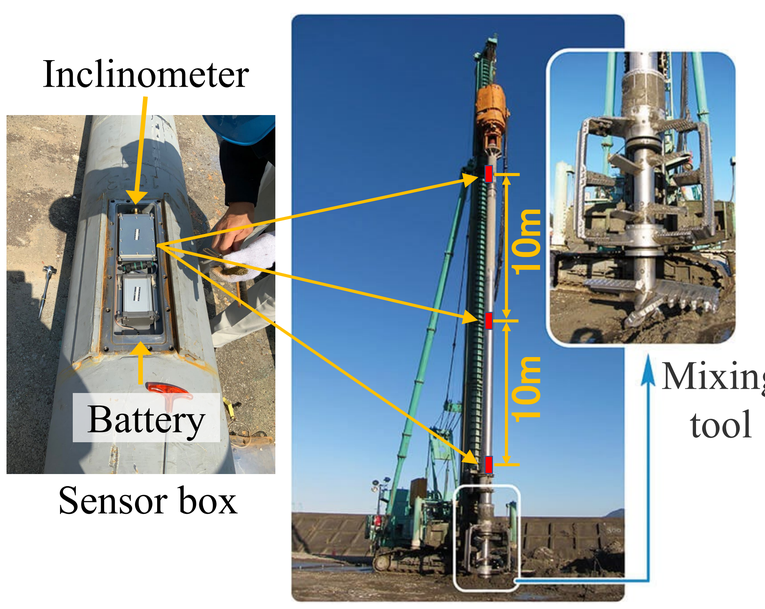
Deep Depth Tip Position Measurement System

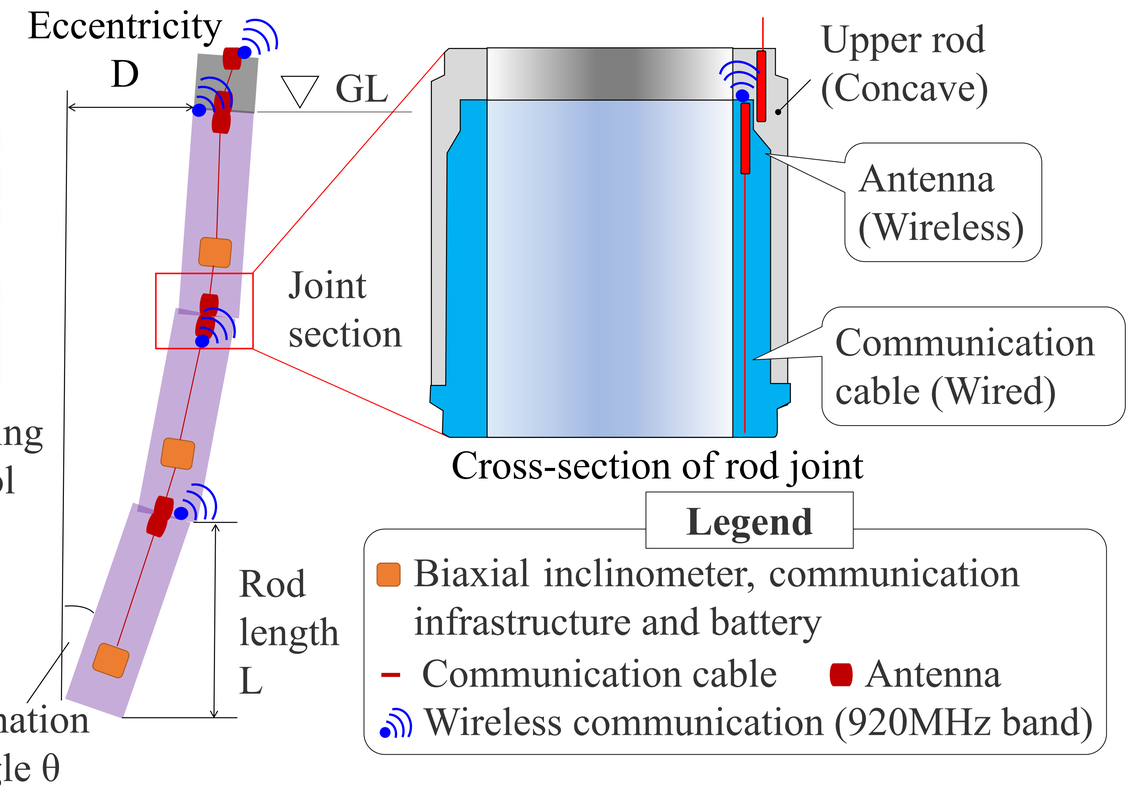
Advanced visualization technology for deep mixing method

