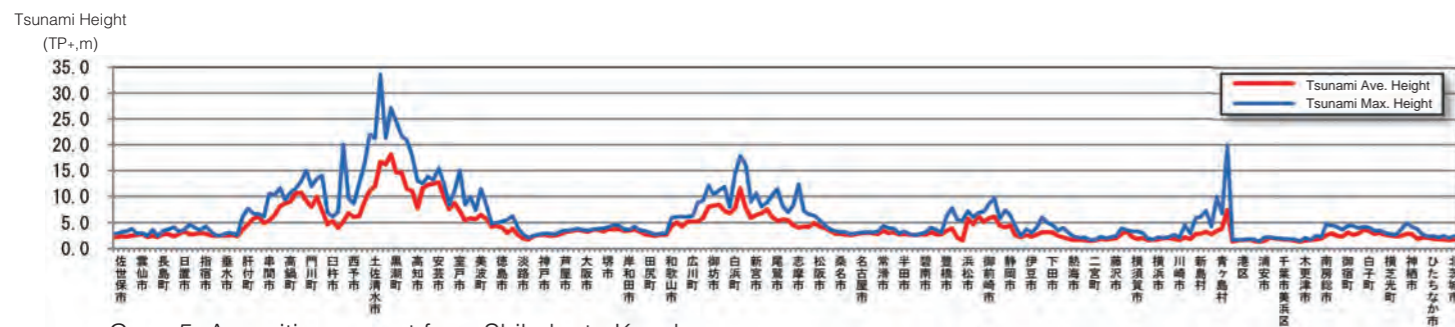


Predicted Tsunami Height of each Cities in Japan

Reported by Working Group under Central Disaster Management Council, 29 August 2012



Case 1: Asperities are set from Suruga Bay to Kii Peninsula



Case 5: Asperities are set from Shikoku to Kyushu area

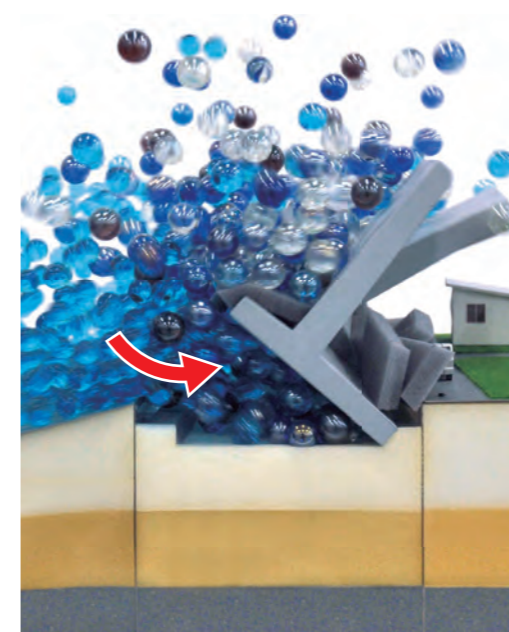
National Resilience

IMPLANT Structure

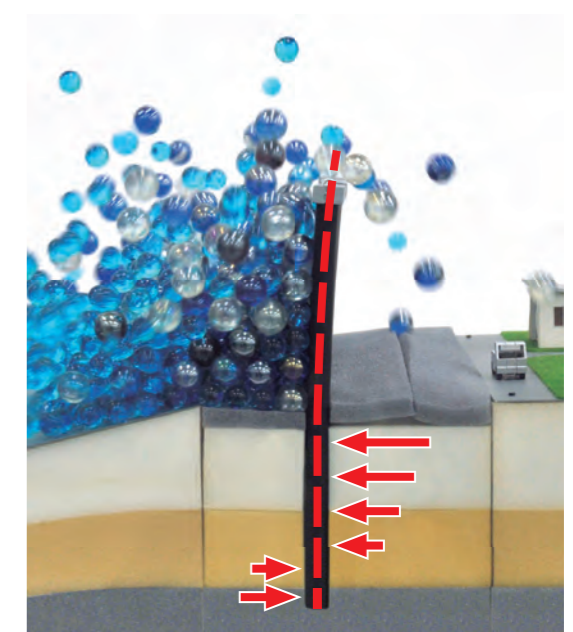
We won't ever suffer from great natural disasters !

Disaster Prevention starts from Structural Revolution

Footing Structure



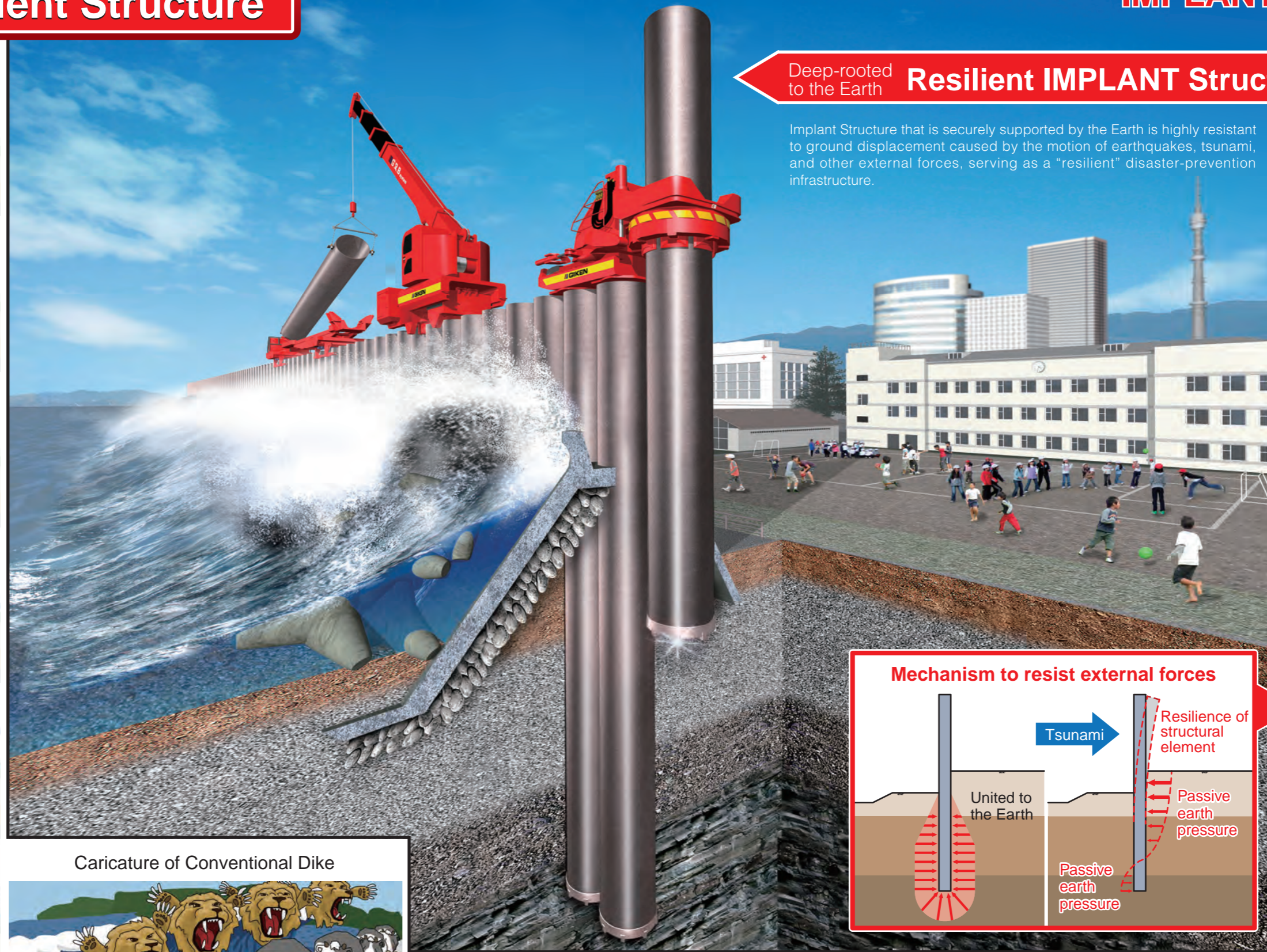
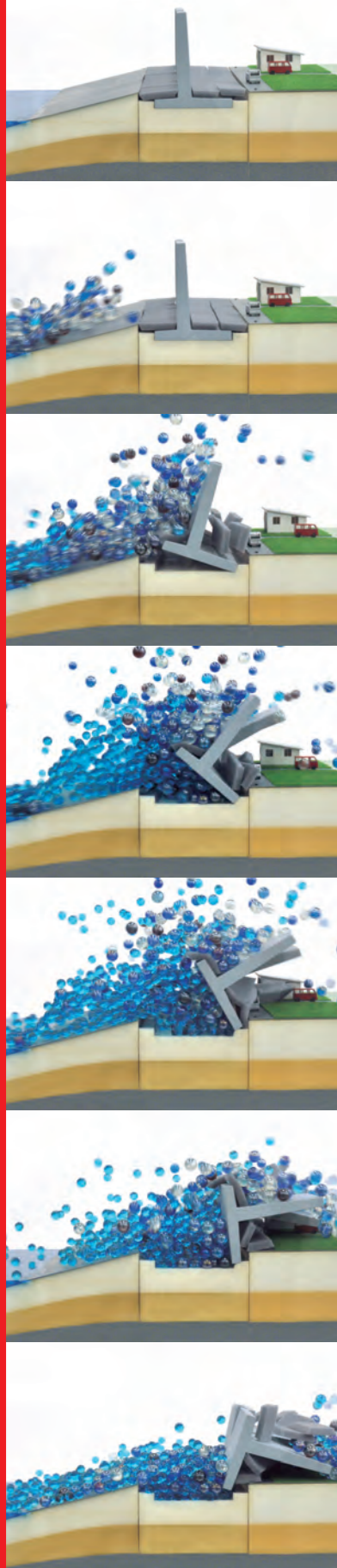
Resilient IMPLANT Structure



Advanced Disaster Management for

- The Resilient Structure
- Levee Reinforcement
- River and Marine
- The Novel Tide Barrier
- Emergency Evacuation
- Liquefaction Prevention
- Industrial Complex
- Quay Wall of Berth
- Road and Railways
- Bridge Reinforcement
- Flood and Tidal Defence
- Landslide Prevention

Vulnerability of Footing Structure



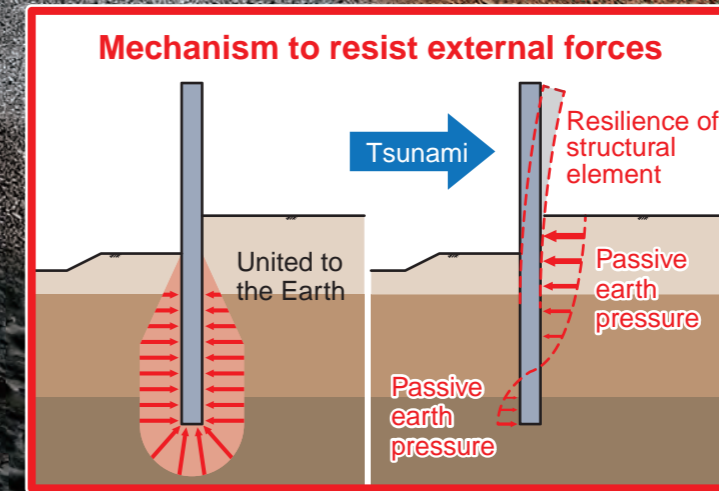
Deep-rooted to the Earth Resilient IMPLANT Structure

Implant Structure that is securely supported by the Earth is highly resistant to ground displacement caused by the motion of earthquakes, tsunami, and other external forces, serving as a "resilient" disaster-prevention infrastructure.

