

An aerial photograph showing a coastal town with a dense residential area on the left, a large green pine forest in the center, and a dark sandy beach on the right. The ocean is visible on the far right.

Improving the scenery of Mihonomatsubara Pine Tree Grove,
part of the World Cultural Heritage, Fujisan

Preserving the Beauty of Mihonomatsubara Pine Tree Grove for Future Generations



~Results of the Mihonomatsubara White Sand and Green Pine
Conservation Technical Committee~



Shizuoka Prefecture

Sanctuary, source of artistic inspiration, and a place of prayer



The Hagoromo Pine Tree



God's Road

■ A place where gods touch down

The tree-lined path which extends from the *Hagoromo* pine tree (made famous from “The Legend of the Celestial Robe”) to the Miho Shrine is called “God’s Road”. It is said that God touched down on Earth using the pine tree to find his way, and the Mihonomatsubara pine tree grove has been known as a holy place for a long time.



Hodaka Konparu of the Konparu school performing the outdoor Noh play “Hagoromo”



The Mihonomatsubara Pine Tree Grove Coast

■ A source of artistic inspiration

The Mihonomatsubara pine tree grove is counted as one of the most scenic pine groves as well as one of the “three new views” of Japan, but even abroad it is known for its symbolic scenery that weaves the pine forest with views of Mount Fuji. Since its scenery was depicted in the *Manyoshu* anthology, it has been the inspiration for many works of art, including *waka* poetry, wood block prints, pictures, and traditional stage performances, and adored by many.

■ First sunrise of the year

On new year’s day, many people crowd around the *Hagoromo* pine tree to watch the first sunrise of the year. The Mihonomatsubara pine tree grove becomes a place of prayer where people pray for the health and safety of themselves and their loved ones.



■ On the World Heritage List as part of the Fujisan Cultural Site

Due to the Mihonomatsubara pine tree grove’s status as a source of artwork, thanks to its famous view of Mount Fuji (Fujisan), it was registered on the World Heritage List as part of the Fujisan Cultural Site as the sacred place and source of artistic inspiration.

A Living Beach and Coastal Erosion

■ Formation of the Miho Peninsula

The site of the Mihonomatsubara pine tree grove, the Miho Peninsula, is a “sandpit” that gradually formed through the accumulation of sand. The main source of this sand is the Abe River, about 15 kilometers south of the Mihonomatsubara.

■ How the beach forms

The Shimizu Coast, which includes the Mihonomatsubara pine tree grove, was formed in the same way as the Miho Peninsula. Sand supplied from the mouth of the Abe River was deposited north along the shore from the movement of waves. It is through this that the balance of sand is maintained as a living beach. The sand at the tip of the Miho Peninsula forms the sandpit as it falls into the deep part of the Suruga Bay.

■ High economic growth and shore erosion

However, the surge in demand for concrete materials in the 1950's following high economic growth lead to large amounts of gravel being extracted (until 1968, when extraction began to be regulated, about 870m³ of gravel was extracted). Because of this, the amount of sand deposited from the mouth of the Abe River diminished, and coast gradually began to erode from near the mouth of the river and extended north. The beach began to disappear, and its natural wave-dissipating function stopped working. Starting in the early 1980's, National Route 150 was ravaged countless times by high waves stemming from typhoons.

■ Combating shore erosion

Because of this, detached breakwater structures were installed around the coast, and this helped progression on preventing coastal erosion. At the coast of Shimizu, before the spread of erosion, starting in 1988 detached breakwater headlands, breakwaters and other similar devices were installed. In 2007, in order to supplement the decreasing drift sand, a source of erosion, the “Sand Bypass Beach Sand Replenishment” was carried out, which transports about 80,000 m³ of sand a year from the Abe River. In 2011, the “Sand Recycle Beach Sand Replenishment”, which utilizes accumulated sand from the tip of the Miho Peninsula, was installed.



