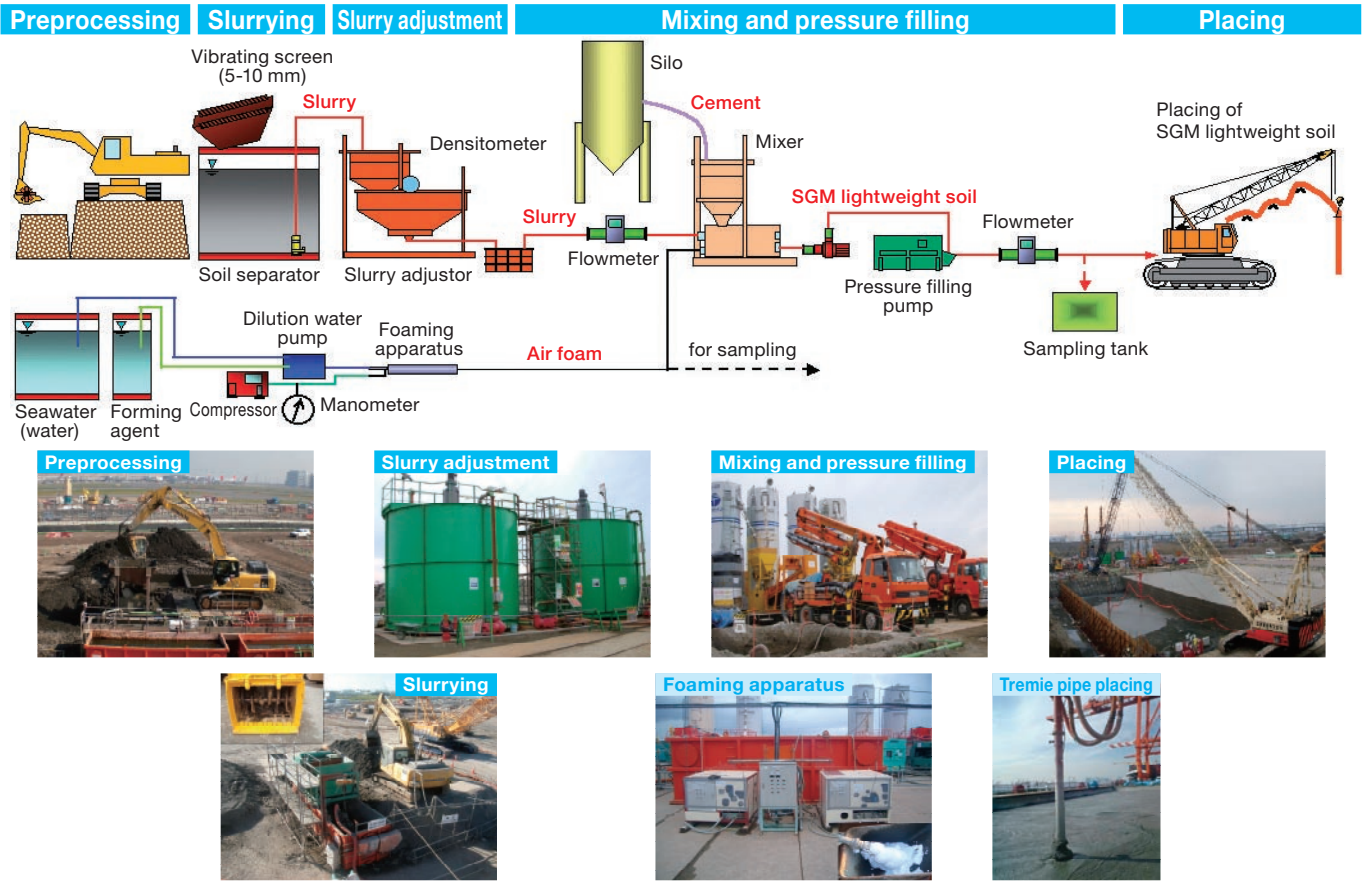


The SGM Lightweight Treated Soil Method for recycling dredged and surplus soils

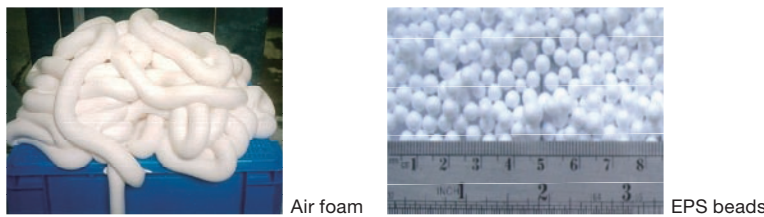
What is SGM lightweight soil

The SGM (Super Geo-Material) Lightweight Treated Soil is a ground material made by adding water to dredged or surplus soil mixed with lightener material (foams, beads), stabilizing agent such as cement. The distinctive feature of the SGM Lightweight Treated Soil is its relatively small density and sufficient strength comparing to non-treated untreated (original) ground materials. Because of these advantageous characteristics, stable, foundations that are able to resist subsidence, earthquake, and liquefaction can be constructed. The SGM Lightweight Treated Soil is produced through the well-designed production system where quantity of stabilizing agent and density of treated soils are constantly monitored and adjustment of mix proportion can be done in order to maintain the specified quality (strength, density).