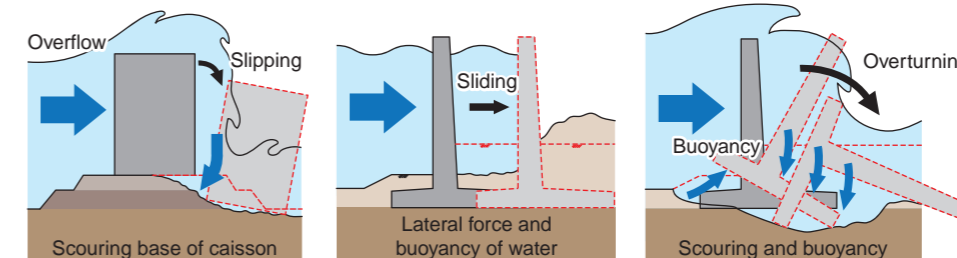
Caricature of Conventional Dike



"Earthquake & Tsunami" vs "Sand-filled Dike"
= "Hungry Lions" vs "Sleeping Cows"
The winner is apparent to everyone !!



Structures that are installed into shallow ground are mechanically weak against external forces of earthquake and tsunami.



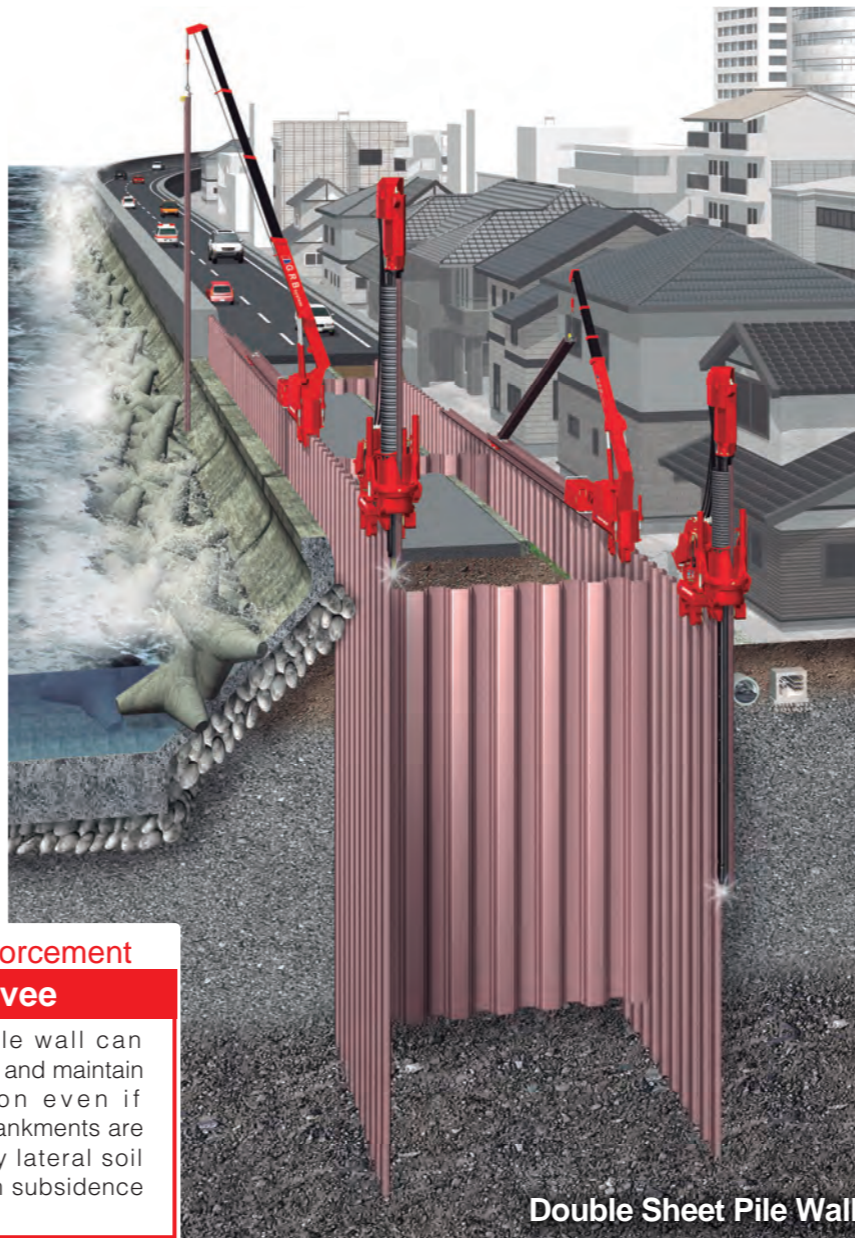
Levee Reinforcement

IMPLANT Structure

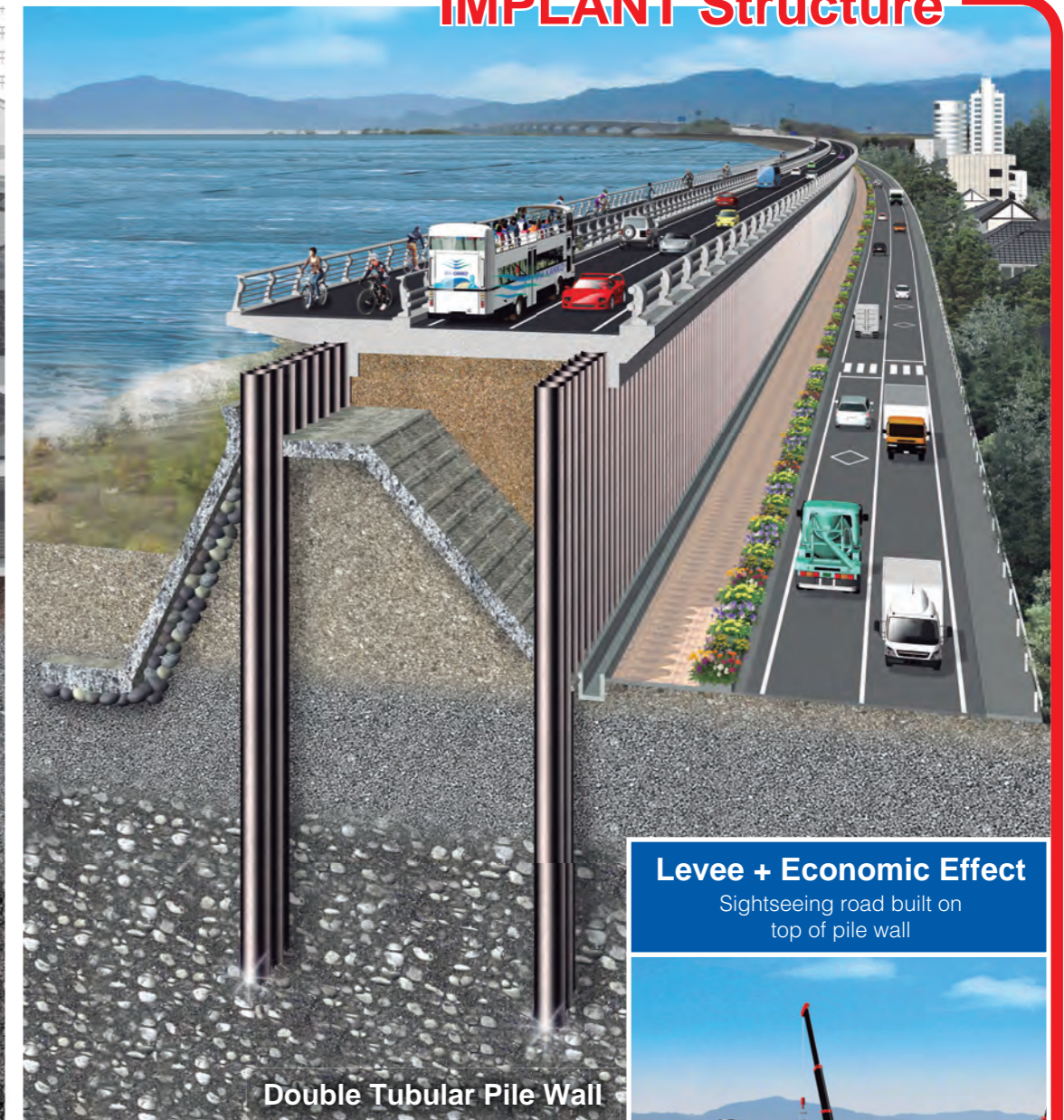


Tubular Pile Wall

"Backbone" Reinforcement Implant Levee
 Highly rigid steel pile wall can increase height of levee and maintain its original function even if concrete-covered embankments are severely collapsed by lateral soil movement, liquefaction subsidence and tsunami.



Double Sheet Pile Wall



Double Tubular Pile Wall

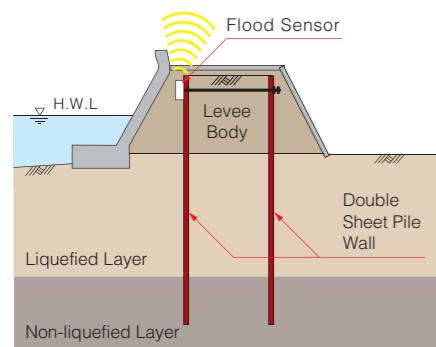
Levee + Economic Effect
 Sightseeing road built on top of pile wall

Five Functions of Implant Levee

(Effect of reinforcement with double sheet pile wall researched by Kochi Prefectural Government, Kochi University and Giken Ltd.)

Ordinary Times

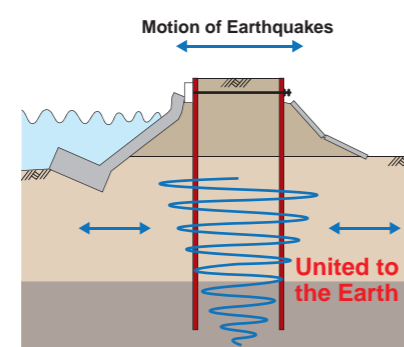
① Displacement Remote Monitoring



Monitoring Levee Conditions
 Management and aggregation of data from sensors is regularly done by emergency headquarters.

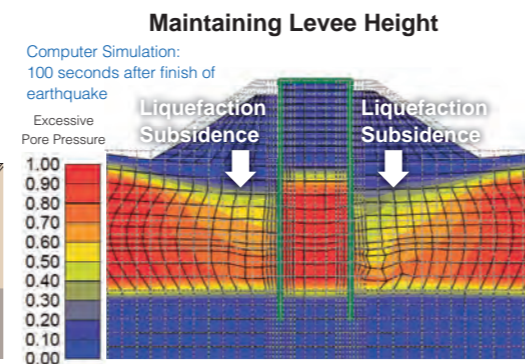
Earthquake Occurrence

② Seismic Movement Resistance



Levee Body united to the Earth
 Piles embedded into non-liquefied layer withstand seismic movement to maintain soundness of levee.

③ Liquefaction Subsidence Resistance

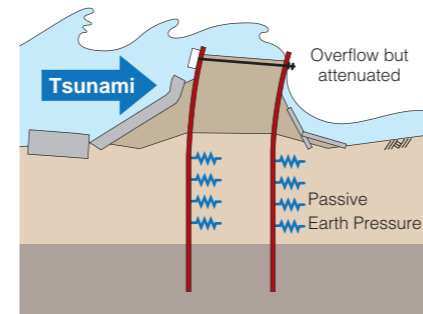


Effect of Aseismic Ground Enclosure
 Enclosed ground by continuous wall restrains lateral soil movement and subsidence to maintain the height of levee.

When Tsunami attacks

④ Tsunami Force Resistance

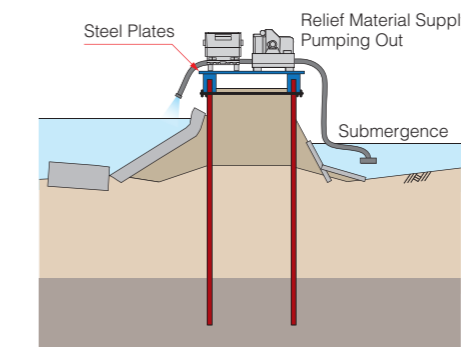
No Collapse, No Breakage



Resilience to repeated attacks
 Levee supported by the Earth withstands forces of repeated tsunami and backwash to secure time for evacuation.

Recovery

⑤ Emergency Transportation Routes



Road on Top of Pile Wall
 Checking soundness of levee, steel plates are laid over the top of piles for relief material supply and pumping out.