Photo from 1983
National Route 150 Damage (Hebitsuka Ward)



Photo from January 2013
Current state of coast structures (Miho Area)

Around 1988, erosion expands in the direction of the Hagaromo pine, work begins on headlands and breakwaters

Current Situation: The beach has still not recovered. If something is not done, it will erode

Around 1970~ Erosion begins around the Abe River and spreads north

Around 1980~ Beach slowly improves starting from the mouth of the Abe River



Preserving the coast while improving the scenery

■ Scenery Fitting For World Heritage

The Miho Peninsula was registered in June 2013 to the World Heritage List as part of the Fujisan Cultural Site, as a “source of artistic inspiration” and a representative viewing spot of Mount Fuji. However, the breakwaters on the site, which have played an important role in maintaining the shore, were criticized for being aesthetically unappealing. This criticism was something that needed to be taken seriously.

■ Establishment of the Mihonomatsubara White Sand and Green Pine Conservation Technical Committee

Due to the eroding seashore, the beautiful beach is in danger of disappearing. In response to this, in order to preserve the beach as well as ensure the beauty of its scenery, measures have been taken. Through these, we have been able to protect the life and property of the area.

However, the erosion continues to occur, and as environmental disasters such as rising sea levels caused by global warming as well as tsunamis caused by earthquakes continue, it is becoming even more important to preserve a space to view Mount Fuji for future generations.

In order to protect the beach as well as preserve the scenery, the Mihonomatsubara White Sand and Green Pine Conservation Technical Committee was held in August 2013. The meeting was held after recognizing the importance of combining the two tasks in order to give it value as a world cultural heritage site, and topics covered combined the expert opinions of specialists with the latest technology.

Members of the technical conference consisted of coastal engineers and scenery/cultural heritage specialists, and representatives of the country, prefecture, as well as Shizuoka City. By March 2015, many ideas were exchanged through a total of 4 technical conferences and 5 group meetings.



Photo from December 2013

Breakwaters deemed unfavorable from an aesthetic perspective



Photo from September 2013

Mihonomatsubara White Sand and Green Pine Conservation Technical Committee

August 7, 2013	Establishment of the committee
September 10th	First Technical Conference (1) Establishment of the meeting (2) Progress of the efforts to preserve the coast (3) Basic information concerning protection and scenery
January 30 th , 2014	Second Technical Conference (1) Basics of the countermeasure (2) Decision on construction methods, etc.
June-November	1 st -4 th Structure of L-type groin/Scenery considerations group meeting
November 20th	Third Technical Conference (1) Installation of breakwaters, structure considerations (2) Monitoring plans, etc.
January 14, 2015	Fifth Structure of L-type groin/Scenery considerations group meeting
February 3rd	Fourth Technical Conference (1) Structure placements, structure decisions (2) Considerations hereafter
March 24th	Final Reports and Announcements

■ Basic Principle: Balancing both protection and fitting scenery



【Protection】 ---Securing current protection standards*

Along with preventing wave surges that occur once every 50 years from spilling into the hinterland, protecting against tsunamis.

*Protection standards...Securing the necessary 80 m of beach width in order to prevent overtopping waves

←Status of #1 and #2 breakwaters during Typhoon #26, 2013



【Scenery】 ---Restoring the scenery seen in drawings

The intrinsic value that makes it a World Heritage site: The combination of Mount Fuji, the pine forest, the beach, and the sea.

←Postcard from 1955 (Around Kamagasaki)

■ How to respond

After careful consideration, the following five points were decided on to improve the scenery.

1	To ensure a coast that can sustain itself in the future without using construction, efforts will be made to ensure the continuous provision of sand.
2	Until the beach can naturally replenish itself, the beach will be protected by small structures that take the scenery into account.
3	The state of the coast will constantly be monitored, and measures will be reconsidered if necessary.
4	To achieve the desired coastline, there will be cooperation with persons and institutions related to the project.
5	Maintain and improve the Mihonomatsubara pine tree grove's cultural value as both a World Cultural Heritage site as well as a place of scenic beauty.

■ Specific considerations to improve the scenery

At the four Mihonomatsubara White Sand and Green Pine Conservation Technical Committee discussions, short-term solutions were the main focus of the discussions. After 8 different alternatives were discussed and narrowed down, it was decided that L-type groins and 50,000m³ a year of beach will would replace the existing breakwaters.