Overview of Technology

Targeting the Deep Cement Stabilization method (DCS method), this system provides real-time and precise tracking of the rod tip positions in the ground. It measures the inclination of each rod using a biaxial inclinometer attached to the casing rod, combined with the rod length. The rod joint adopts wireless communication, simplifying the process during rod addition. By applying "multi-hop communication technology" with data relay functions in the measuring devices on each rod, enabling the acquisition of underground rod inclination data at the surface.



Construction machine mounted with the system

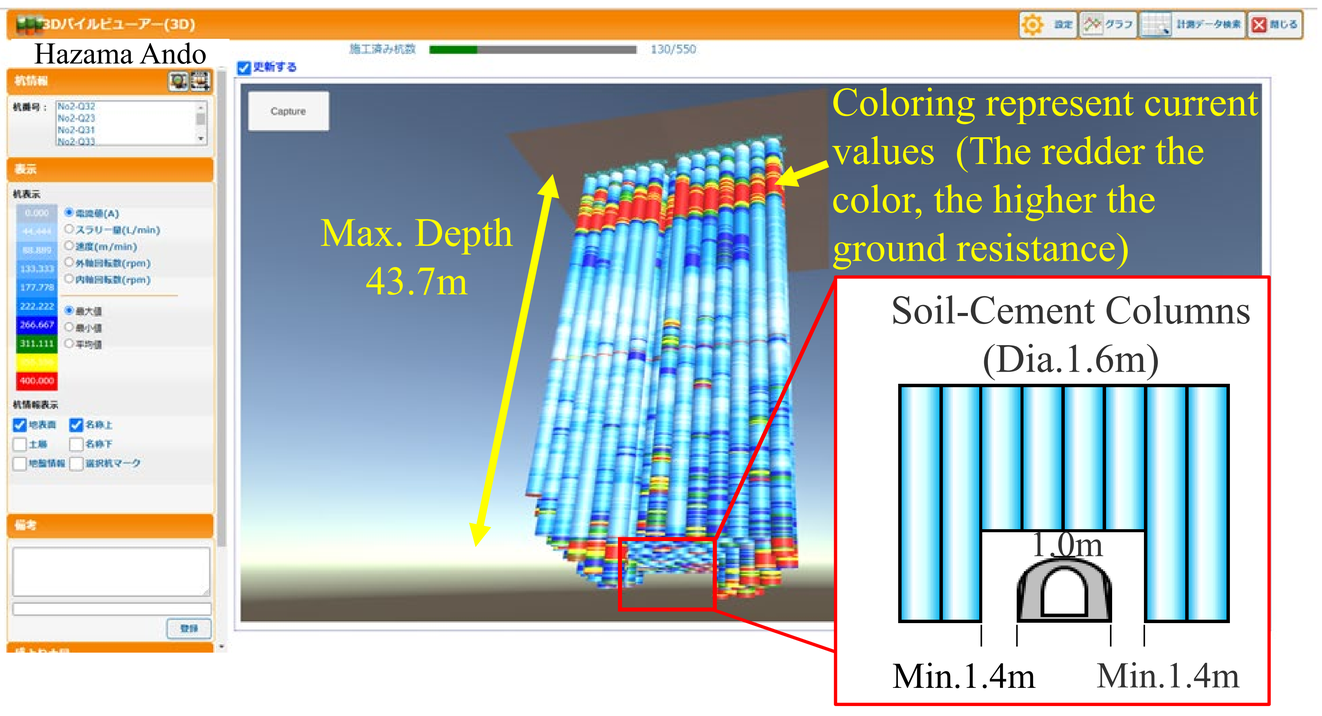


Overview of the system

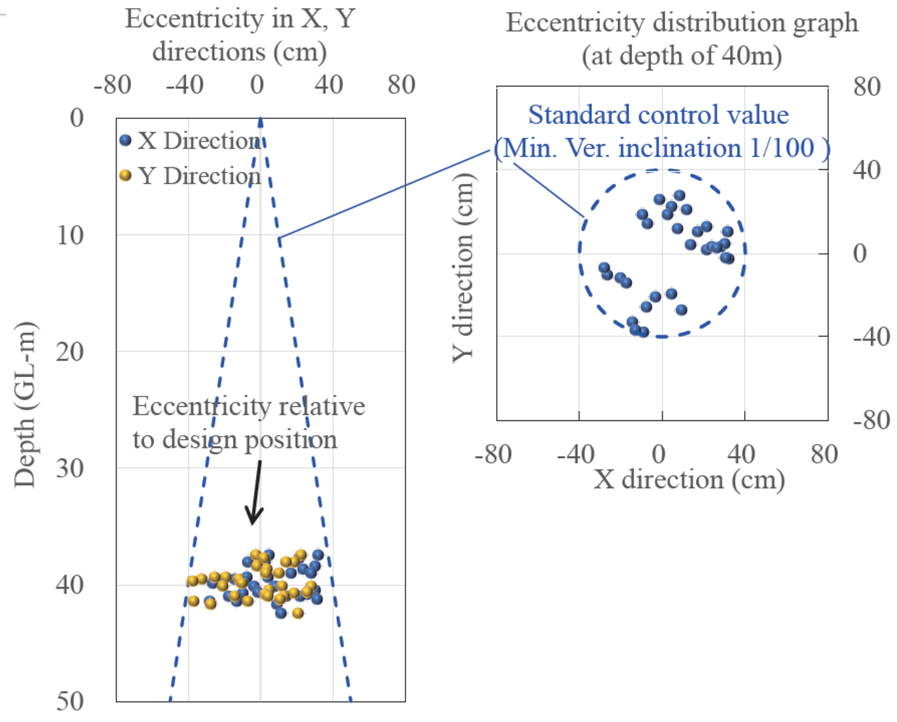
Antenna installation

Effect of Technology

The system was applied to a seismic reinforcement ground improvement project. With a maximum depth of 43.7 meters, the construction required consideration for an existing waterway tunnel at the bottom of soil-cement columns. By integrating our developed