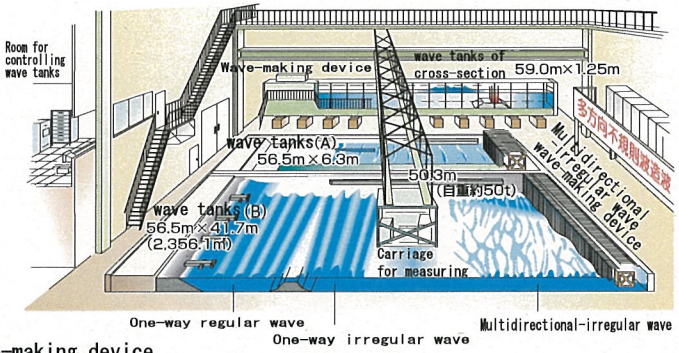
About hydraulic model experiment

We manage ports in Niigata, Toyama, Ishikawa and Fukui prefecture.
We develop, investigate and design the technology that is necessary for harbor construction.
At hydraulic laboratory, we experiment how the wave comes into the harbor and how stable the harbor structure is to use a model.
Numerical simulation with computers has been developing recently.
However, hydraulic model experiment is useful enough to solve the complicated phenomenon that cannot support by the simulation.

There are wave tanks of 2D-flat surface which we can experiment widely, and wave tanks of cross-section surface which we can observe a model experiment from the side. This laboratory building has an area of 4,000 m² and there is no post in the center



Ability of wave-making device

Classification	Wave-making device		Ability of wave-making		Wave kind
	Type	Length of device	Maximum height of wave	Period	
Multidirectional -irregular -wave-making -device	Piston-type	50cm×12=6m (A tank) 50cm×72=36m (B tank)	Regular wave: 35cm (on model) 35m (on site)	0.4-4.0sec. (on model) 4.0-40sec. (on site)	One-way regular wave (include oblique wave) One-way irregular wave (include oblique wave) Multidirectional-irregular wave

＊"on site" is a scale example when the model scale is 1/100.

Facilities

Wave-making device

This is the device which can create waves artificially.
It can move each wave-making board independently, and produce the wave which is similar to the real sea wave*.

*Multidirectional irregular wave:
Waves come from far away and various directions,and many waves-such as big, small,long and short waves- are overlapping.

Carriage for measuring

This carriage can move over wave tanks freely. It moves to the place indicated in sequence and measures the height of waves and the speed of flows at various points.
It allows observing wave tanks from right above by moving in this carriage.

Room for controlling wave tanks and data analyzing

This room is for the purpose of controlling wave-making devices and carriages, and analyzing the collected data.

Mechanism of producing wave and its type

Wave fall into 2 categories.
- Wind swell—Wave of irregular form by wind.
- Swell—Wind swell changes to Swell when wind swell arrives at the windless place.

1 Making

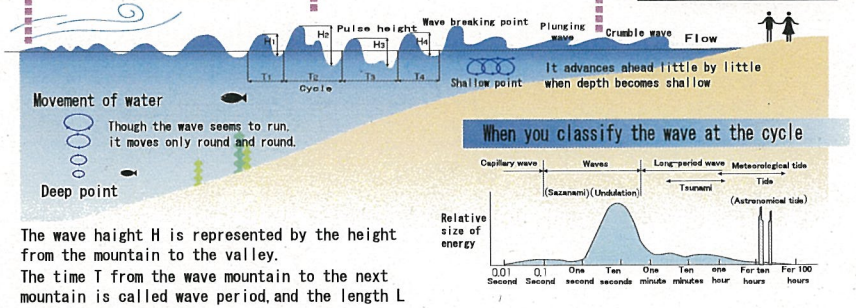
The surface of the sea is disturbed by wind, and then waves generate.

2 Growth

As for waves, their heights and periods and wave directions are inconsistent.

3 Vanishing wave

When the sea depth becomes shallower, the wave becomes higher. At a certain moment, the wave breaks, batters the shore, then the wave vanishes.



The wave haight H is represented by the height from the mountain to the valley.
The time T from the wave mountain to the next mountain is called wave period, and the length L is called wave length.
We measure a hundred of wave height or period, and usually calculate the average of the top 1/3 wave height or wave period. It is called "Significant wave," and it can be used even in the weather forecast.

Wave observation

In each port, we observe waves and a tidal level.
It is very important to grasp wave height and wave state.
We make use of this information to make a breakwater withstanding the high coastal waves of Sea of Japan in winter.

Observation facilities of wave

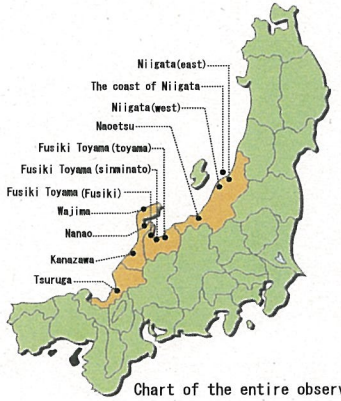


Chart of the entire observation

Flow of making model and experiment

Measure off the reproduced geography

To reproduce a complex topography of the seabed, the water tank is divided by the wooden crate.