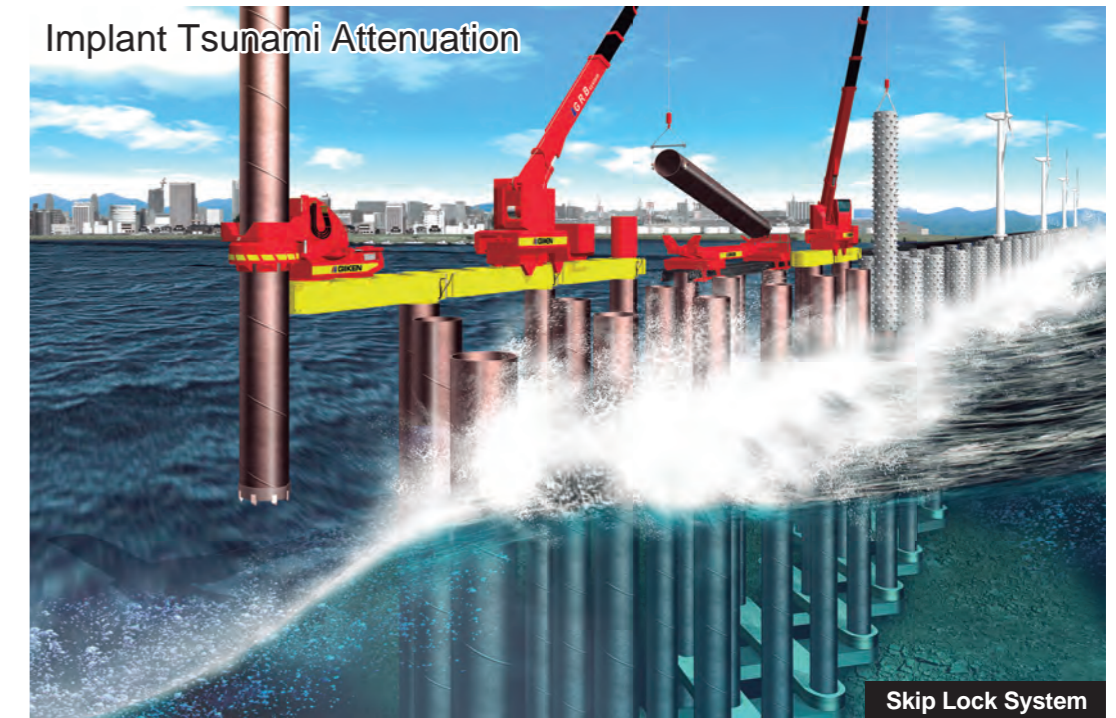
Risk Reduction against Nankai Megathrust Earthquake

Kochi Seacoast Levee Reinforcement
by Ministry of Land, Infrastructure, Transport and Tourism



Further Applications of Resilient Structure

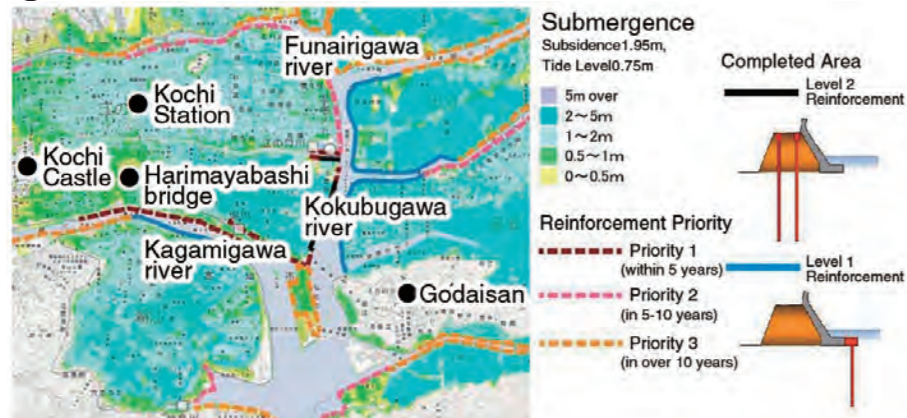
Implant Tsunami Attenuation



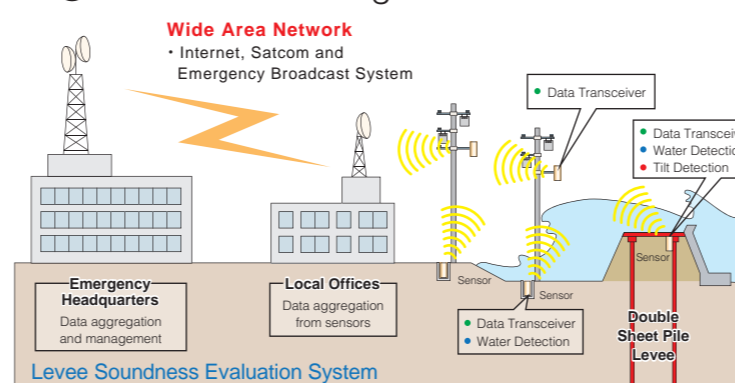
Resilient Implant Piles in a staggered alignment attenuate the force of tsunami.

Earthquake-Tsunami Management by Kochi Prefectural Government

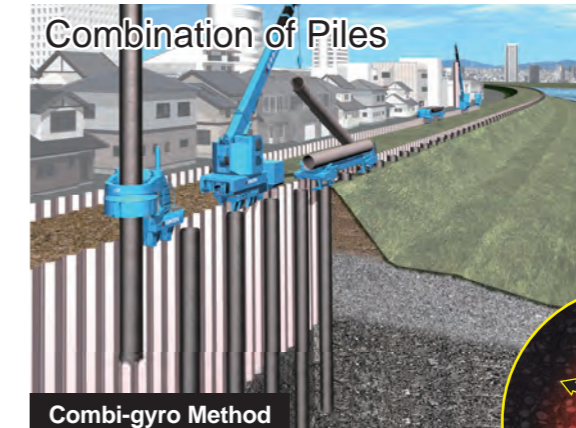
① Aseismic Reinforcement of River Embankments



② Remote Monitoring of Levee Conditions



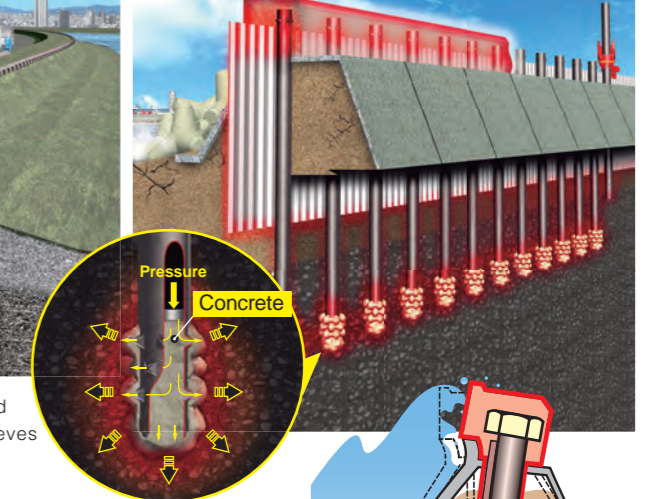
Combination of Piles



Combi-gyro Method

Combined wall of water-tight hat sheet piles and rigid tubular piles is flexibly designed and achieves high performance on economics.

Levee locked into the Earth



Kagamigawa-river in Wakamatsu-cho (Tubular Pile Wall)



Gyropress Method

Kokubugawa-river and Kumagawa-river (Double Sheet Pile Wall)

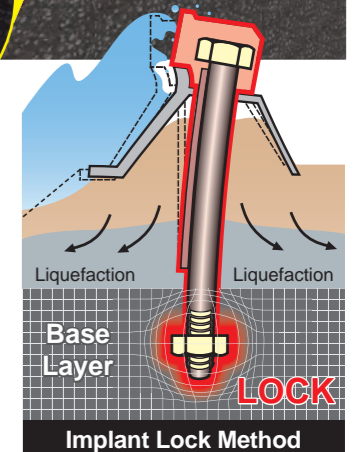


Press-in Method

Achievement in USA



Press-in Method



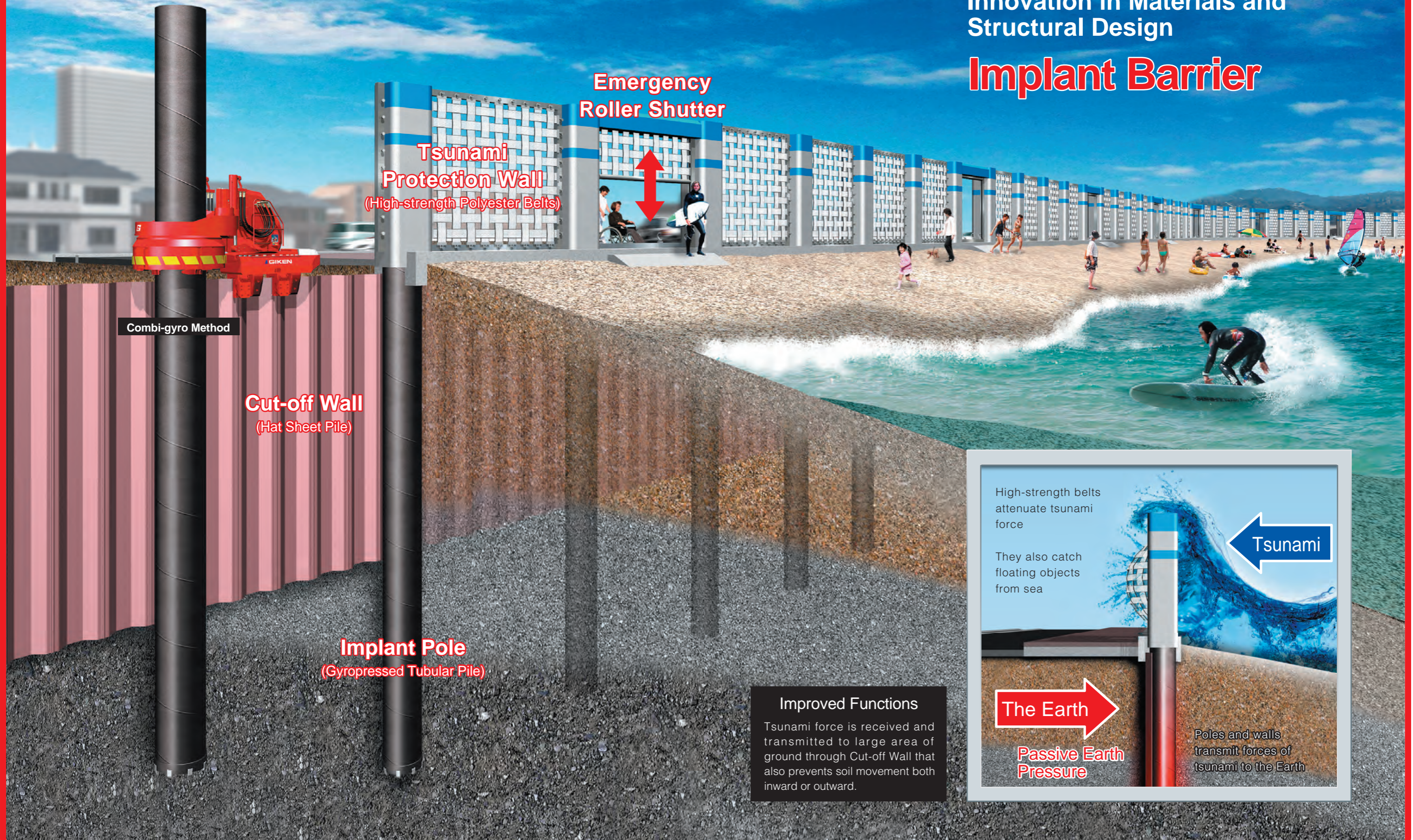
Tubular piles combined with cut-off wall locks existing structures to base layer.

