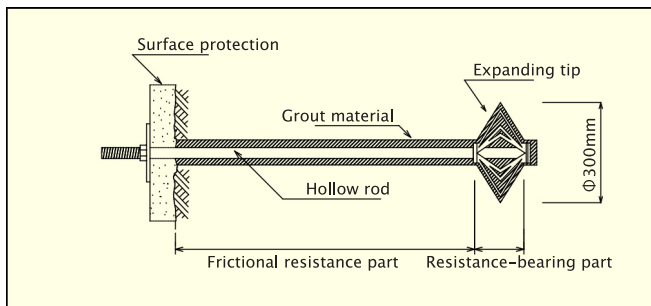


# Mini-anchor DO

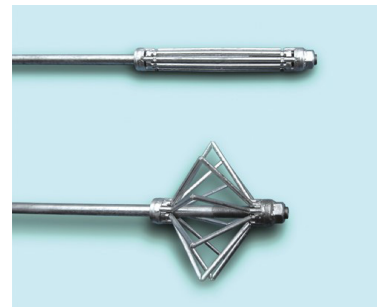
(as a unique approach to earth reinforcement)

## Overview

In response to demand for reliable and economical ways to stabilize steep slopes for effective land use and environmental wellbeing, systematic earth reinforcement approaches such as the mini-anchor DO method are today increasingly applied. In the technique reported here, mini anchors with tips that expand after insertion into the ground are used for stabilization instead of reinforcement bars. The approach is particularly effective on sites with fixed boundaries.



Mini-anchor DO

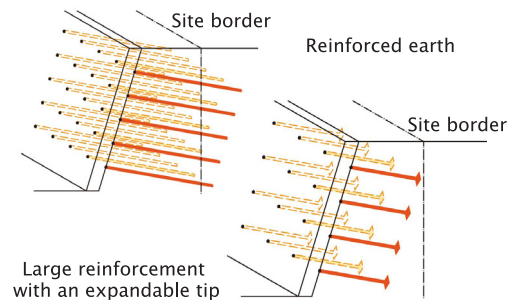


Mini-anchor DO expansion

## Advantages

The product's expanding tip enables:

- ◆ Reduction of reinforcement material usage
- ◆ Reduction of areas affected by construction
- ◆ Reduction of influence on issues with adjoining sites
- ◆ Potential for larger placement pitches
- ◆ Appropriate grouting with injection from the reinforcement tip via a hollow rod
- ◆ Construction in restricted spaces thanks to reduced need for heavy plant



## Construction procedures

### ① Boring

Mechanical boring



### ② Mini-anchor DO insertion/expansion

Mini-anchor DO tips are opened using a special expander.



### ③ Slope (wall surface) construction

Concrete spraying/placement, lattice frame installation and tree planting using lattice frames can be conducted on slopes.



# Constructions

	Detail	Duration	Conductor	Construction overview
1	Senri Purification Reservoir retaining walls	December 2007 March 2008	Osaka Prefecture	Reinforcement of existing retaining walls. Cohesive soil; mini-anchor lengths: 3.5/4 m
2	Narumi Water Distribution Plant renovation	February March, 2008	Nagoya	Reinforcement of existing retaining walls. Sandy soil; mini-anchor lengths: 2.5/5 m
3	Landslide prevention in disaster-related areas	2008	Kashiwa, Chiba	Recovery from the Mid-Niigata Prefecture Earthquake (reinforcement of existing slopes and other structures)
4	Civil engineering and other work to improve the approach road to the National Defense Academy of Japan (20)	November 2009 January 2010	South Kanto Defense Bureau	Cut reinforcement (temporary). Embankment sandy soil; mini-anchor length: 2/4 m
5	Higashi Kanto Expressway Ibaraki Junction construction	June 2009	Nexco East Mito Construction Office	Cut reinforcement (permanent). Sandy soil; mini-anchor length: 2.5/4 m
6	Road disaster recovery in the Tenpyodai area	June 2011	Munakata, Fukuoka	Reinforcement of existing retaining walls (permanent). Sandy soil; mini-anchor length: 2.5 m
7	Renovation of Prefectural Road 207 Construction of Bikuniya Bridge substructure (A1, P1)	July 2012	Kumamoto River and National Highway Office, Kyushu Regional Development Bureau	Cut reinforcement (permanent), EPS back. Sandy soil; mini-anchor length: 3.5 m
8	Construction at Fudodani on Route 57 in Kumamoto	July 2013	Kumamoto River and National Highway Office, Kyushu Regional Development Bureau	Ground reinforcement. Existing embankment soil (unknown); mini-anchor length: 5/6 m
9	Nagoya Handa-route improvement work Nos. 3/5	October 2013	Aichi Prefecture Chita Construction Office	Cut reinforcement (permanent). Sandy soil (mixed with clay); mini-anchor length: 1.5/2/2.5 m
10	FY 2013 Meihan Expressway Mukai IC development	June 2014	Hokusei National Highway Office, Chubu Regional Development Bureau	Cut reinforcement (permanent). EPS back; mini-anchor length: 2.5/3/3.5/4/4.5 m
11	Slope recovery at the Tsunagi Water Distribution Plant	November 2014	Morioka, Iwate	Disaster recovery for an existing slope. Cohesive soil/silt; mini-anchor length: 3 m
12	External work for structural installation on the Kitakata-Nobeoka Route 218 in Miyazaki	March 2015	Nobeoka River and National Highway Office, Kyushu Regional Development Bureau	Reinforcement of retaining walls (permanent). Gravelly soil; mini-anchor length: 2.5/3/3.5/4/4.5 m
13	Shirotori Tunnel, Tokai-Hokuriku Expressway	April 2016	Nexco Central	Slope reinforcement (permanent). Embankment soil; mini-anchor length: 6 m
14	Uphill lane construction at Kabutonakazaike on the Meihan Expressway	November 2017	Hokusei National Highway Office, Chubu Regional Development Bureau	Slope reinforcement (permanent). Embankment soil; mini-anchor length: 5 m



Reinforcement of existing retaining walls. Min. distance from residential areas: 1.7 m; manual drilling (construction case 1), concrete placement finish



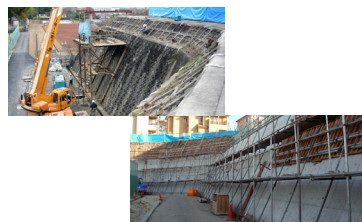
Reinforcement of existing retaining walls: shotcrete finish



Temporary landslide prevention walls for condominium construction



Temporary landslide prevention for a cut site in the widening of National Route 1 (construction case 4)



Reinforcement of existing retaining walls (construction case 6), concrete placement finish



Ground reinforcement (part of construction case 3), tree planting finish