Construction flow



Lightener materials



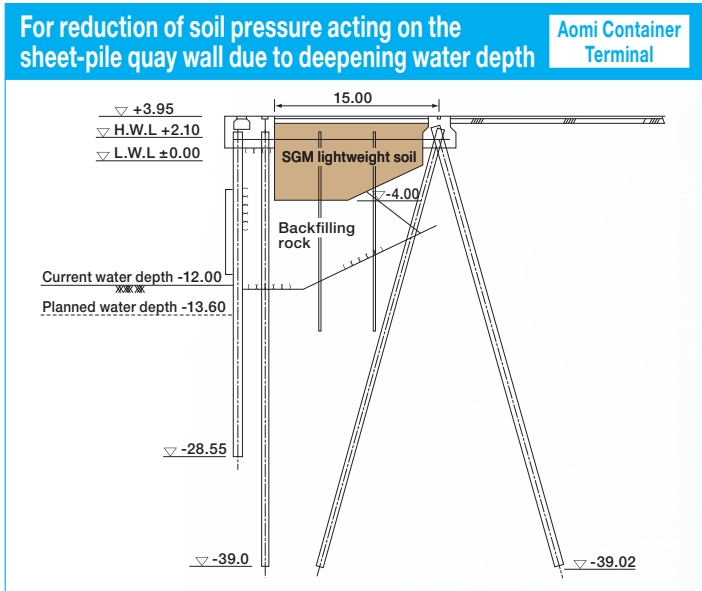
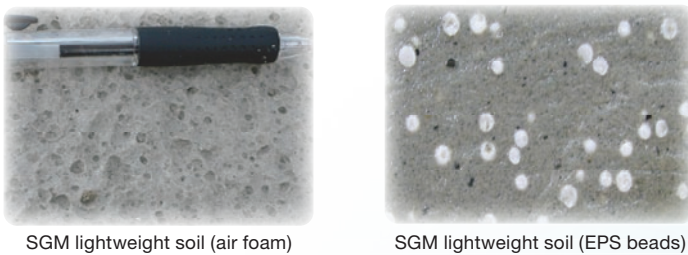
Example of mix proportion

		Example for under water placing		Design density 1.15g/cm ³ , Design strength 200kN/m ²		Mix density 1.10g/cm ³ , Mix strength 440kN/m ²				
	Source soil	Source soil (kg/m ³)	Adjusting water (kg/m ³)	Additive* (kg/m ³)	Swelling water (kg/m ³)	Stabilizing agent (kg/m ³)	Forming agent (kg/m ³)	Dilution water (kg/m ³)	Air content (ℓ/m ³)	EPS beads (kg/m ³)
Air foam	Clay soil (W _L = 70%)	334.4	655.4	—	—	100.0	0.522	9.720	194.4	—
	Sandy soil	371.7	360.5	18.6	185.8	150.0	0.682	12.701	254.0	—
EPS beads	Clay soil (W _L = 70%)	410.9	632.8	—	—	100.0	—	—	—	6.326
	Sandy soil	429.5	326.4	21.5	214.7	150.0	—	—	—	7.959

