

# 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

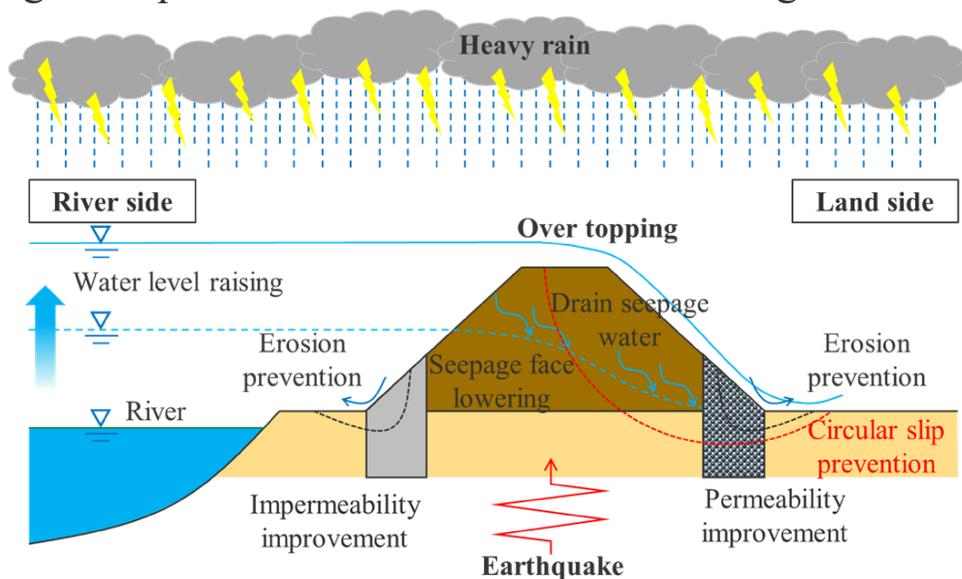
Prevent erosion of the embankment toe caused by overtopping and piping

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  $k=1.0 \times 10^{-3} \text{m/sec}$