construction information visualization system "3D Pile Viewer" with this system, we directly monitored the tip position of the soil-cement columns in real-time, ensuring construction without impacting existing structures.



3D Visualization by 3D Pile Viewer
(When construction near existing waterway tunnel)



Measurement results surrounding existing waterway tunnel

HAZAMA ANDO CORPORATION

Multi-directional Slurry Oscillation Stirring Method “WILL-m method”

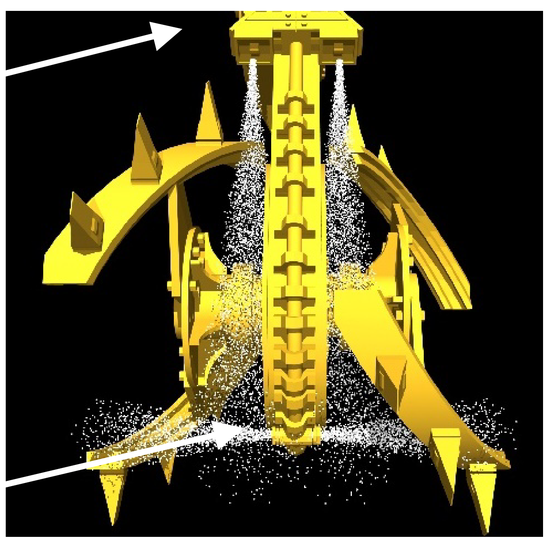
New jetting mechanism boosts construction efficiency by 20%

Overview of Technology

The WILL method is classified as a mid-depth mixing technique among soil-cement mixing methods. It creates improved structures by mixing cement slurry and the original ground using a special mixing tool. The "WILL-m method" was developed by adding a new jetting mechanism to the conventional WILL method. This mechanism ejects cement slurry at high pressure from a newly installed upper outlet, significantly improving the mixing performance.