The Novel Tide Barrier

IMPLANT Structure

Innovation in Materials and Structural Design

Implant Barrier



Combi-gyro Method

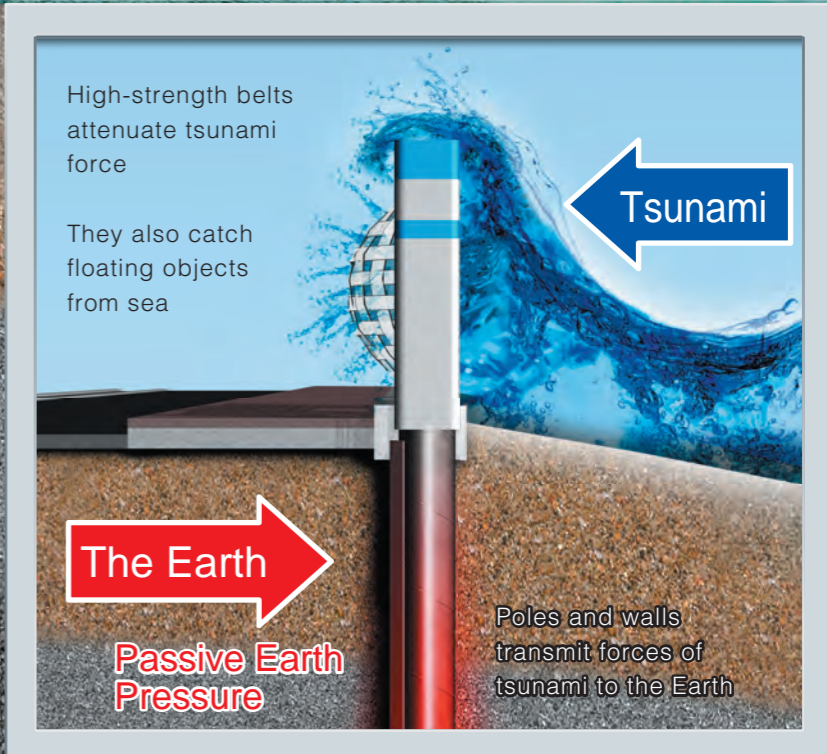
Cut-off Wall
(Hat Sheet Pile)

Implant Pole
(Gyropressed Tubular Pile)

Tsunami Protection Wall
(High-strength Polyester Belts)

Emergency Roller Shutter

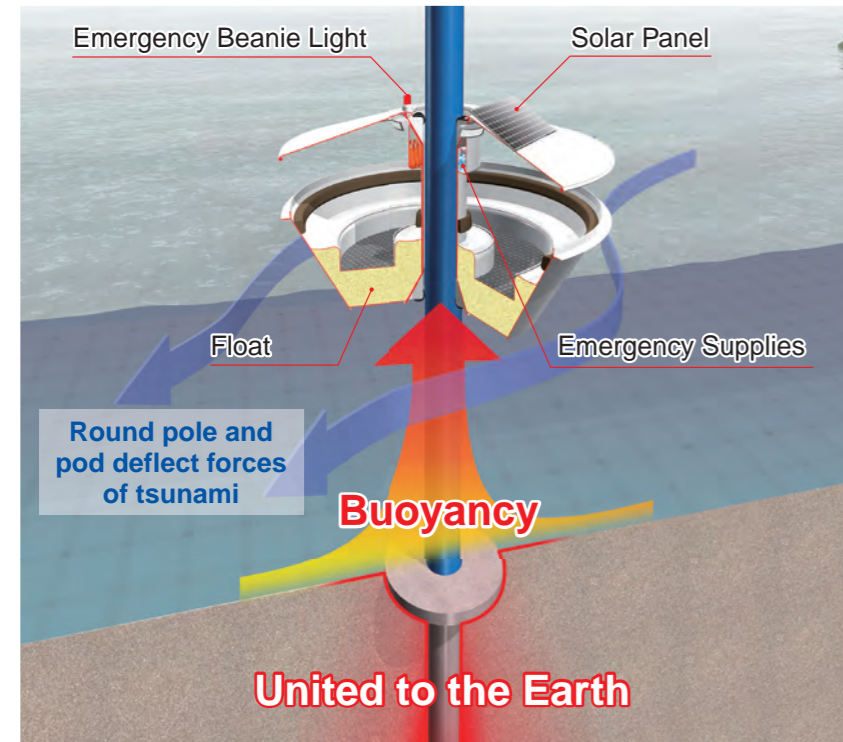
Improved Functions
Tsunami force is received and transmitted to large area of ground through Cut-off Wall that also prevents soil movement both inward or outward.



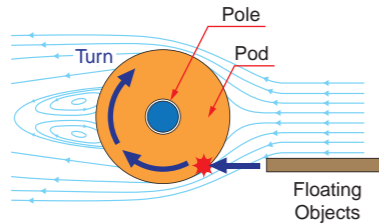
Emergency Evacuation

■ Prompt, Smooth and Safe Evacuation

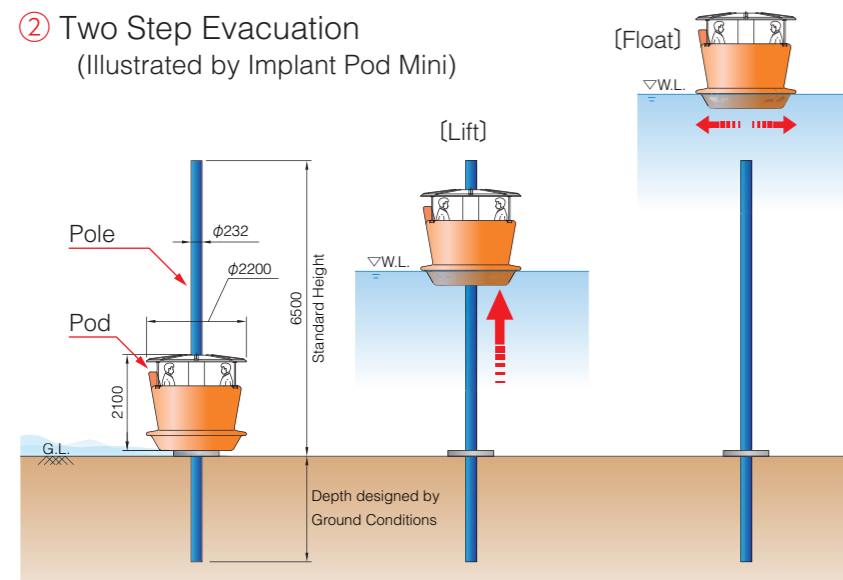
① Implant Pod



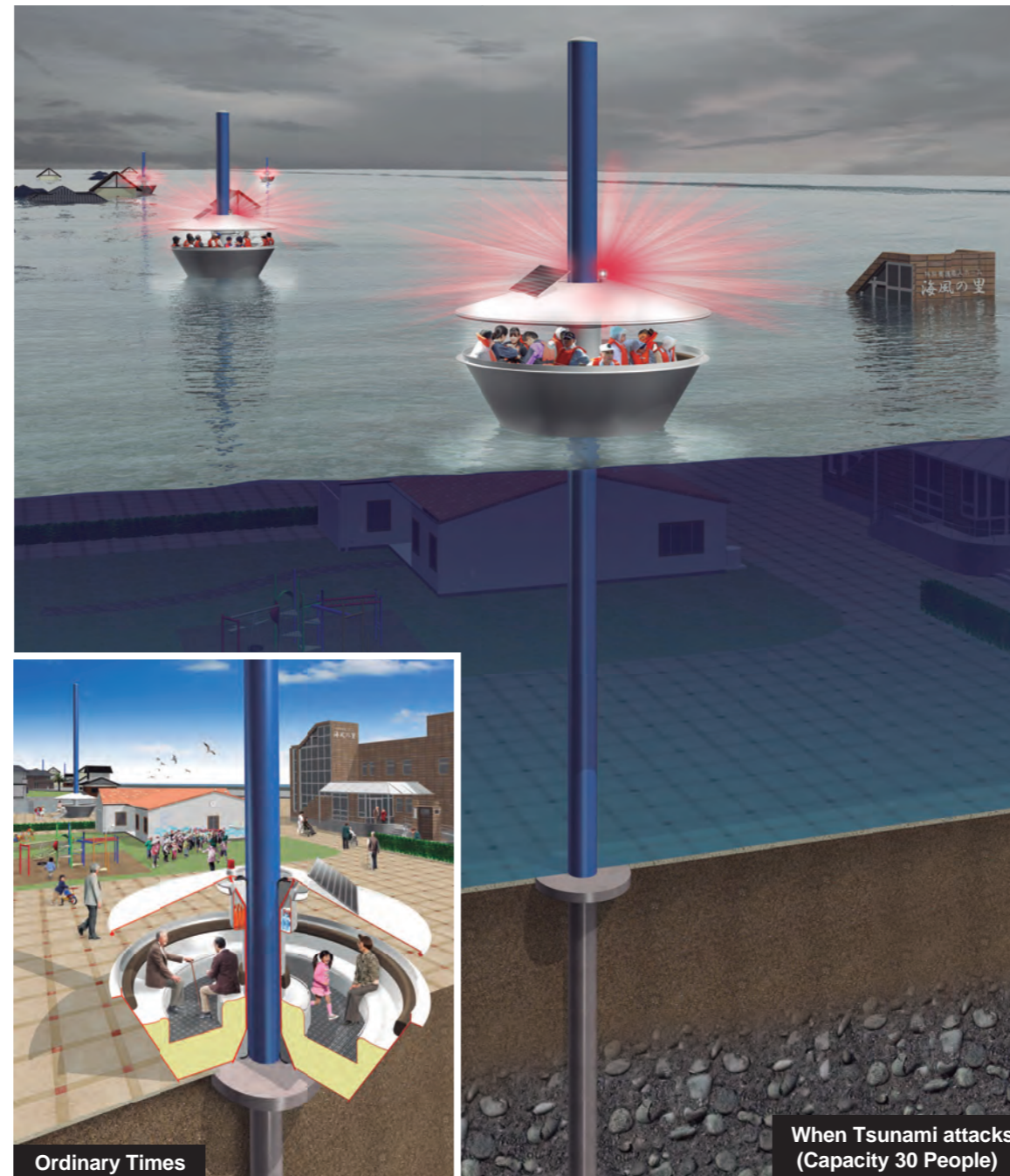
Deriving a lesson from the Great East Japan Earthquake, Implant Pod was designed with combination of deeply embedded single pole (inspired from trees and poles) and round floating evacuation pod (from ship).



② Two Step Evacuation (Illustrated by Implant Pod Mini)



When tsunami height is lower than the pole, Implant Pod lifts by water force. When higher, it starts floating out of the pole as a lifeboat.



Implant Pod lifts at the Home Position

(Implant Pole + Floating Pod)

■ Seven Advantages of Implant Pod

- (1) Resilience : Implant Pole withstands rigidly against earthquake and tsunami.
- (2) Small-footprint : Easy installation enables placement close to important facilities.
- (3) Promptness : Evacuation completes by just walk and ride on the ground level.
- (4) Labour-saving : Self-lifting is kind to people who needs support for evacuation.
- (5) Safety : Turning shape deflects forces of tsunami and floating objects.
- (6) Deliverance : Lifting at the fixed place allows rescuer to specify location easily.
- (7) Versatility : Implant Pod provides a common place of recreation for daily use.

IMPLANT Structure

■ Independent Disaster Management

① Implant Pod Mini of 5 People Capacity



Downsizing increased flexibility to install. It can be set on the floor of bed room where sick or old members of family regularly accommodate.

② Strong Polyethylene Body



Tough body is made of polythene and filled by expanded polystyrene to secure buoyancy.

