Case studies of Advanced Construction and Demolition waste(CDW) Recycling initiatives and technologies In JAPAN

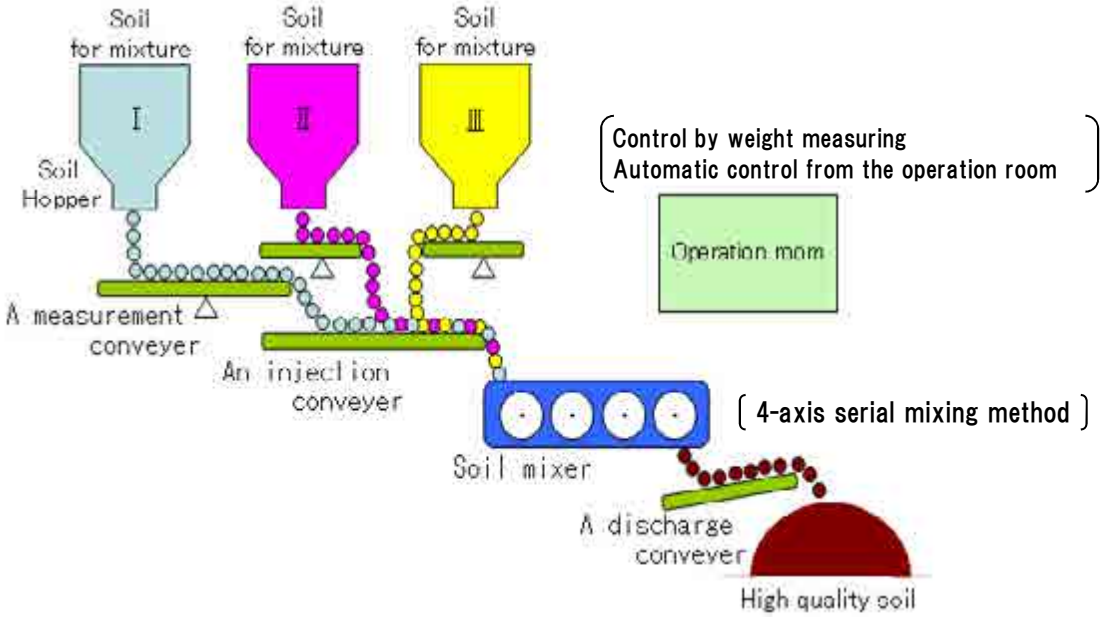
Affiliation	OKUNOKOTOH Co. ,Ltd	
Location	1-14-13,Otukacho,Takatsuki-shi,Osaka 569-0034 Japan	
Position:	Vice president	
Name/Surname	HIROZO OKUNO	
e-mail	hz.okuno@okunokotoh.jp	
Title	**OKUNOKOTOH Soil improvement technology**	
Theme classification	○	Prevention
		Re-use
	○	Recycle
		Reduce Co2
		Legacy
		Business to overseas
		Etc.
Technology development stage	○	Practical use
		Scheduled to be put into practical use by 2020
		Scheduled to be put into practical use after 2020
Specific content	- This technology combines excavated soil of different soil properties with low-appearance excavated soil, which cannot be used as it is, and mixes them by stirring to adjust the particle size and improve the strength, thereby producing high-quality soil materials. - It is also possible to add additives at the same time, and it can be improved to the required quality soil material at low cost and according to the application to be used. Facility configuration: Sediment hopper, lightweight conveyor, input conveyor, universal soil improvement machine, discharge conveyor (solidifying material hopper) Application location: River embankment filling material Roadbed / road floor filling material, backfill material, land section building 	
Appeal point	- Recycling of low-quality excavated soil and contribution to a Sound Material-Cycle Society. - Continuous construction and productivity improvement through mechanization of soil mixing. - System technology based on computerization of mixed operation management.	

OKUNOKOTOH **Soil improvement technology**

The universal soil improving system for construction surplus soil

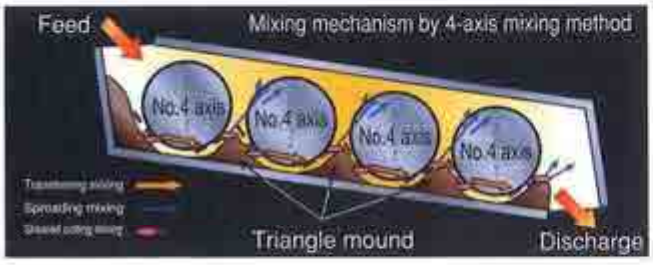
The universal soil improving system revives construction surplus soil to quality soil, by evenly stirring soil to improve grain size, as well as by adding hardening agents.
With four mixing chambers, it repeats shearing, moving, diffusing and mixing, which can accommodate various size and types of soil and clay. This system also works brilliantly for soil improvement of sludge.