Comparison “WILL method” and “WILL-m method”

	Outlet	Pressure	Slurry Supply Amount (L/min)
WILL method	Lower	1MPa	240
WILL-m method	Upper	**Over 10MPa**	**400**
	Lower	1MPa	

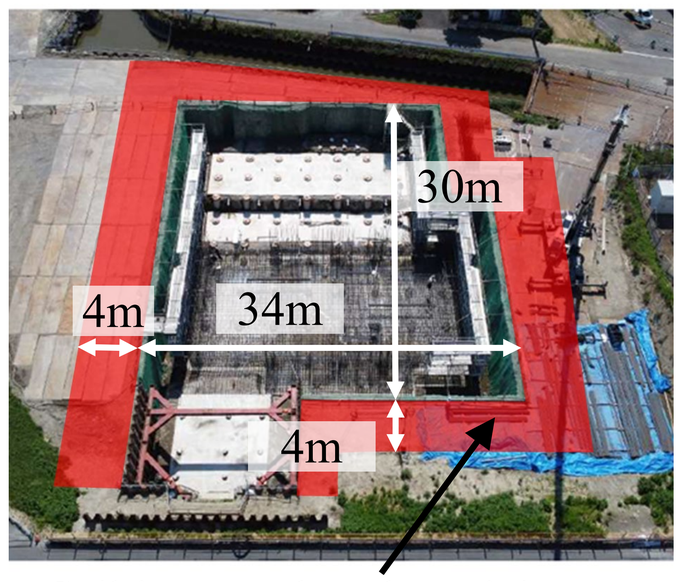


Stirring blades of WILL-m method

Construction machine of WILL-m method

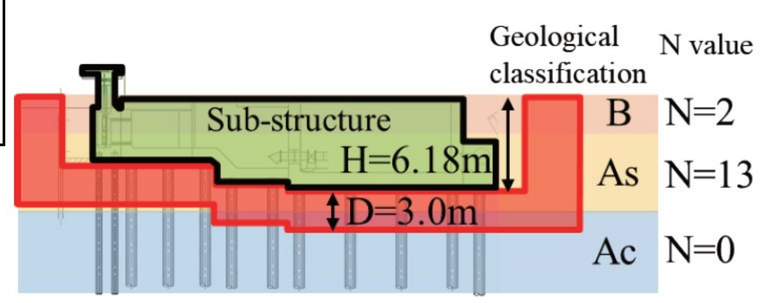
Effect of Technology

The WILL-m method was applied to construct a soil-improved earth retaining structure in agricultural pump station construction. Compared to the conventional WILL method, the mixing time was reduced by approximately 18%, and it was confirmed that the newly developed method achieves a quality equivalent to or higher than the conventional type.

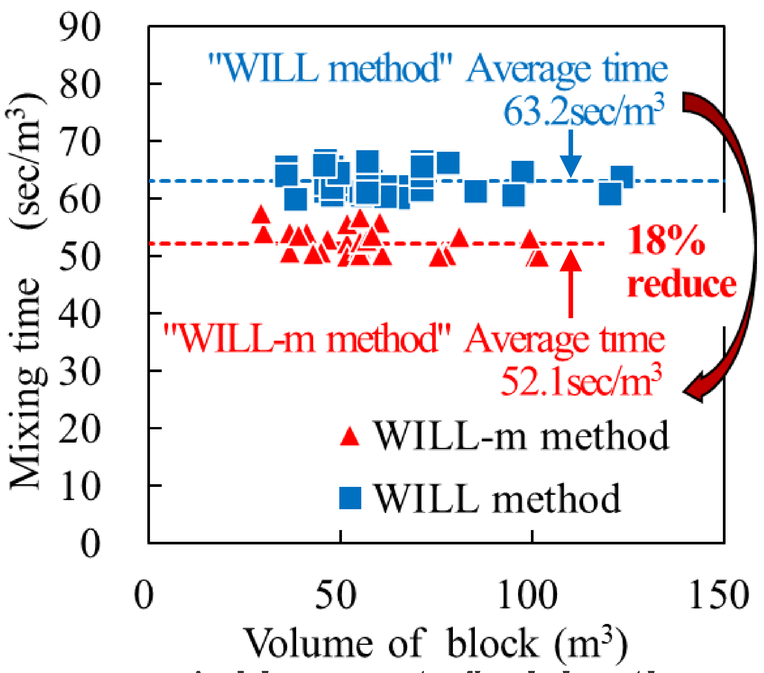


Soil-improved earth retaining
(Design strength:0.28MPa)