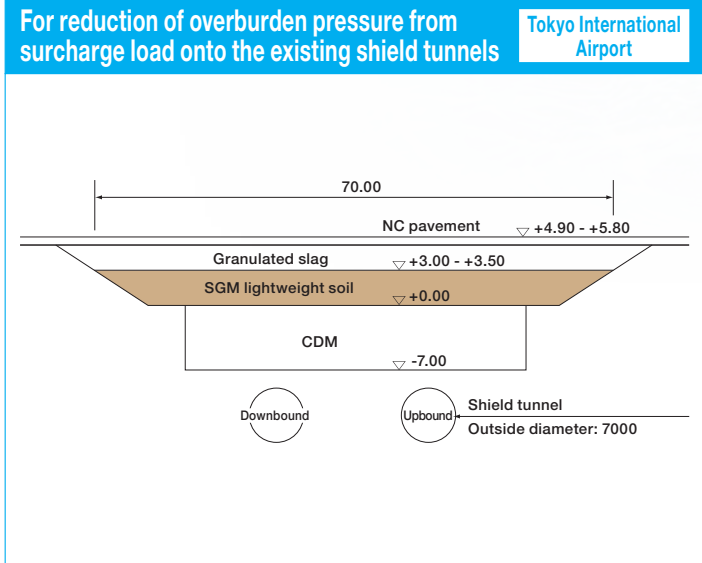
*Bentonite

Examples of Field Application

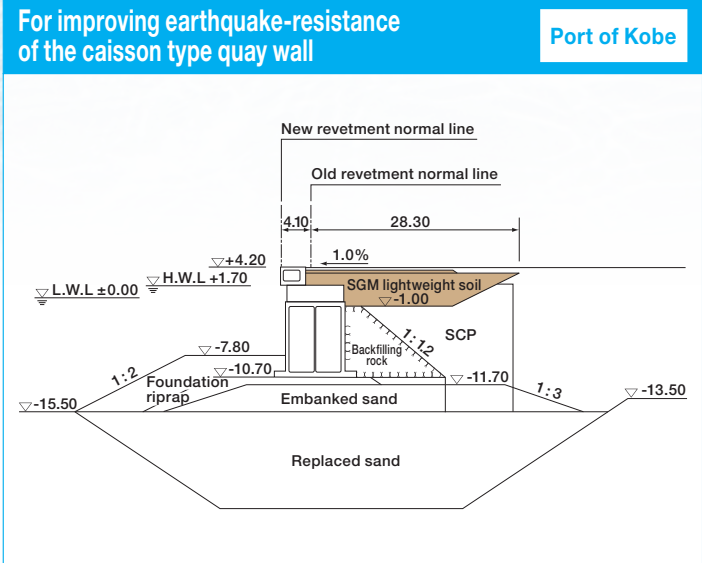
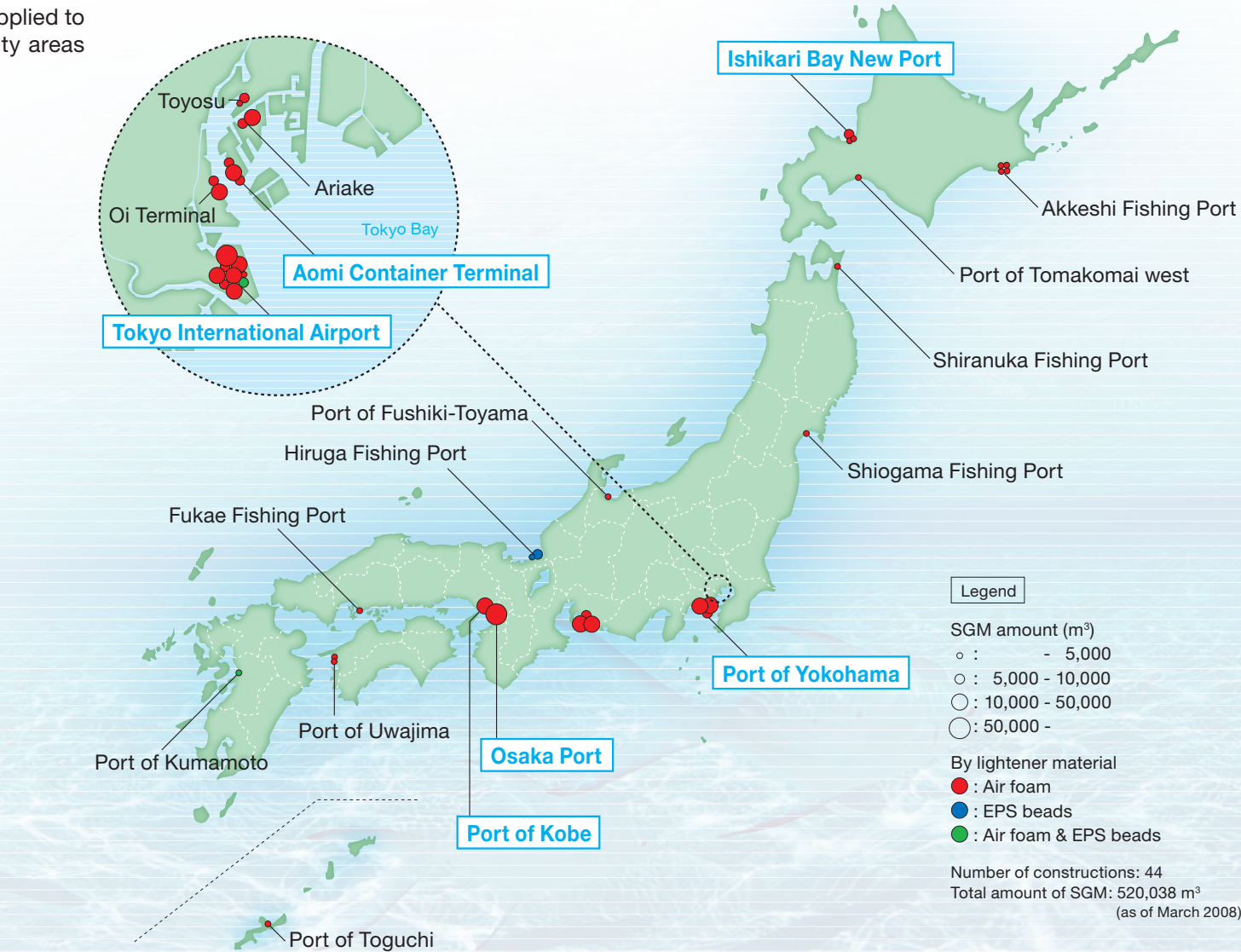
The SGM Lightweight Treated Soil Method has been widely applied to the construction projects in Japan, especially in the major city areas such as Tokyo, Yokohama, Nagoya, and Osaka.