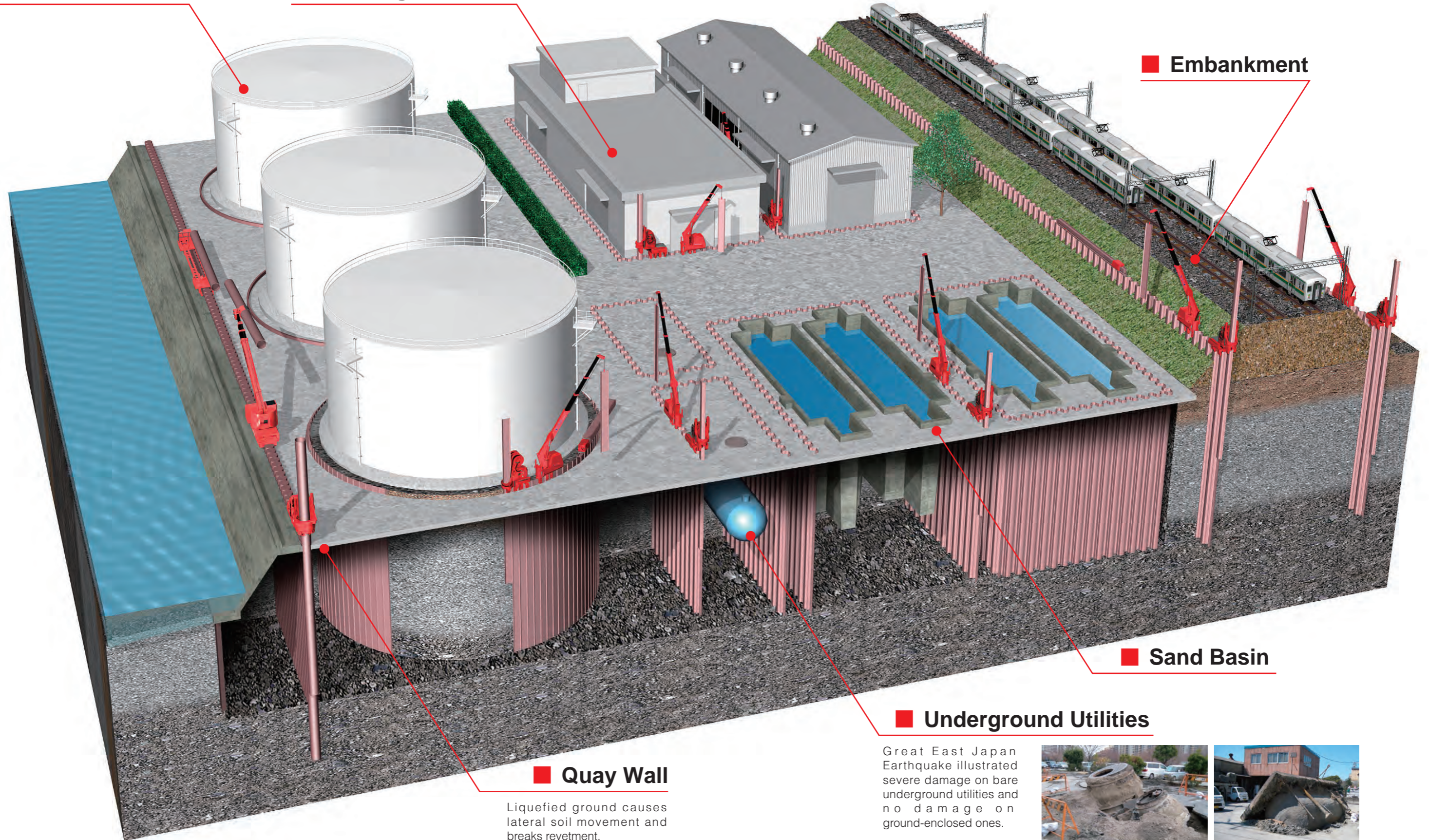
Aseismic Ground Enclosure by Implant Wall

(Prevention of Lateral Soil Movement, Displacement and Uneven Subsidence)

■ Petroleum Tank

■ Building & Houses

■ Embankment



■ Sand Basin

■ Underground Utilities

■ Quay Wall

Liquefied ground causes lateral soil movement and breaks revetment.

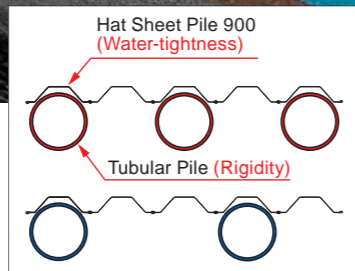
Great East Japan Earthquake illustrated severe damage on bare underground utilities and no damage on ground-enclosed ones.



Industrial Complex

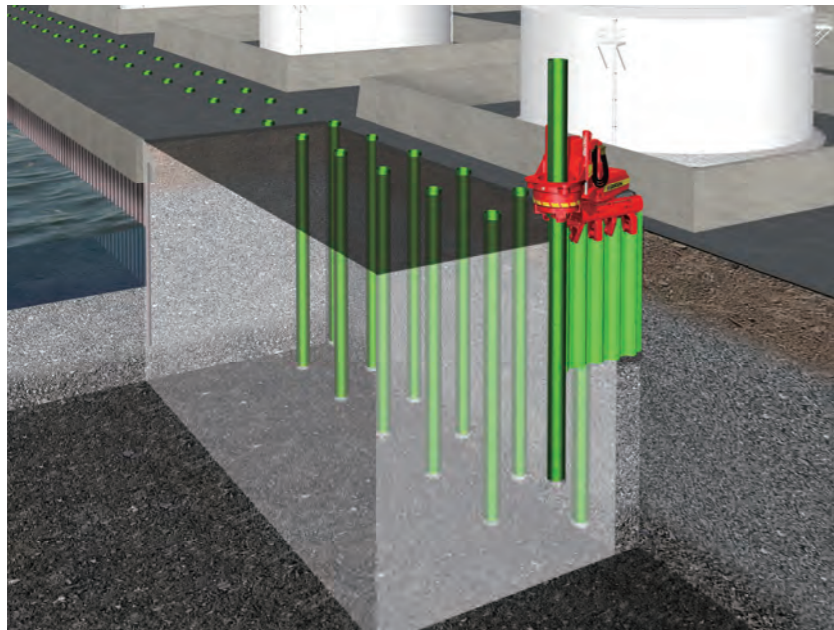
■ Aseismic Reinforcement of Quay Wall

① Functional and Economical Combi-gyro Wall

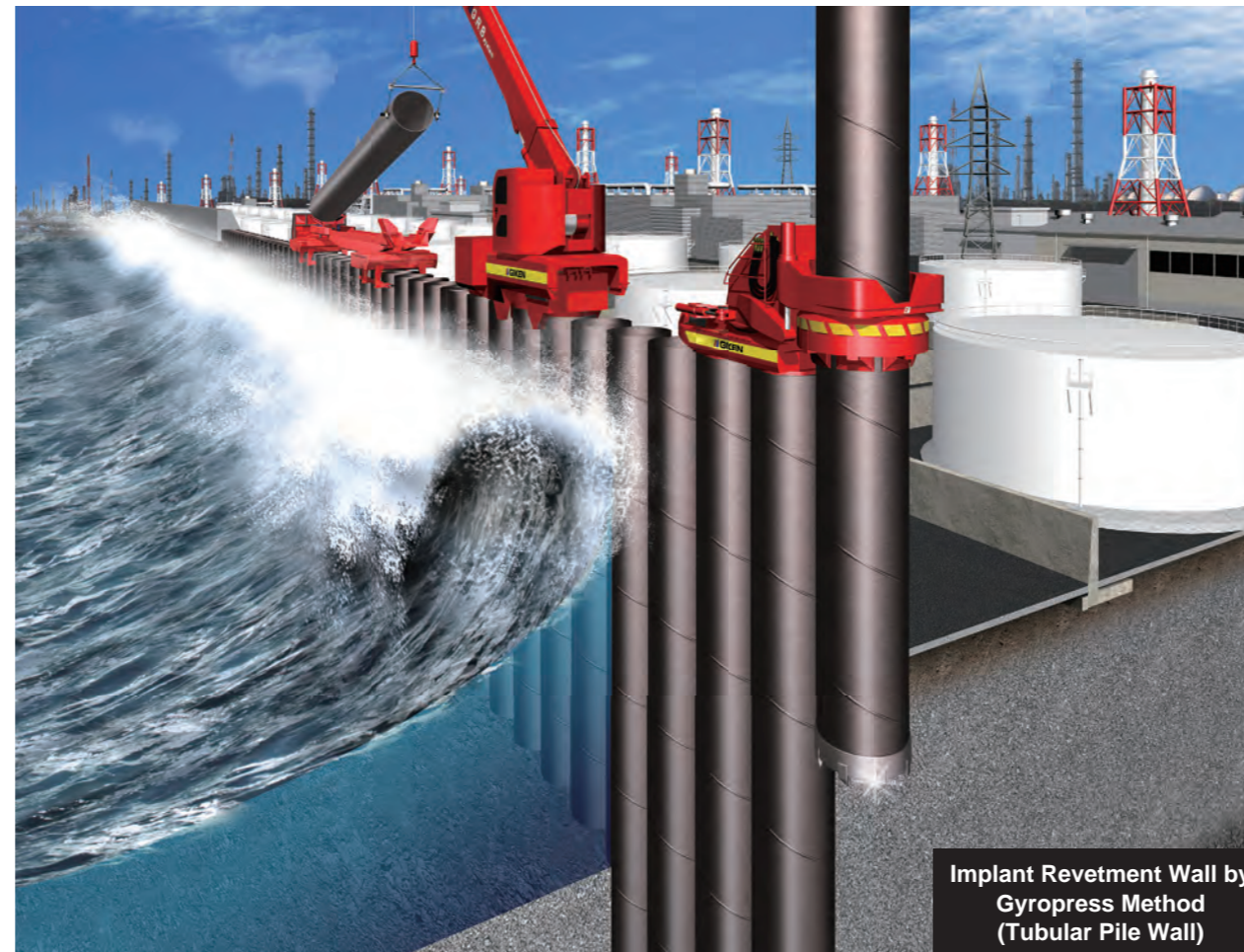


Combined wall of water-tight hat sheet piles and rigid tubular piles is flexibly designed and achieves high performance on economics.

② Implant Preventive Piles



Tubular piles in a staggered alignment outside oil fence retain lateral soil movement caused by liquefaction of earthquakes and minimise subsidence of petroleum tank to prevent an outflow of oil.



Implant Retevment Wall by Gyropress Method (Tubular Pile Wall)

Protection against Earthquake and Tsunami

(Resilient Implant Retevment and Aseismic Ground Enclosure)

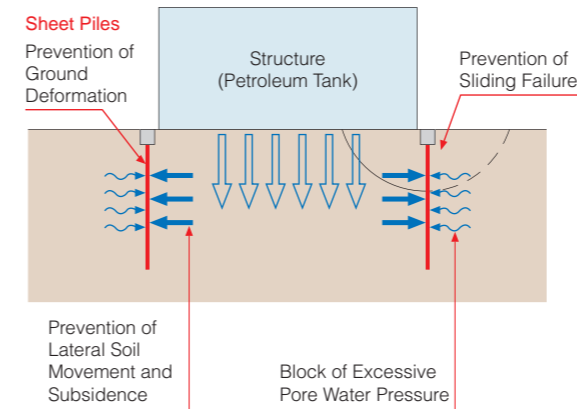
■ Aseismic Reinforcement of Petroleum Tank

① Liquefaction Prevention



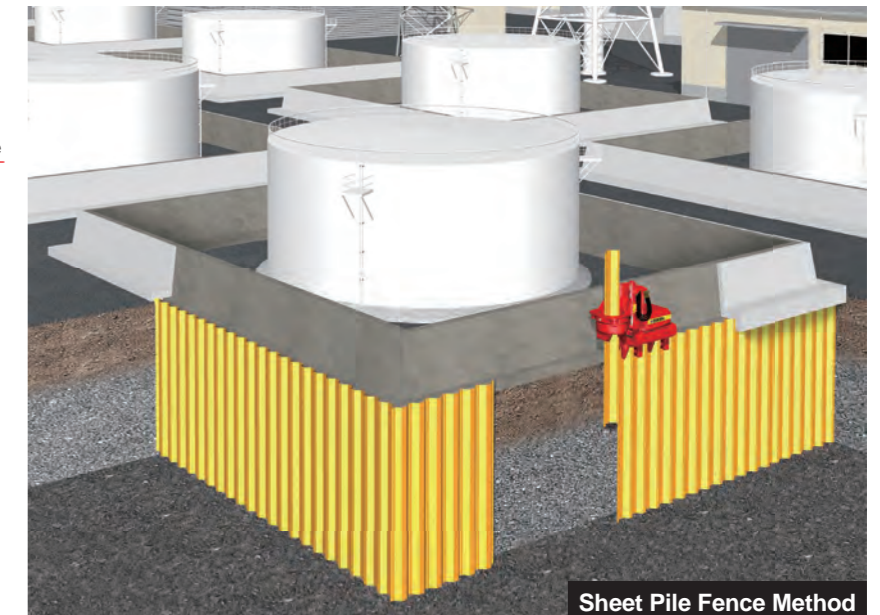
Sheet Pile Ring Method

Mechanism of Aseismic Ground Enclosure



Enclosed ground by continuous wall acts as a shock absorber by liquefaction when strong earthquake occurs but restrains uneven load of upper structure and lateral soil movement. As a result, displacement or deformation of structure can be avoided.