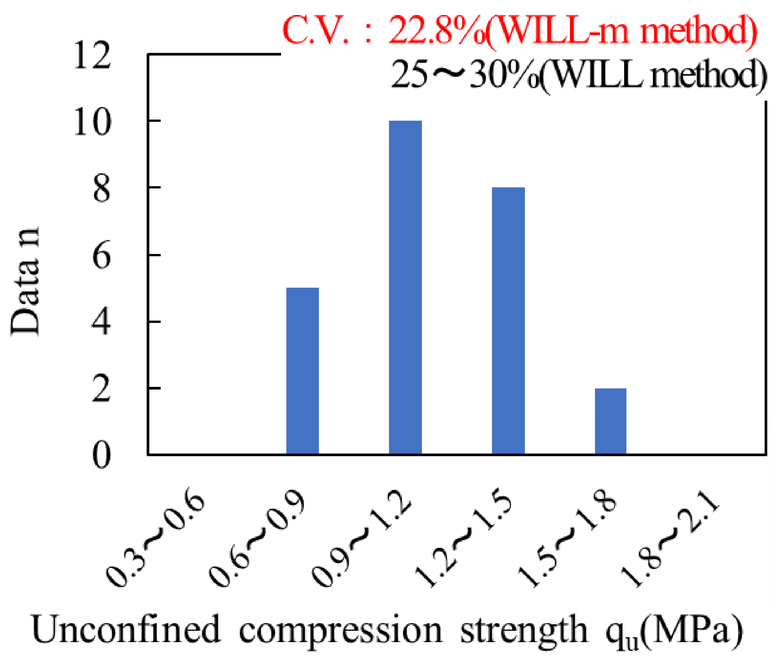
(a)Overview picture



(b)Cross-section



Achievement of mixing time (WILL-m method and WILL method)



Distribution of UC Strength (WILL-m method)