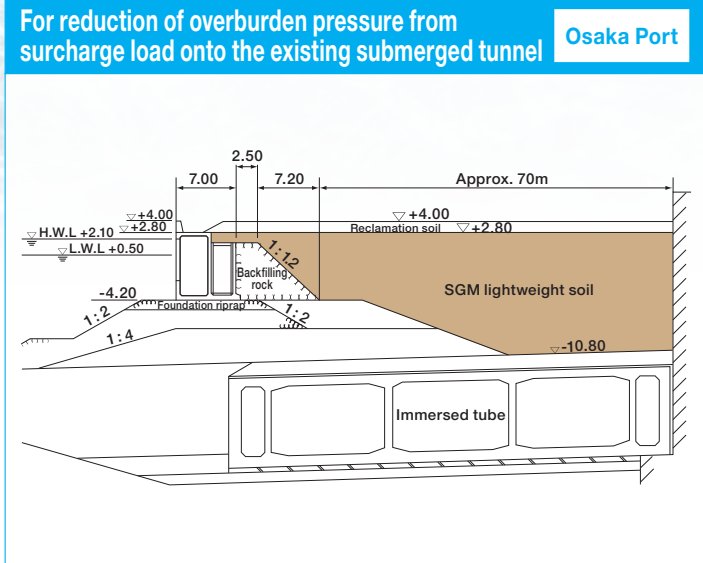
SGM lightweight treated soil is used to reduce soil pressure when deepening the depth of existing terminals from a 30,000DWT level to a 40,000DWT level.



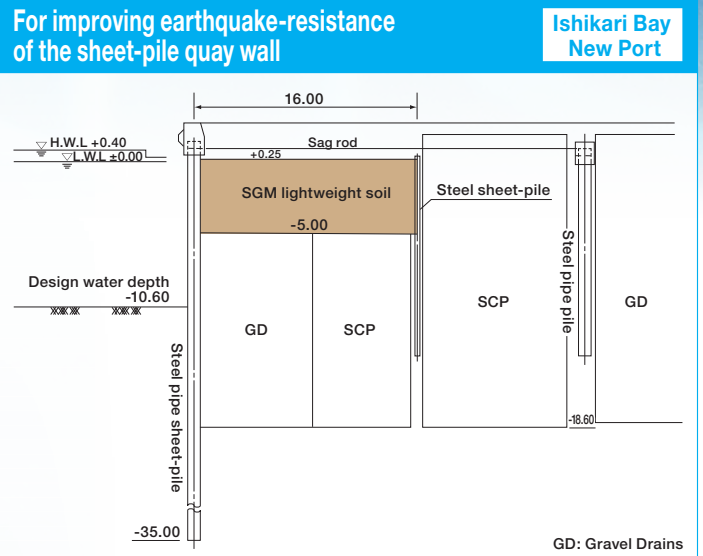
SGM lightweight treated soil has been used as lightweight material to reduce the overburden load on the shield tunnels.