② Aseismic Ground Enclosure with Oil Fence

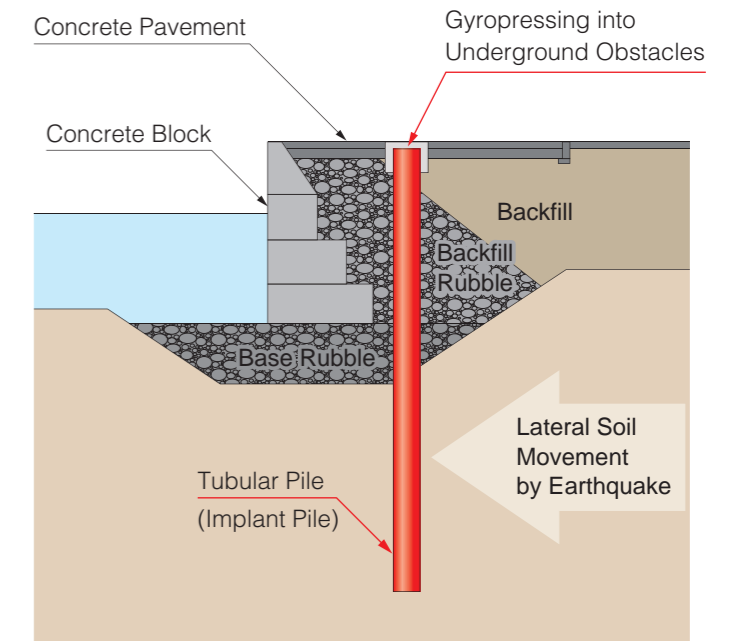


Sheet Pile Fence Method

Enclosing sheet piles are repositioned outside the oil fence and connected each other to reinforce against subsidence or turnover caused by forces of earthquake or tsunami.

IMPLANT Structure

■ Penetration into Obstacles



Combination of press-in force and gyration force allows a tubular pile to penetrate into underground obstacles.

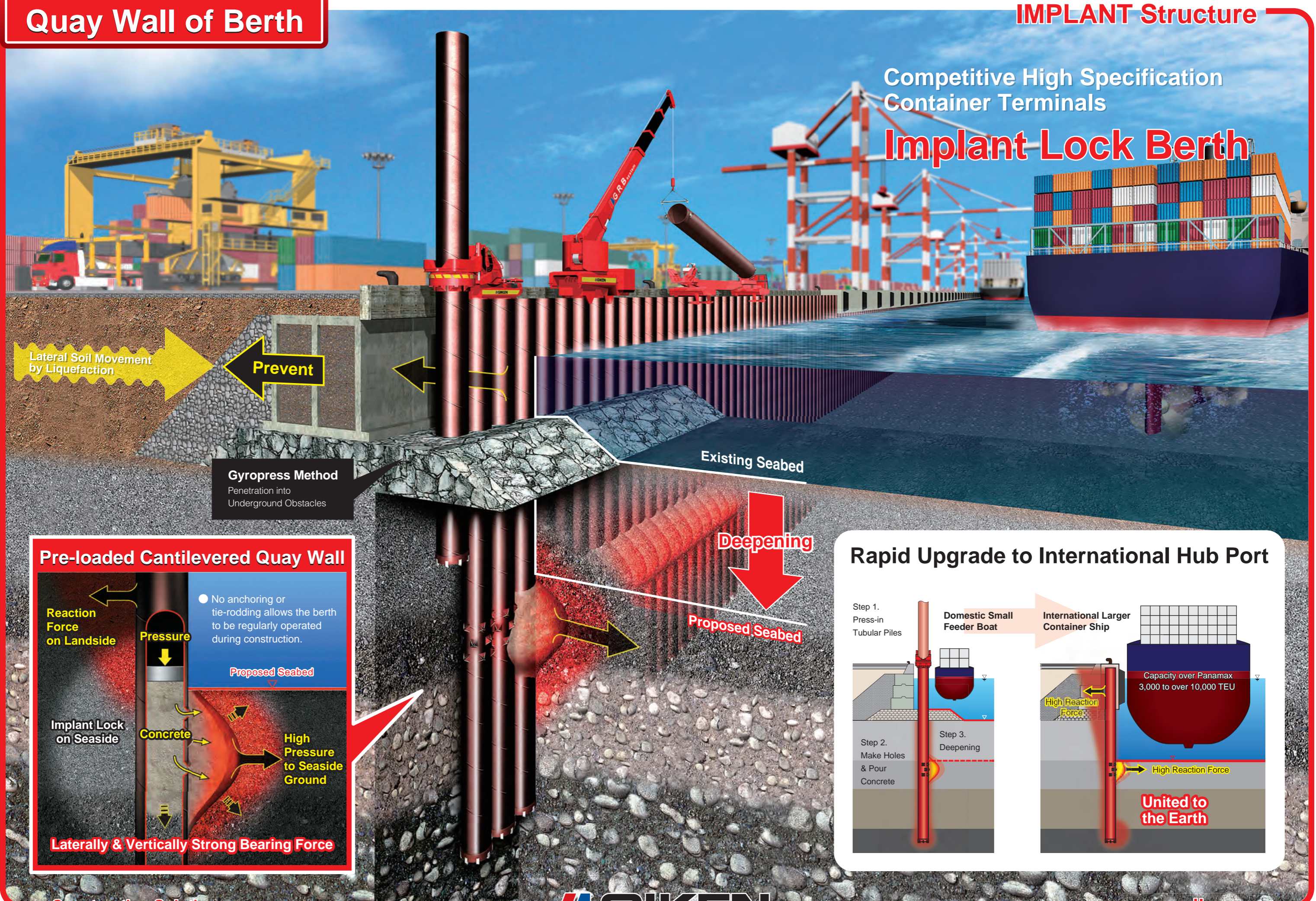


Quay Wall of Berth

IMPLANT Structure

Competitive High Specification
Container Terminals

Implant Lock Berth



Lateral Soil Movement
by Liquefaction

Prevent

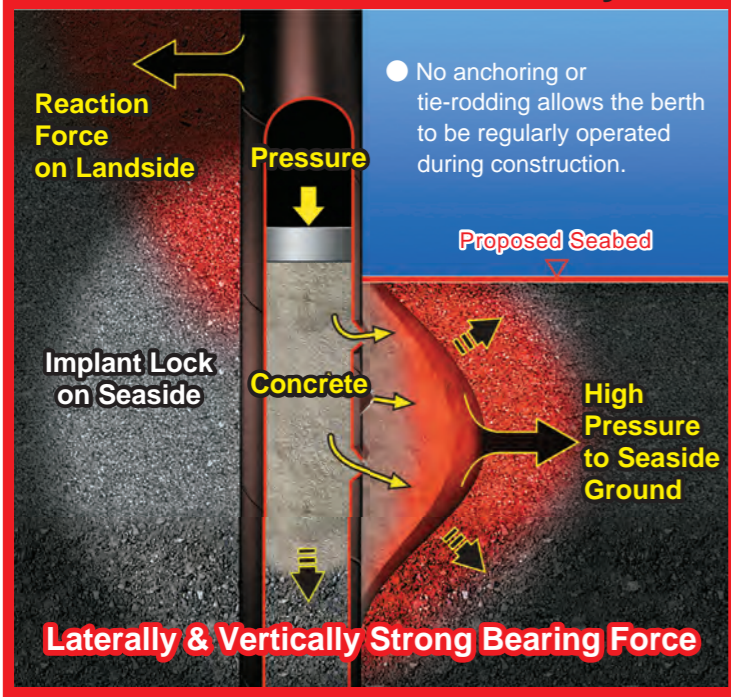
Gyopress Method
Penetration into
Underground Obstacles