System scheme



4-axis serial mixing method

- It adopts a unique structure that consists of 4 axes of the mixing blades, which are arranged perpendicular to the earth flow. It works effectively for mixing various types of soil, including clay soil, by combining deferent types of mixing methods, such as transferring, spreading, and sheared cutting.
- The special mechanism to rotate 4 axes at a higher speed one by one enables effective mixing.

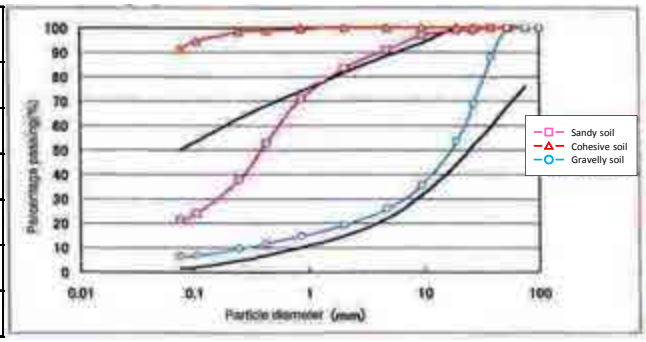


- The mixing blades arranged at random enable a continuous and stable operation, because of less pinching of foreign materials.
- The durable cemented carbide tips attached to the mixing blade reduce maintenance works, and improve the cost performance.

Construction example

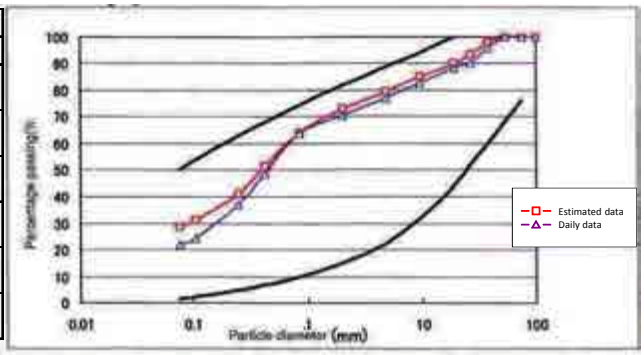
Preliminary soil test data and grain size distribution

			Sandy soil 6	Cohesive soil 2	Gravelly soil 2
Preliminary laboratory test	Water content（%）		13.5	38.2	2.2
	Classification	Gravel（%）	16.7	0.0	80.6
		Sand（%）	62.0	8.7	13.0
		Fine-fraction（%）	21.3	91.3	6.4
	Cone index (kN/m2)		5753	230	—
Soil classification			Class 1 construction-surplus soil Class	Class 4 construction-surplus soil Class	Class 1 construction-surplus soil Class



Post-mixing soil test data and grain size distribution

			Mixed soil	
			Laboratory estimated data	Daily data
laboratory test	Water content（%）		14.8	14.6
	Classification	Gravel（%）	27.2	29.6
		Sand（%）	44.3	48.3
		Fine-fraction（%）	28.5	22.1
	Cone index (kN/m2)		3277	1800
Soil classification			Class 2 construction-surplus soil Class	Class 2 construction-surplus soil Class



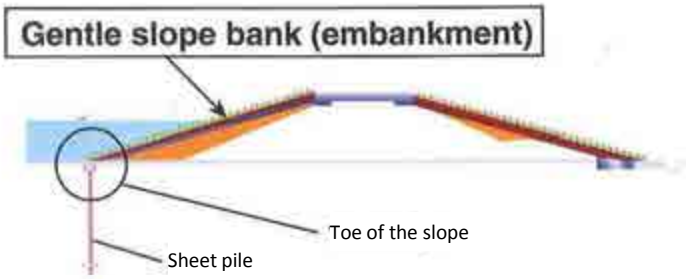
Case: Recycling of construction surplus soil into mound soil for banks

Super bank construction

Super banks may not burst even if the river-water overflows due to a serious flood; accordingly they prevent urban areas from a devastating flood.