Implementing gradual measures

Long, intermediate, and short-term solutions were presented. The #1 and #2 breakwaters, which have a big influence on the scenery of Mount Fuji when viewed from near the Hagoromo pine tree, were designated as part of the short-term solutions, and specific solutions were considered.



Considering Alternate Construction Methods

After considering the protection, scenery, utilization, construction, and cost regarding the eight construction methods, it was narrowed down to the following three methods.



Verified through a simulation

Choosing a desirable construction method

After a comprehensive assessment, L-type groins were chosen after they were found to improve the visibility of the facilities as sediment advances as well as work efficiently as breakwaters.

Consideration of Long breakwaters (Extreme Sea Depth), Beach Sand Replenishment Amount

A simulation was conducted to see if replacing breakwaters with L-type groins had a large effect on the transformation of the seashore. After a comprehensive assessment, it was determined that in order to extract from areas with built up sediment in the future, an amount of 50,000m³ a year of beach sand replenishment was necessary. It was decided to combine the replacement of the breakwaters with L-type groins and 50,000m³ a year of beach sand replenishment.



The decision to use L-type groins

The L-type coated block type (impermeable structures) were decided on, which have already been adopted by the vertical sections of the already existing L-type groins, and can accumulate sediment and fit in well with the beach. This was decided based on the topography of the installation location of the L-type groins, and as the results of experiments comparing the structure and hydraulic models, and in light of the fact that the horizontal part of the L-type groins is exposed to strong waves from the sea floor and terrain variation. By installing the foundation underground, the safety can be ensured, while the accumulation of sediment can be expected with the permeable leg-type construction.

Considering Alternate Construction Methods

Plan #	Current Breakwater	General Construction Method
①	Already placed	Improve scenery with artificial rocks, etc.
②	Reduce	Beach sand replenishment
③	Removal	Beach sand replenishment
④	Removal	Detached breakwater headland
⑤	Removal	New detached breakwater type
⑥	Removal	Manmade reef
⑦	Removal	I-type groin
⑧	Removal	L-type groin

※Blue refers to narrowed down choices

①Seashore Change Simulation

Predicted the form of the seashore in 20 years, and confirmed the protection function.

②Scenery Simulation

Using a photo montage, confirmed the situation of the coast, the visibility of the facilities, and the view of the horizon from a visual perspective. We also checked how it fit in with the surrounding scenery in the model.

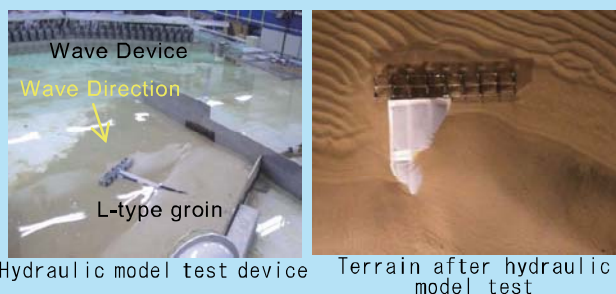
③Comprehensive Assessment

We selected the most appropriate plan after a comprehensive assessment that considered protection, scenery, utilization, and cost, among other factors.

※For more details about the simulation, see page 6.

Verifying Sediment Effect from Hydraulic Model Experiment

A model experiment with the caisson being both permeable and impermeable was conducted. The result of the experiment confirmed that a specific sediment buildup could be expected with a leg-type permeable structure.



Hydraulic model test device

Terrain after hydraulic model test

Specific Measures

Progression of the plan to improve scenery

Short Term

~In about 10 years (2015~about 2024)

Scenery improvement will be prioritized on the high-visibility #1 and #2 breakwaters around the Hagoromo pine tree.

*The removal of the two breakwaters will be considered once the protective standards of the 80 meter width of the beach is ensured.

Mid Term

After 10~30 years (Around 2025~Around 2044)

While monitoring the coast changes on the north side from the #2 breakwater, countermeasures will be considered in a sequential manner.