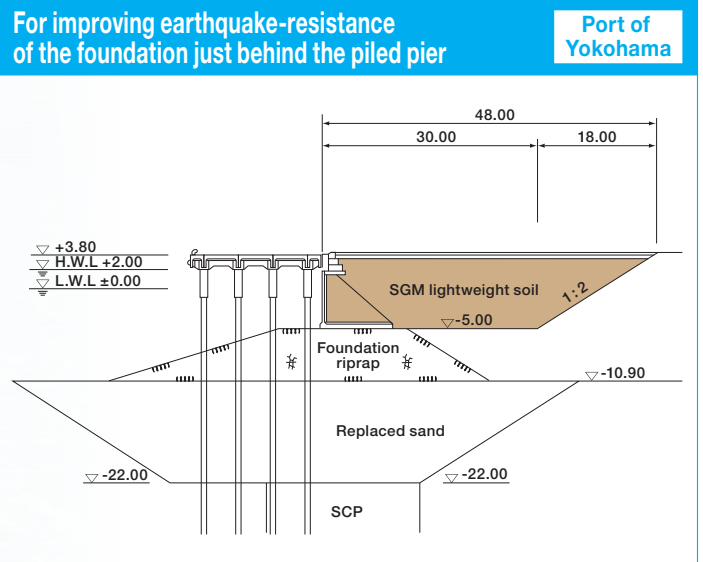
SGM lightweight treated soil is used to reduce the soil pressure exerted during earthquakes in the restoration work the quaywalls damaged during the Great Hanshin-Awaji Earthquake.



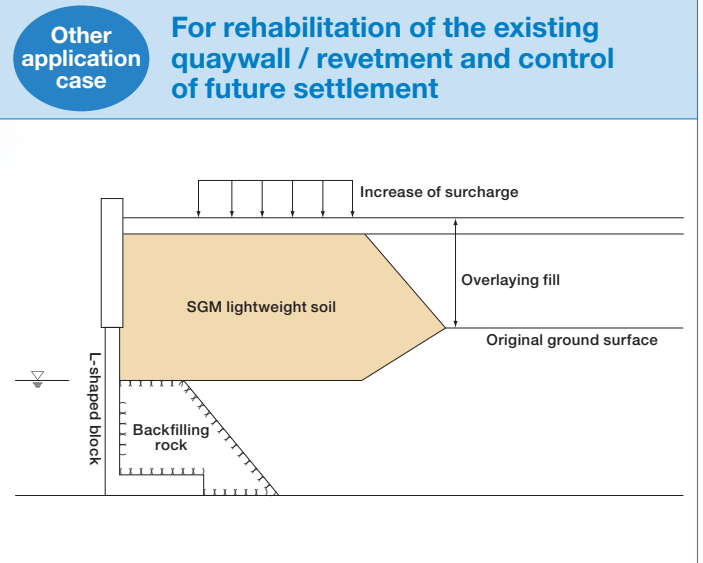
SGM lightweight treated soil is used to reduce the overburden load on submerged tunnels.



SGM lightweight treated soil is used to reduce soil pressure and control lateral displacement because of the need to increase the earthquake resistance of the sheet-pile quay wall.



SGM lightweight treated soil is used for improving the earthquake resistance of jetty facilities because, even for a Level II earthquake, keeping existing jetties stable is necessary.