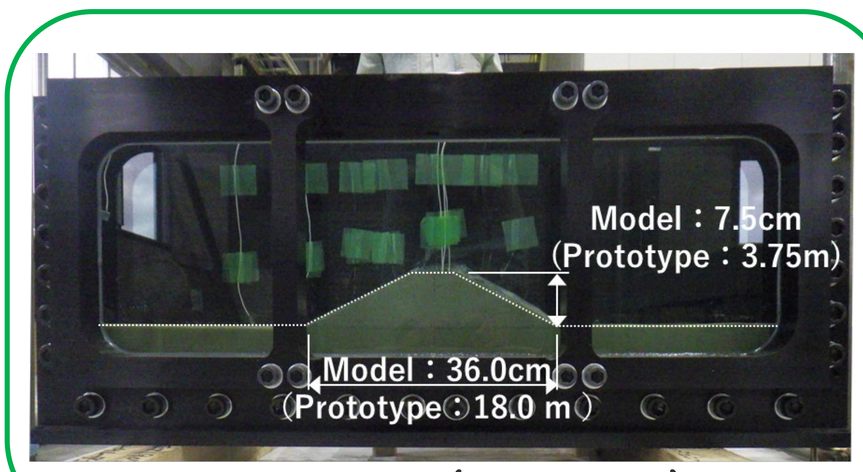
HAZAMA ANDO CORPORATION

Geotechnical Centrifuge

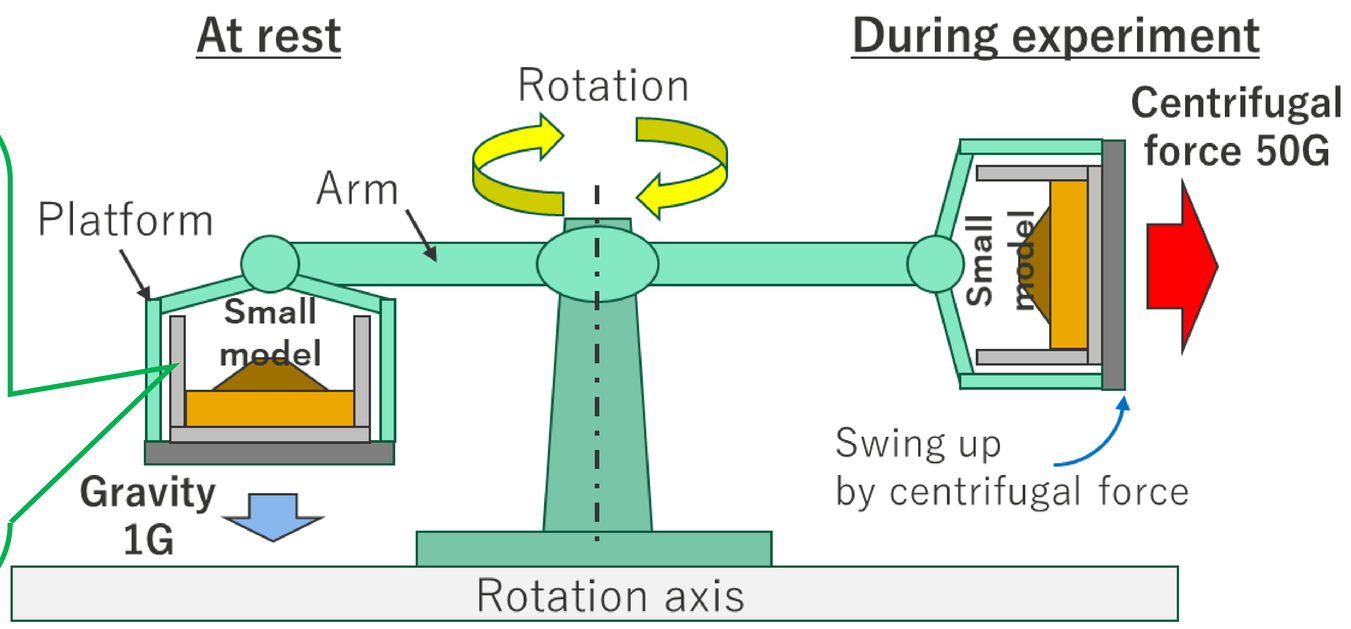
Highly precise simulation of the real object's behavior with a small-scale model

What is a Geotechnical Centrifuge?

A geotechnical centrifuge is a tool used in model experiments to understand the behavior of the ground, soil-structures, and underground structures. A small-scale model is mounted on a swing platform at the end of an arm that extends from the rotating axis. By rotating the device at high speed, the swing platform is swung up by centrifugal force, which can apply a large gravitational acceleration to the small-scale model. By adjusting the gravitational acceleration according to the scale of the model, it is possible to simulate behavior equivalent to the actual scale.