Measure off the reproduced geography

Make the depth contour

Draw the depth contour on sand, and lay stake all out.
Then link each stake by plywood.

Make the depth contour

Cover with sand

To the height of each model, smooth the sand

Cover with sand

Cast mortar

Mortar is placed on sand by 5cm in thickness and the surface is finished up smoothly.

Cast mortar

Completion

It is completion of the model.
It takes about two months to make the model of the port.

Completion

Experiment of tranquilizing effect

We examine the most suitable placement of the harbor facilities by reproducing wave characteristic in harbor.

※This experiment is the one of the fusiki Toyama port
The model is made in the size of 1/100 on site.

Experiment of tranquilizing effect

Other experiment

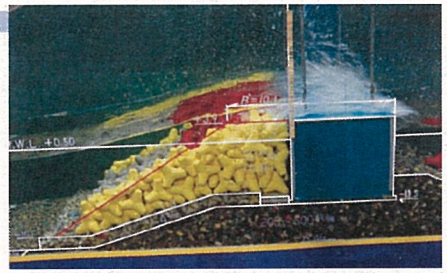
Experiment of drift sand

We investigate measures for shore erosion to observe the movement of sand by the wave in the reproduced sandy beach

The movement of sands is inspected

Stability experiment/ Experiment of overtopping waves

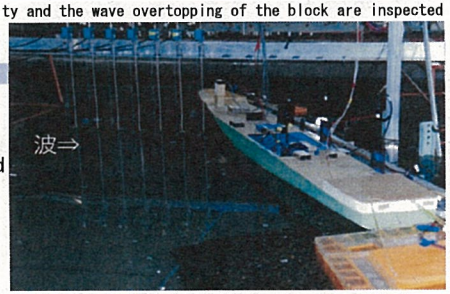
We observe and measure the movement of a breakwater and various blocks caused by waves, and inspect stability to the wave. And we observe quantity and a state of overtopping waves, and make use of it to the design.



Stability and the wave overtopping of the block are inspected

Experiment of hull behavior

In some cases, the wave getting into the port shakes the hull greatly, and disturbs the passengers getting on and off or loading and unloading



The effect of facilities against the hull behavior is verified.

Tour of hydraulic laboratory

We have laboratory tour regularly in order to notice the role of laboratory and explain the function of port government

It closely visits the installation model

It looks down at the water tank and it visits it

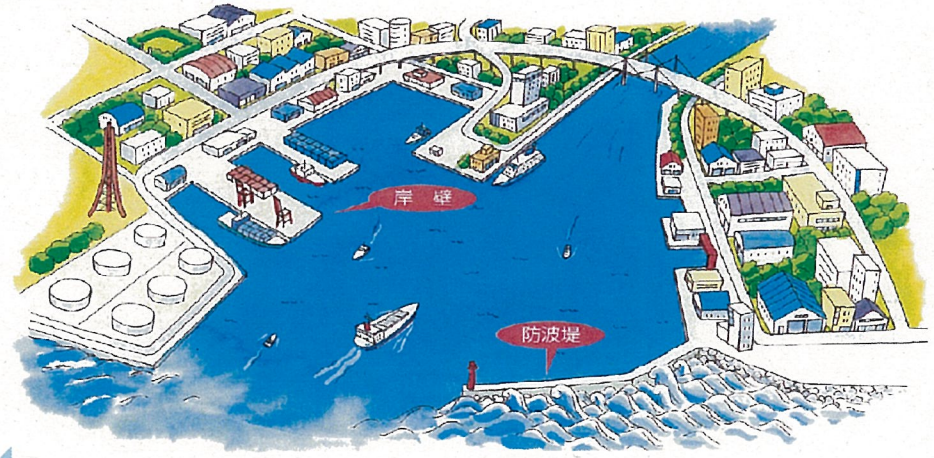
Excursion reception

Inquiries: Intelligence Section

TEL.025-222-6115

Appearance of port

In the port, there are many kinds of structures, for example breakwaters, quay, revetment



Structure of construction

Breakwater

The breakwater prevents wave damage of the port, keeps the port calmly, maintains the sea depth, and protects the harbor facilities and surrounding land.
We design the breakwater considering natural condition or utilization purpose of each site.

(fukui port)

(niigata port)

Quay

Quay is the place where we tie up ships safely, and handle cargo. It is designed by the size of ships, kind of cargo and the ground condition. Recently, we design a quay in accordance with utility form such as the quay for upsizing ships or the quakeproof enhanced quay.

(nanao port)

Revetment

Revetment is a structure to protect the reclaimed land in the port.
We design the revetment to keep the place behind a revetment where people can relax.

The revetment where people are familiar with water

(Tsuruga port)

(fusikitoyama port)