Bank reinforcement construction

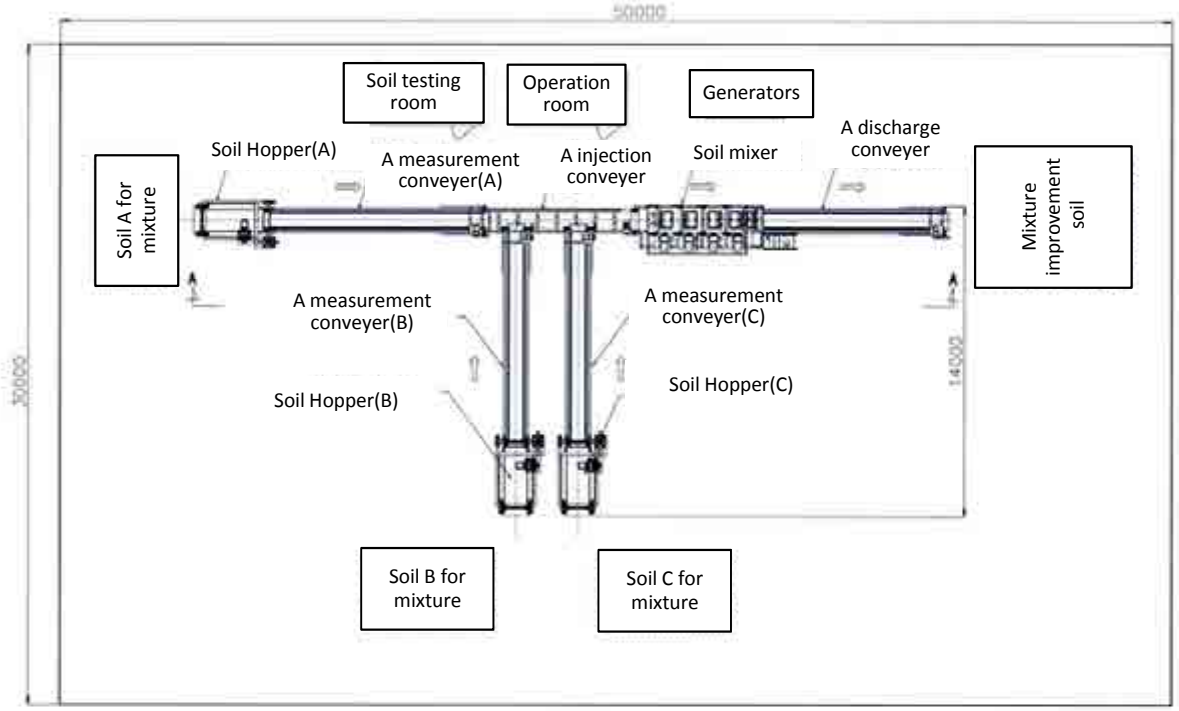
Conventional banks are built up simply by banking soil; therefore, it may burst when the bank is in a wet condition with water penetrating it, or the bank surface is scoured.
It is called bank reinforcement to strengthen the conventional bank strength ageinst bursting.



A gentle slope bank is build up by widening the bank cross-section.Increasing the bank cross-section makes a stable bank that is strong against floods. This method is used for draining quickly the water penetrated in the bank to lower the water level, by replacing soil around the toe of the slope on the river-back side (residence side) with permeable materials, such as stones.
*Toe of the slope; a point where an area protected by levee or a major bed.

Example of system setup (Case of three-kind soils)

※An arrangement is possible according to the situation of the site.



Cross-section A-A

Specification of system

Standard specification

Equipment name	Technical standard		Intended purpose
Soil Hopper ※ (With scooping-out device)	Capacity of motor: Capacity of soil hopper:	7.5kw 2㎥	Soil slot Carrying out soil measured
A measurement conveyer ※ (With measurement device)	Capacity of motor: Size of belt:	7.5kw 750㎜ width × 10m (Distance between axes)	Transporting soil measured Measuring
A injection conveyer	Capacity of motor: Size of belt:	5.5kw 750㎜ width × 7m (Distance between axes)	Transportation halfway
Soil mixer	Capacity of motor: Size of mixing axis:	22kw×4 1mϕ×1m width(Per axis)	Mixing soils
A discharge conveyer	Capacity of motor: Size of belt:	7.5kw 750㎜ width × 10m (Distance between axes)	Carrying out soil mixed
Operation room	4500×2000×H2390m		System control
Generators	250kVA		Power

※The number of the soil hoppers and the measurement conveyers changes depending on the number of soils mixed.

The case of three kinds of soils: 3 devices
The case of two kinds of soils: 2 devices

株式会社オクノコトー
OKUNOKOTOH Co., LTD.

Head office : 1-14-13,Otukacho,Takatsuki-shi,Osaka 569-0034
Phone: 072-675-0388 Fax: 072-671-9565

Hyogo office : 487,Babasaki,Higashi-honjo,Sanda-shi,Hyogo 669-1357
Phone: 079-568-6375 Fax: 079-568-6378

Kanto office : 1078-1,Kamikocho,Omiya-ku,Saitama-shi,Saitama 330-0855
Phone: 048-780-2049 Fax: 048-643-2058