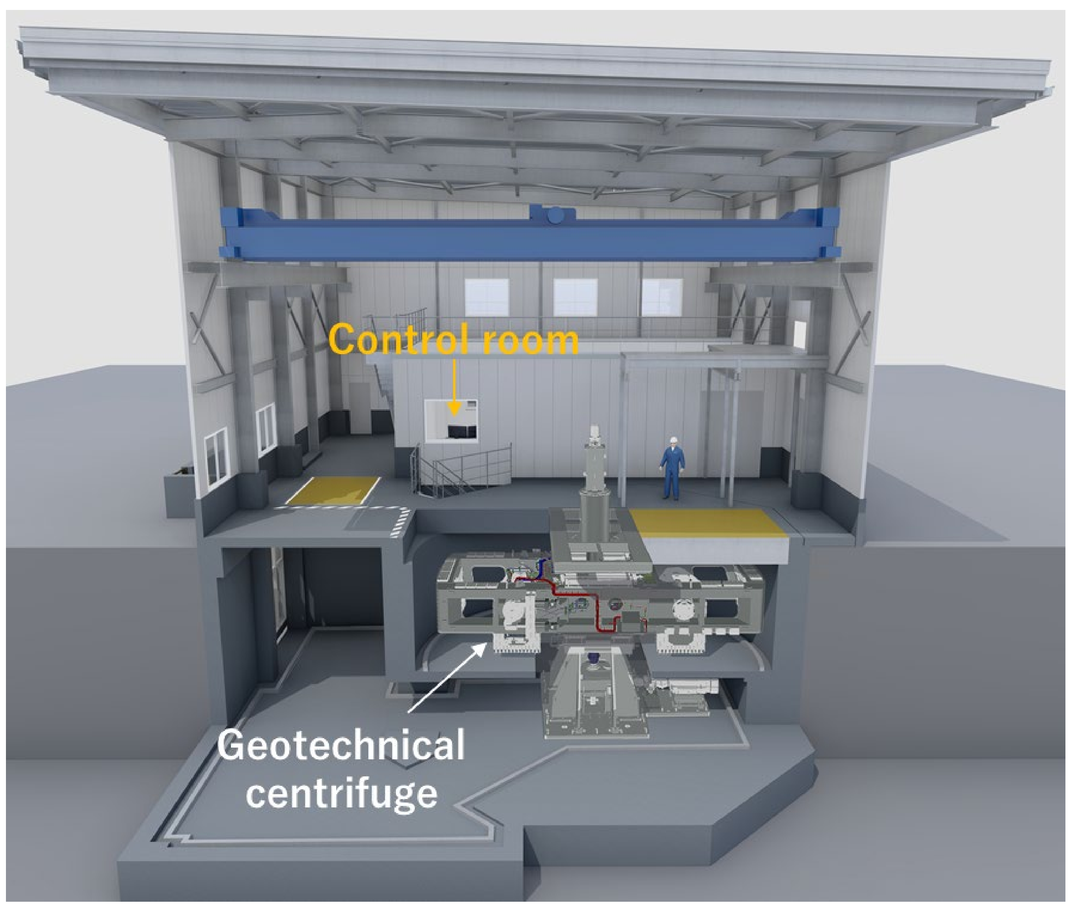
Small model（Riverbank）



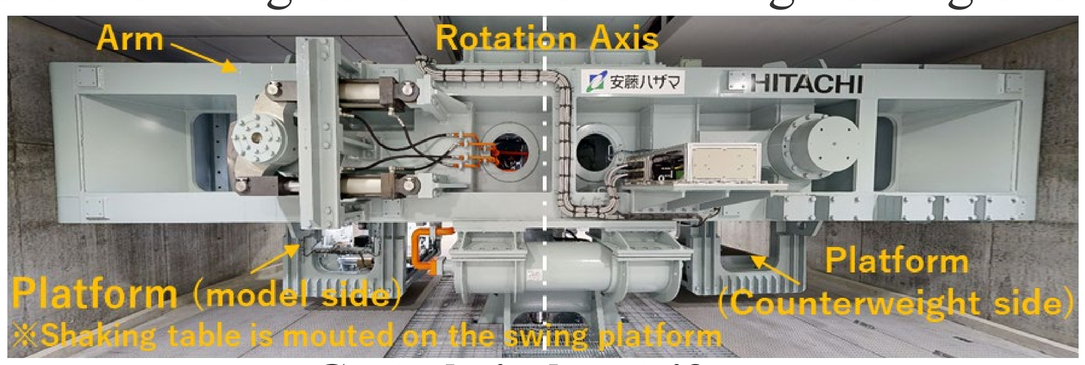
Overview of Geotechnical Centrifuge

Geotechnical Centrifuge of Hazama Ando Corporation

Hazama Ando Corp.'s Geotechnical centrifuge can apply a maximum centrifugal acceleration of 100G, enabling highly precise simulation of the behavior of real structures 100 times the size of the model. A shaking table is mounted on the swing platform, facilitating vibration experiments such as earthquake simulations. Utilizing this device allows for efficient and accurate design, construction, and development of new technologies for structures related to the ground in the civil engineering and architecture fields.



Geotechnical centrifuge Lab.



Geotechnical centrifuge

Geotechnical centrifuge specification

Items		Specification
Effective rotation radius		3.5m
Maximum centrifugal acceleration		100G
Maximum loading weight		200G/t
Loading space		L1.2m × W1.2m × H1.0m
Shaking table	Adjustable centrifugal acceleration	25～100G
	Size	L1.1m × W0.5m
	Maximum acceleration	50G
	Maximum loading weight	370kg

HAZAMA ANDO CORPORATION

Prepared for complex disasters of heavy rain and earthquakes.
“Embankment Enhancement Technology”
New embankment reinforcement method by impermeable and permeable ground improvement

Background of Technology

In recent years, natural disasters like heavy rain and earthquakes have increased in frequency and scale, leading to escalated damage to embankments and reservoirs. Against this background, there's a growing need for rational measures to address these complex disasters.