Existing Seabed

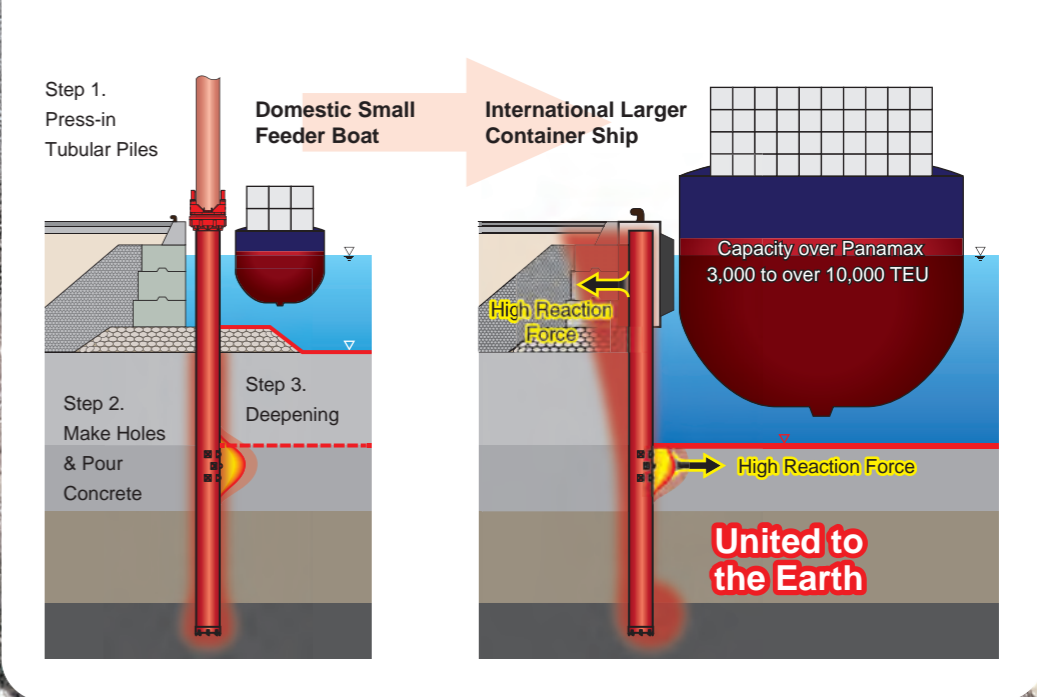
Deepening

Proposed Seabed

Pre-loaded Cantilevered Quay Wall



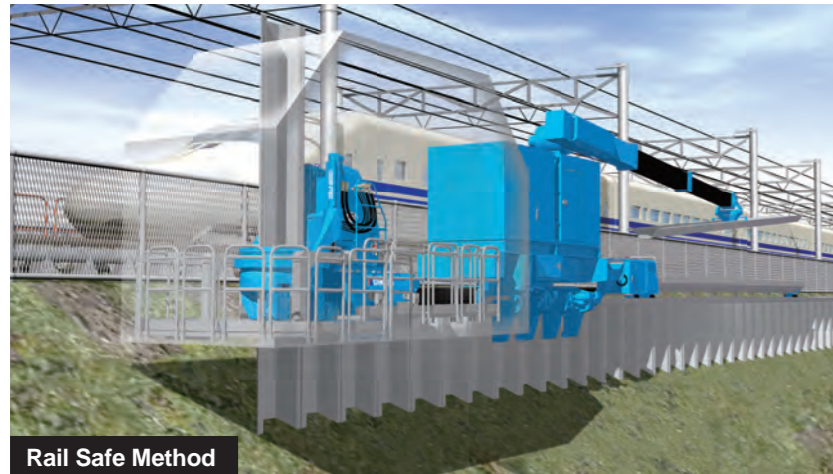
Rapid Upgrade to International Hub Port



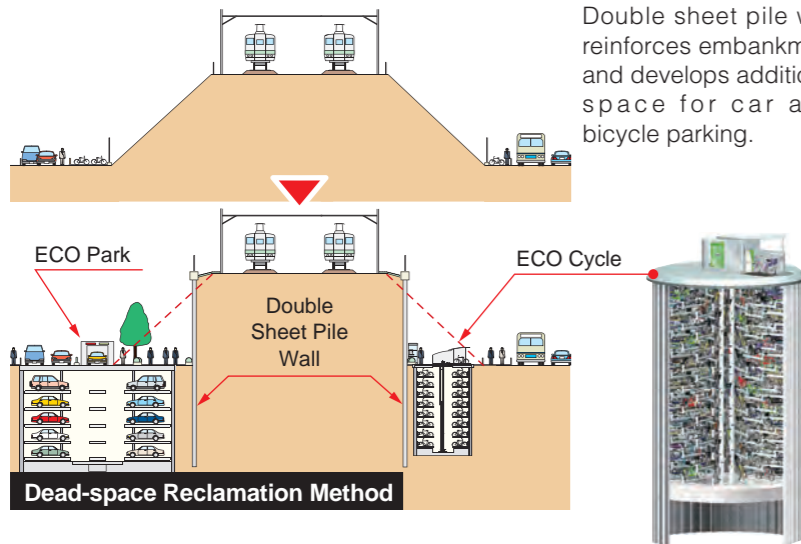
Road and Railways

Reinforcement and Effective Use of Embankment

① Seismic Reinforcement by Double Sheet Pile Wall



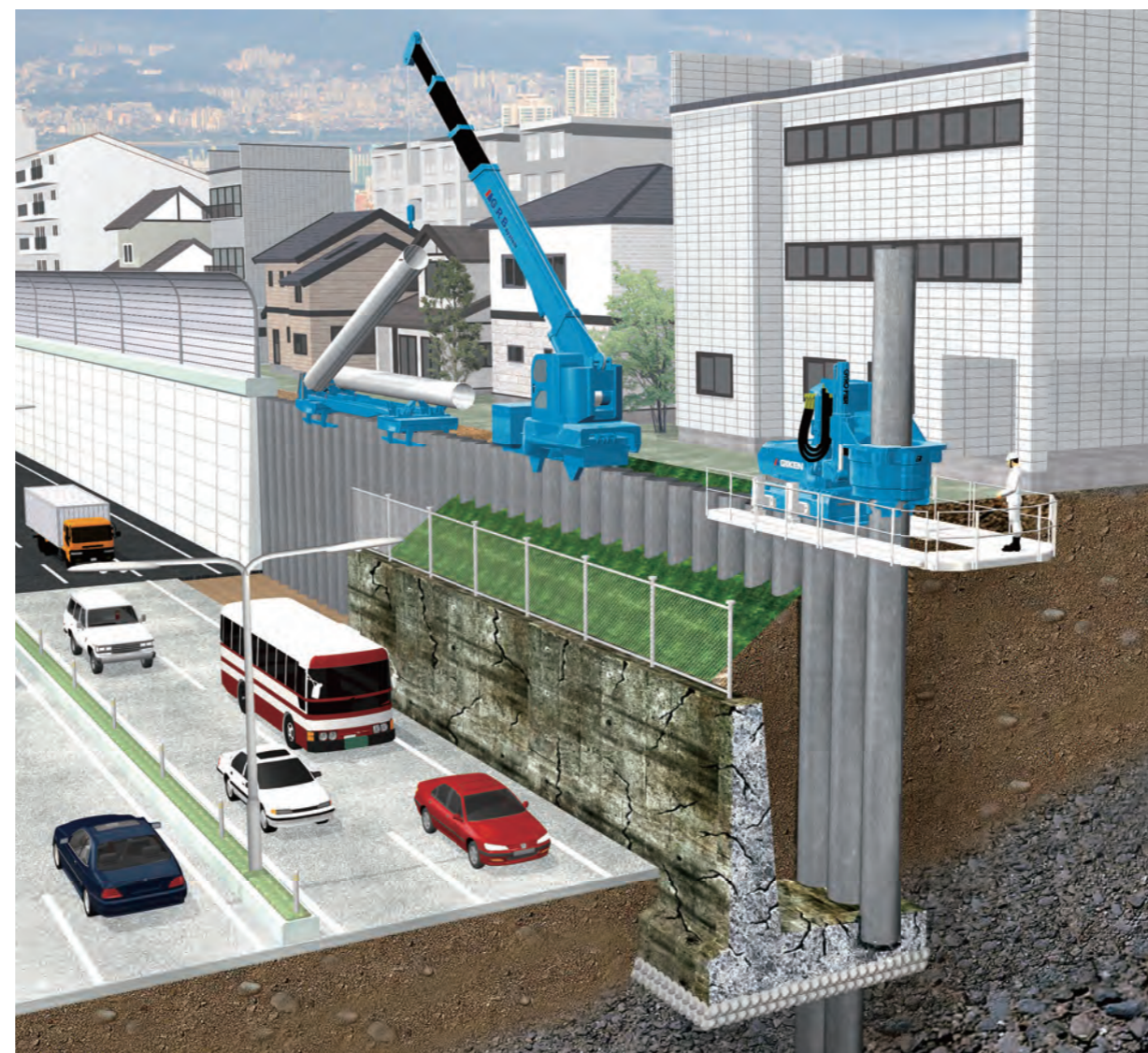
Double sheet pile wall reinforces embankment and develops additional space for car and bicycle parking.



② Road Widening for Evacuation Route



As a tsunami mitigation, evacuation route to hills must be widen for capacity and reinforced against earthquakes.



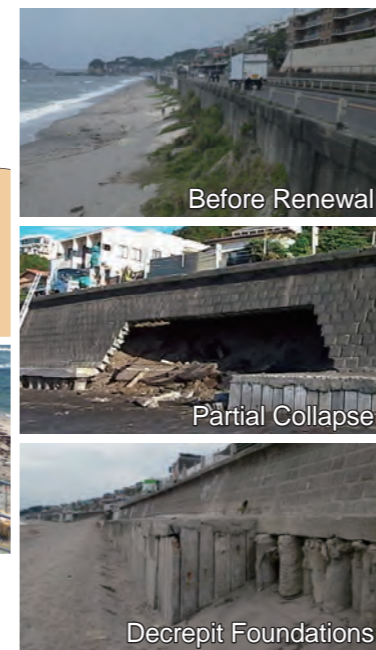
Seismic and Resilient Implant Retaining Wall

(Penetration into the Existing Foundation or Obstacles)

Improvement Work with out Disturbance of Active Traffics

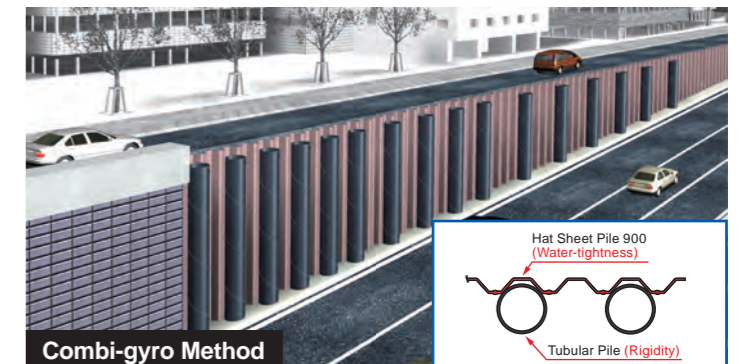


Road retaining wall of national route 134 along Sagami Bay suffered aging degradation and has been renovated without removal of existing wall.



IMPLANT Structure

New Strong and Economical Structure



Combination of hat sheet piles and tubular piles provides resilient cantilevered wall with high specifications and economical advantage.

Other Applications

① Landslide Prevention



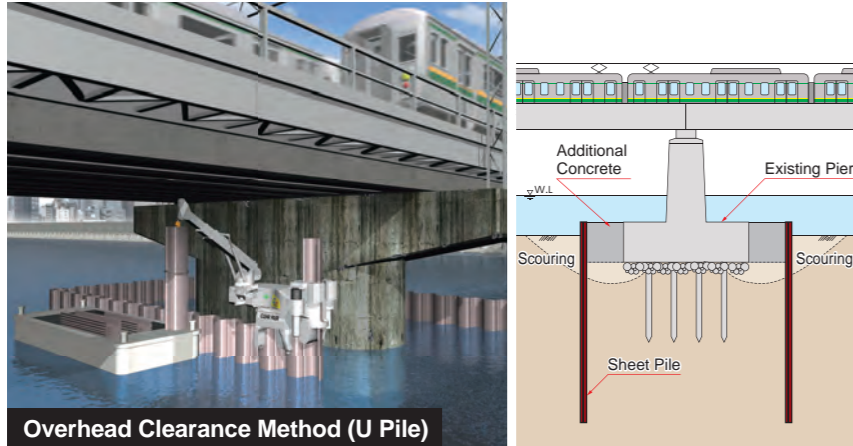
② Road Widening of Urban Express Way



Bridge Reinforcement

■ Implant Shaft for Abutments and Piers

① No Disturbance of Active Traffics



Overhead Clearance Method (U Pile)

Seismic reinforcement or rehabilitation of abutments and piers can be carried out maintaining upper structures and existing traffic.

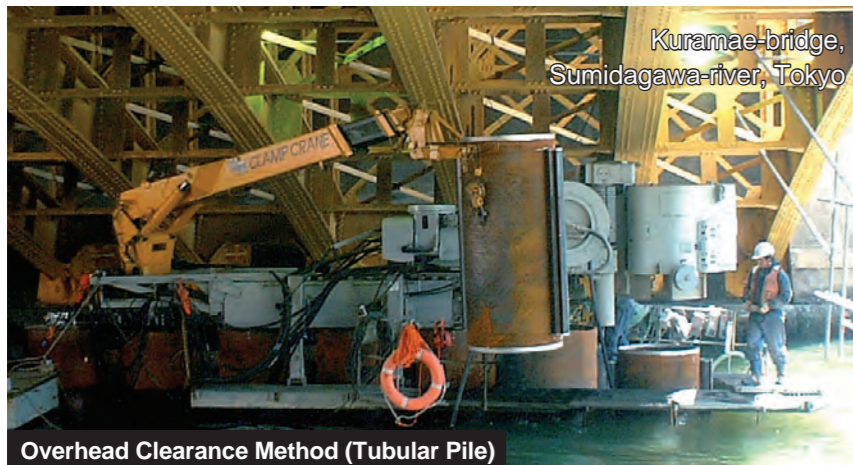
② Seismic Foundation by Tubular Piles



Gyropress Method (Tubular Pile)

Implant Shaft composed of rigid tubular (sheet) piles has laterally and vertically strong bearing force against earthquakes.

③ Reinforcement under Ultra-low Headroom



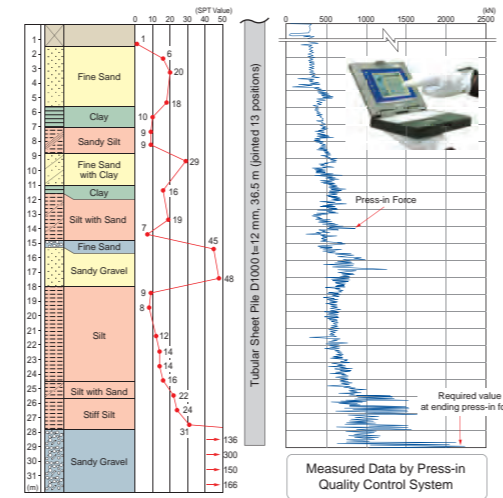
Overhead Clearance Method (Tubular Pile)

In our record, the special Clear Piler completed press-in work in just 1 m headroom between bridge and pile top.