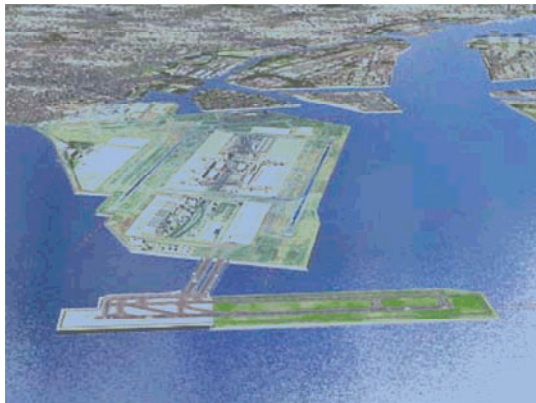


the stable airport foundation

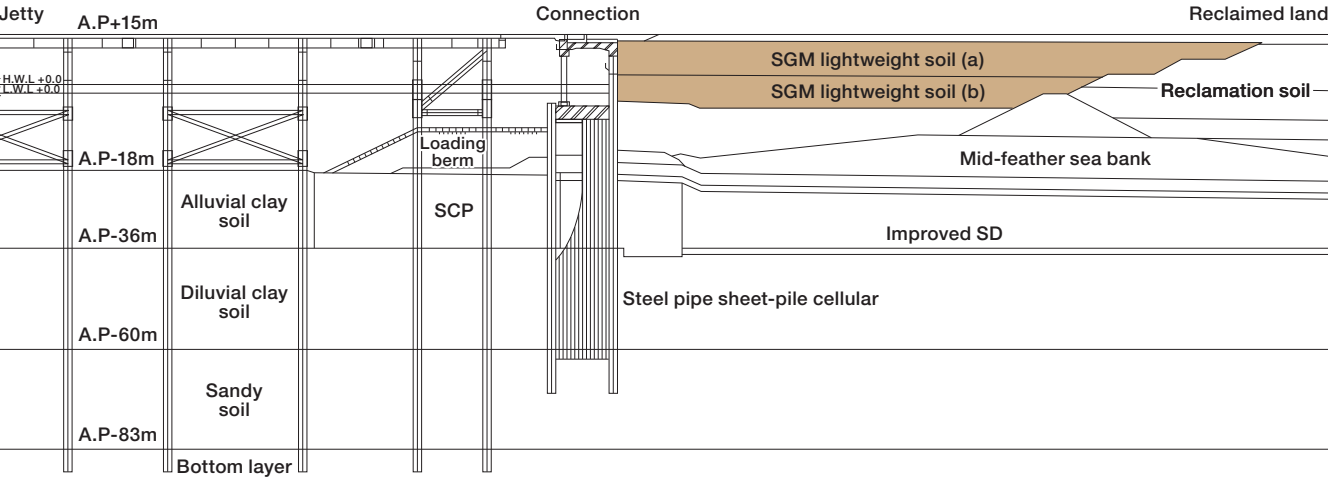
● Tokyo International Airport Runway D Construction

Designs

- Dredged soils obtained from the modification work for Tokyo Harbor's Waterway No.1 have been used for the mother material of the SGM Lightweight Treated Soil.
- The SGM Lightweight Treated Soil has been used for backfill material behind the steel pipe sheet-pile cellular type bulkhead connecting between the reclamation area and the piled pier area so that soil pressure against the bulkhead and residual settlement can be reduced, and accordingly the rational design can be implemented.



Section diagram



Item	Specification		Adjusting soil		Stabilizing agent (kg/m³)	Air foam		Note
	Density (g/cm³)	Unconfined compressive strength (kN/m²)	Dry soil (kg/m³)	Seawater (kg/m³)		Forming agent	Dilution water (kg/m³)	
SGM lightweight soil (a)	1.00	200	192	732	86	0.55	9.2	Aerial placing
SGM lightweight soil (b)	1.10	200	230	806	78	0.31	5.1	Underwater placing

*Mix proportion varies depending on source soil properties.

Construction overview

Schedule: May 2009 to December 2009

SGM amount: Approx. 800,000 m³

Placing method: Using SGM lightweight soil dedicated vessel (placing capability: 360 m³/hr)



SGM lightweight soil dedicated vessel



SGM Lightweight Treated Soil Method Association

AOMI CONSTRUCTION CO., LTD.
OHMOTO GUMI CO., LTD.
ONODA CHEMICO CO., LTD.
Kubota Construction Co., Ltd.
PENTA-OCEAN CONSTRUCTION CO., LTD.
JSP Corporation
SHIMIZU CORPORATION
SEKISUI PLASTICS CO., LTD.
TAIHEIYO CEMENT CORPORATION
Taiheiyō Soil Corporation
TOA CORPORATION
TOYO CONSTRUCTION CO., LTD.
Nishimatsu Construction Co., Ltd.
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JDC Corporation
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MIRAI CONSTRUCTION CO., LTD.
MIRAI GEO-TECH CO., LTD.
NISSAN RINKAI CONSTRUCTION CO., LTD.
WAKACHIKU CONSTRUCTION CO., LTD.

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The SGM Lightweight Treated Soil Method

toward achieving sustainable ocean developments

Technical Information and Projects

SGM Lightweight Treated Soil Method Association