Earthquake Damage to Reservoir
（Domae Pond, Fukushima Pref.）

Source: Characteristics of Reservoirs damage in Fukushima Prefecture and Emergency Measures due to the 2011 Tohoku Earthquake, Agriculture, Forestry and Fisheries Research Council

Earthquake Damage to Riverbank
（Naka river, Ibaraki Pref.）

Source: Status of Emergency Restoration Works on Directly Controlled Rivers (River Disaster Sites due to the 2011 Tohoku Earthquake), River Department of Kanto Regional Development Bureau, MLIT

Overview of Technology

Hazama Ando Corp. proposes a new embankment reinforcement method combining impermeable and permeable ground improvements to address complex disasters from heavy rain and earthquakes.

■ **Permeable improvement body**：Possessing high shear strength and permeability

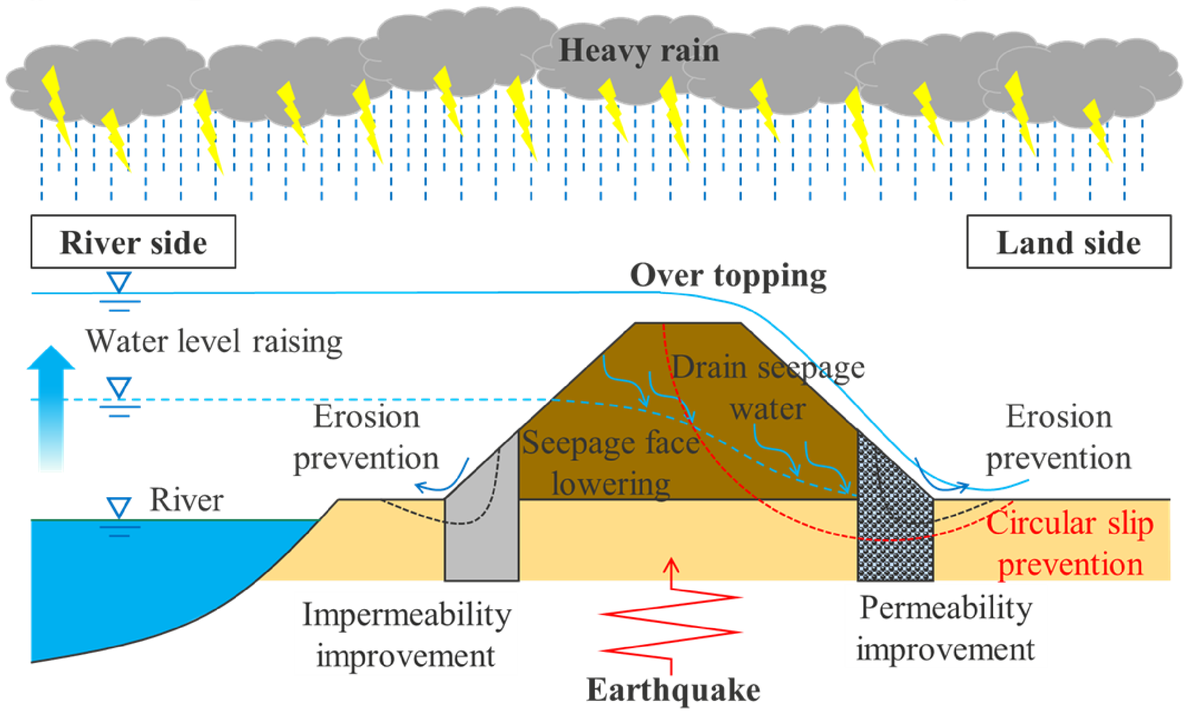
During heavy rain: Efficiently drains the infiltrated water within the embankment
Prevent erosion of the embankment toe caused by overtopping and piping

During earthquake: Restrain deformation of the ground and embankment caused by liquefaction

■ **Impermeable improvement body**：Construct by in-situ mixing method

During heavy rain: Prevent river water infiltration into the embankment and erosion of the toe

During earthquake: Restrain deformation of the ground and embankment caused by liquefaction



Imaging of new reinforcement method

Permeable improvement body
Hydraulic conductivity $k=1.0\times10^{-3}$m/sec

HAZAMA ANDO CORPORATION