Long Term

After about 30 years~ (Around 2045)

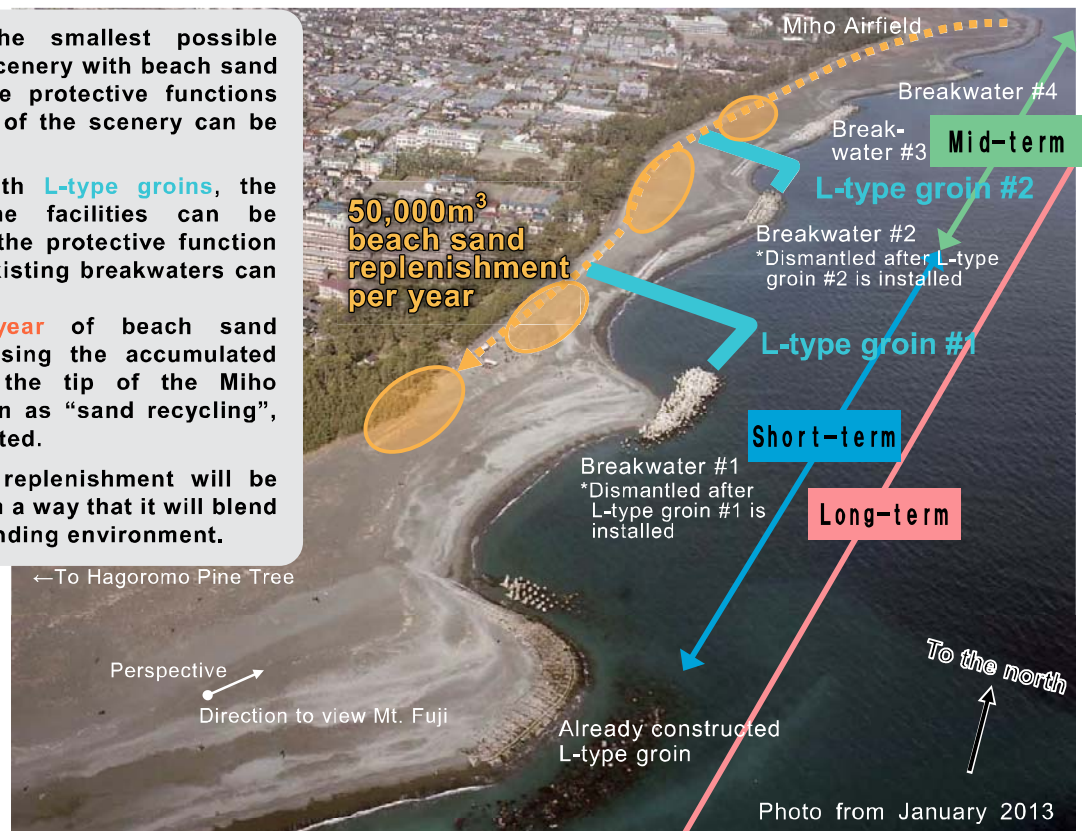
The aim is to have a sustainable coast maintained only with sediment provided from the Abe River, etc.

The design and construction of the L-type groins, the changes in the coast and environment and their influence on utilization will be considered in the Technical Follow-up Conference for the Improvement of the Landscapes of the Mihonomatsubara pine tree grove.

By combining the smallest possible facilities for the scenery with beach sand replenishment, the protective functions and improvement of the scenery can be devised.

- By replacing with L-type groins, the visibility of the facilities can be improved while the protective function of the already existing breakwaters can be ensured.
- 50,000 m³ a year of beach sand replenishment using the accumulated sediment from the tip of the Miho peninsula, known as "sand recycling", will be implemented.

The beach sand replenishment will be carried out in such a way that it will blend in with the surrounding environment.



【Beach Sand Replenishment】

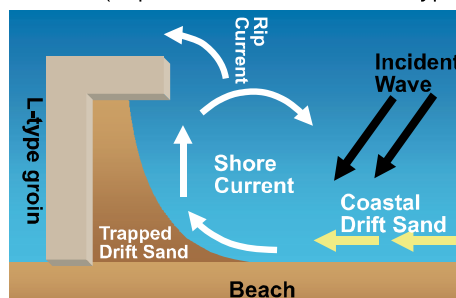
The sediment accumulated in the sand drift of the lower part of the Miho Peninsula will be transported to the upper part of the coast, and reused (known as "sand recycling"). Until now, 30,000 m³ a year of beach sand replenishment was implemented, but to ensure protective standards for the 80 meter width of the beach, this amount will be increased to 50,000 m³ a year of beach sand replenishment.