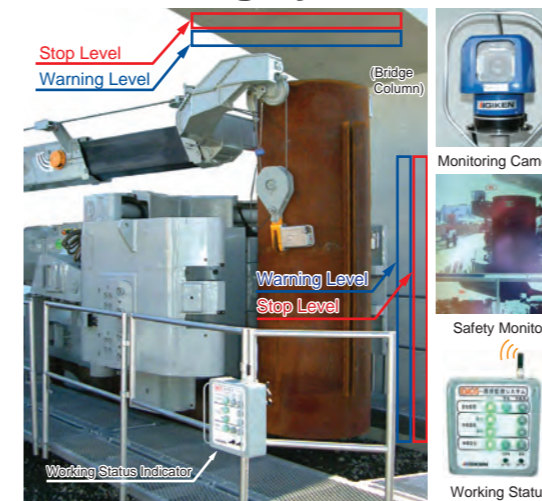


Implant Wall for Bridge Reinforcement (Securement of Emergency Transportation Routes)

■ Scientific Quality Control and Monitoring System



Real time condition of pile can be monitored and recorded.

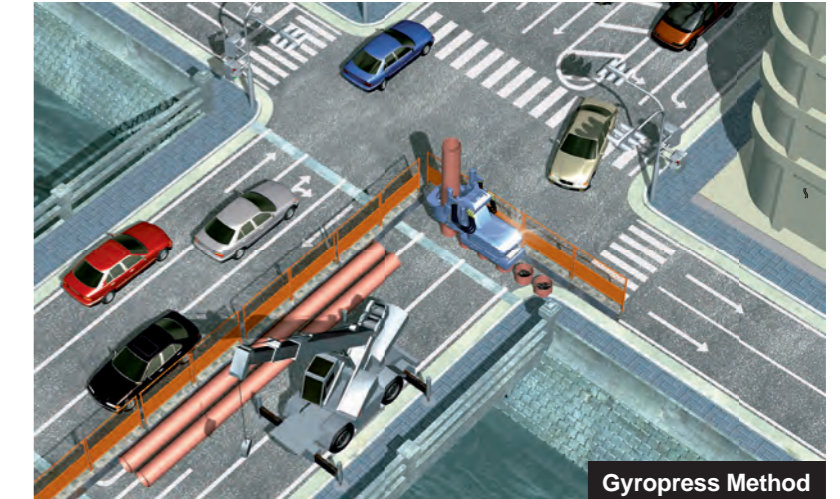


Safety monitoring device controls machine movement to avoid contact with structures.

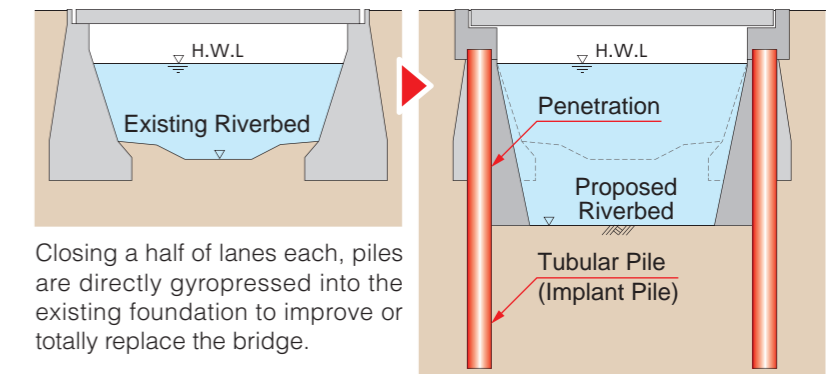
IMPLANT Structure

■ Implant Bridge for Replacement

① Rehabilitation Work maintaining Active Traffics



Gyropress Method



Closing a half of lanes each, piles are directly gyropressed into the existing foundation to improve or totally replace the bridge.

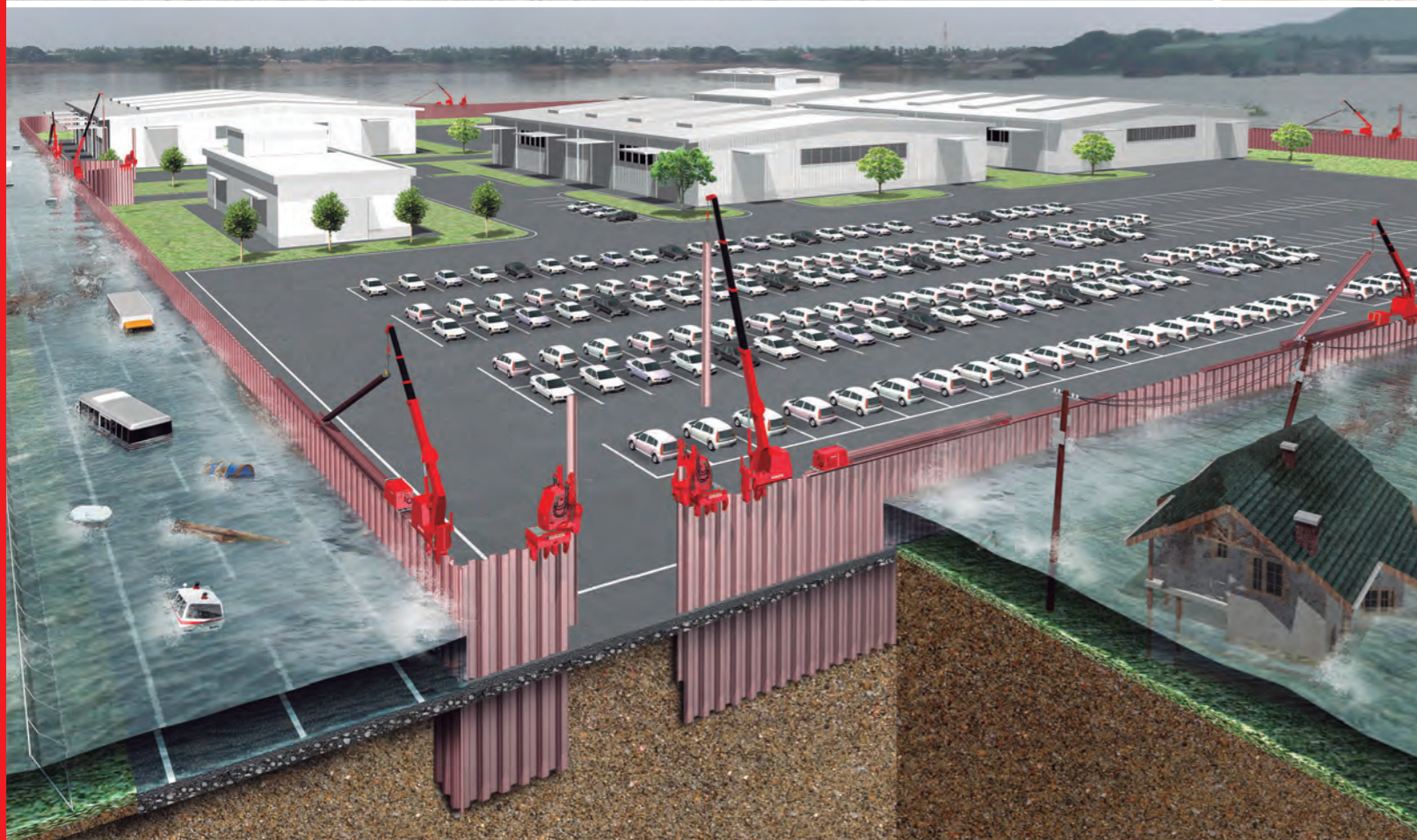
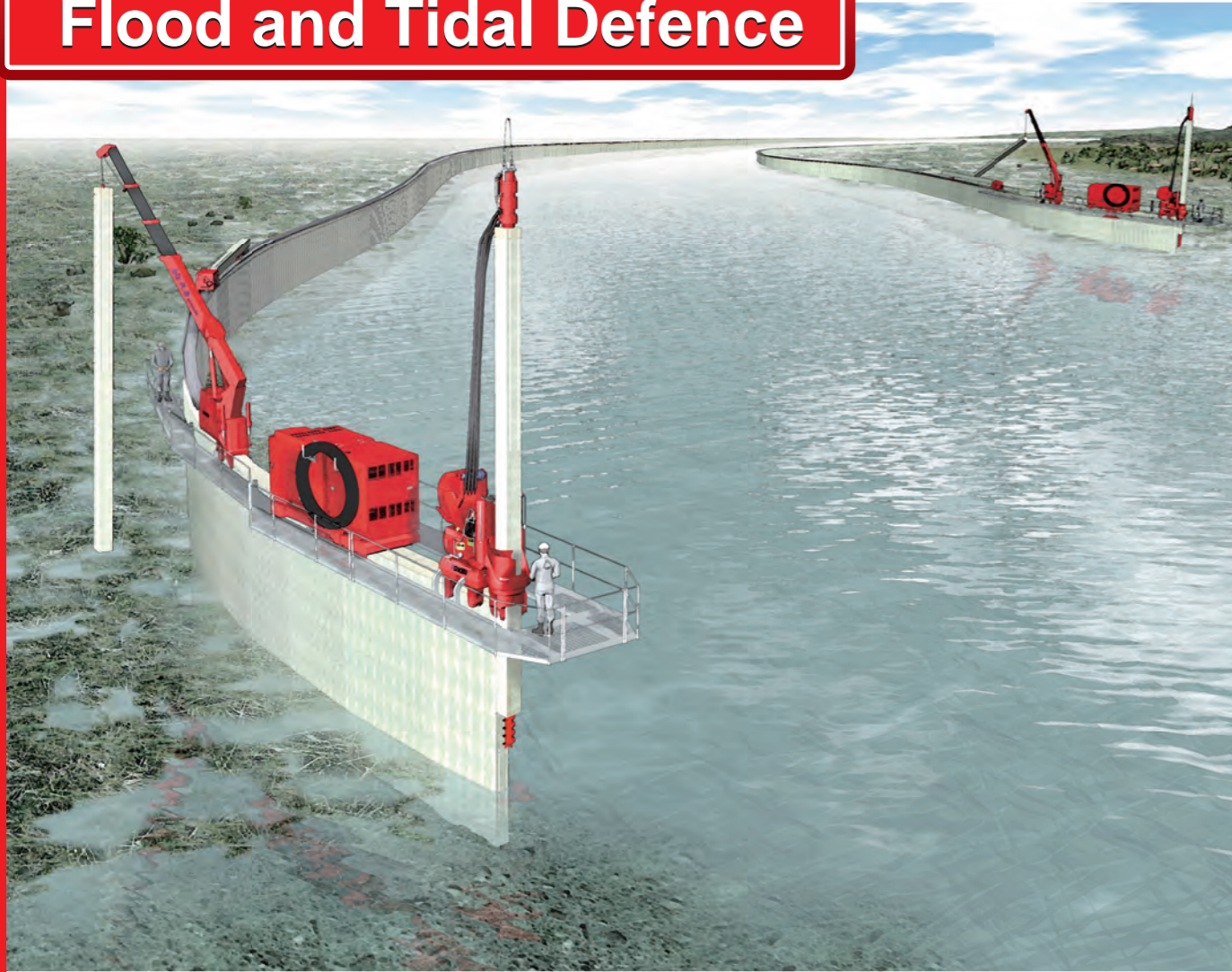
② Implant Bridge Construction on Urban River



At the same time of flood protection work against Typhoon, Implant Bridge was constructed in densely populated area.

Flood and Tidal Defence

IMPLANT Structure



Kandagawa-river, Tokyo

Implant Landslide Prevention

Rapid Construction of Highly Resilient Preventive Pile with Minimum Environmental Impact

Gyropress Method with Skip Lock System

Combi-gyro Method

Hard Ground Press-in Method

Disaster Prevention

Resilient Implant Preventive Piles prevent landslide caused by strong earthquakes and torrential downpour.

Effective Design

Piles embedded into stable ground hold soils and allow excessive ground water to flow down through pile gap.

Rapid Execution

All procedure is rapidly carried out top of the piles without disturbance of daily lives and surrounding environment.