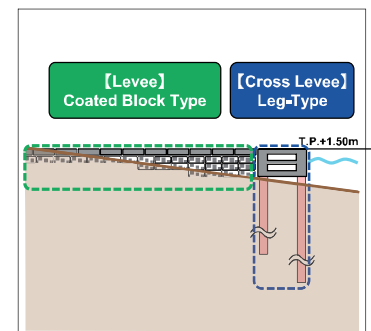
Appearance of beach sand replenishment being carried out

【L-type Groin】

Levees with a low crest height are placed from the shore to offshore, and cross-levees are placed parallel to the shoreline. It supplements the drift sand traveling in the direction of the coast. On the north side of the currently existing #1 and #2 breakwaters, one will be installed at each. In response to areas with noticeable erosion, in order to quickly begin the improvement of the scenery, the construction on the #1 L-type groin will be prioritized. It will consist of cross-levees (permeable leg-type), and levees (impermeable coated block type).



L-type groin Mechanism (Ground Plan)



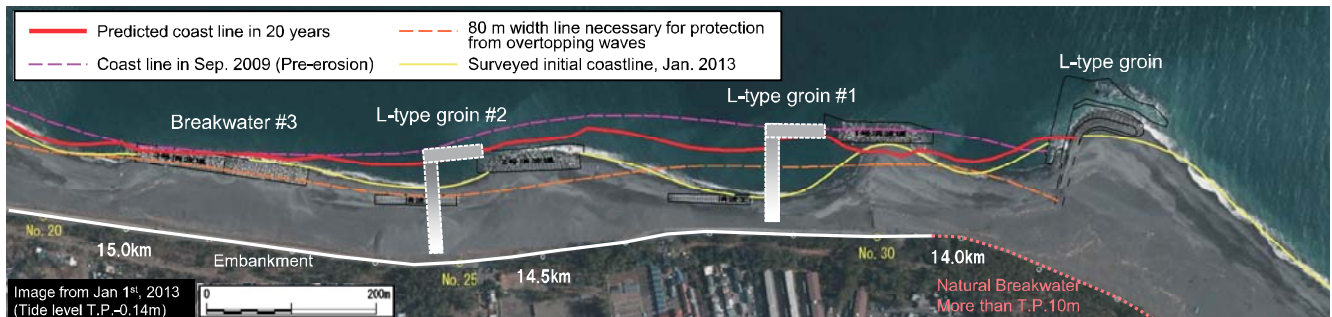
Structure of L-type groin (Cross section view)

Future Vision

Future predictions of beach changes using a simulator

The change in beach topography was predicted using a numerical simulator, and the retention of the future protective function was confirmed. By combining L-type groins with beach sand replenishment, the advancement of the coast line and the switch to low-altitude structures has been planned, and the protection of the coast as well as the scenery can be improved.

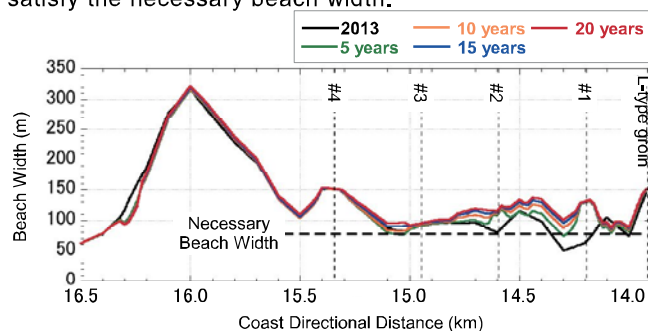
Envisioned coast line in 20 years: The area around #1 and #2 will move forward, and discontinuity of the coast will reduce.



※T.P.(Tokyo Average Sea Level) refers to the standard height above sea level used for the whole country.

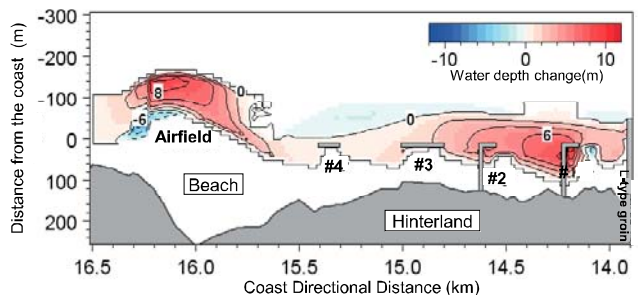
Predicted beach width for next 20 years

The coast line around #1 and #2 will move forward, and satisfy the necessary beach width.



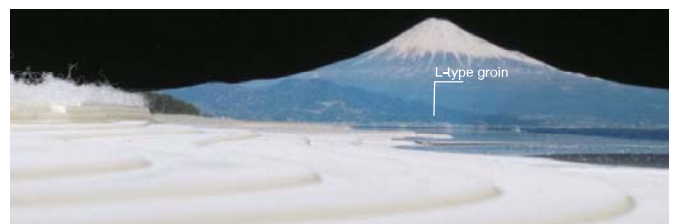
Predicted water depth change for next 20 years

Around #1 and #2, sediment will accumulate, and the protection will be improved.



Prediction of Scenery Improvement

Based on the results of the beach change simulation, a photo montage was created from the perspective of the area around the Hagoromo pine, and the visibility of the facilities as well as the view of the horizon and change in coast line were confirmed. A model was also created and the blend of the scenery with the construction was also confirmed.



Model L-type groin Prediction in 20 Years

The situation today

The zone around the breakwater is prone to erosion, and the beach width is narrow.

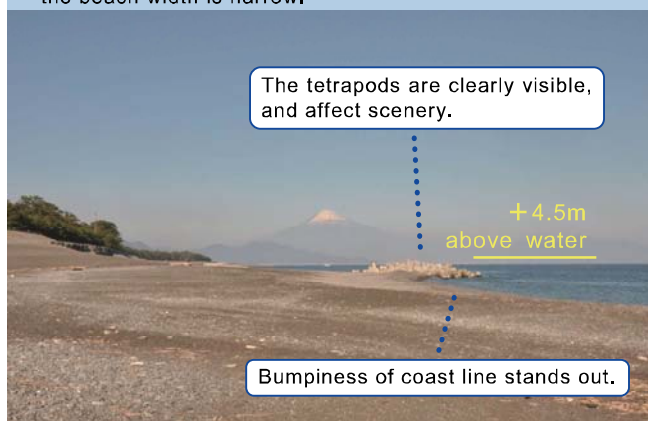


Photo simulation 20 years from now

By implementing the measures, the state of the beach can be ensured, and the hinterland protected.

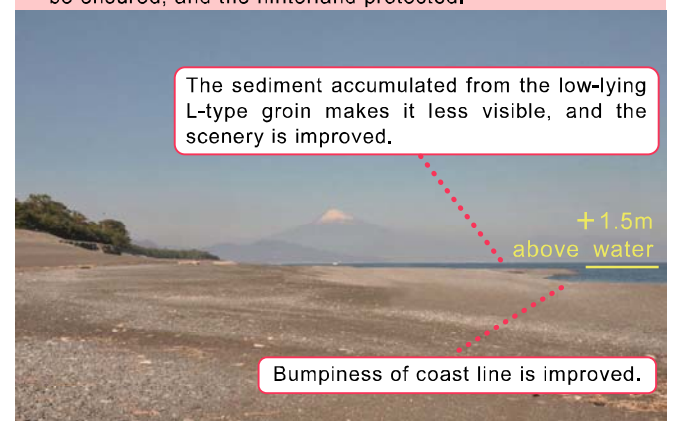


Photo Montage



Contact

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We have a website with information about the Shimizu Coast (Japanese).
Search "Shimizu Kaigan" to access the portal site.

Portal Site :
<http://shimizu-kaigan.net/>

Shimizu Kaigan

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