Japanese Policy on National Resilience and Disaster Prevention on Coastal Area

May 11th, 2021

International Policy Planning Office,
Ports and Harbors Bureau, MLIT

1. Lessons Learned from the Great East Japan Earthquake

Damage to Port Facilities due to the Great East Japan Earthquake

- The damage caused by the tsunami was extensive and spanned from the Tohoku to the North Kanto area. It included complete destruction or partial destruction of frontline breakwaters, collapse of coastal levees, damage due to floating debris such as rubble and containers, and other damage such as that to cargo-handling machinery.

[Arrival of the tsunami (photo taken from the Kamaishi Port office)]

Damage to frontline breakwater

- Breakwater at the mouth of Kamaishi Port

- Hachinohe Port northside breakwater

Coastal levee damage

- Ofunato Port Chayamae Area levee

Damage to cargo-handling machinery

- Sendai-Shiogama Port

- Port of Onahama

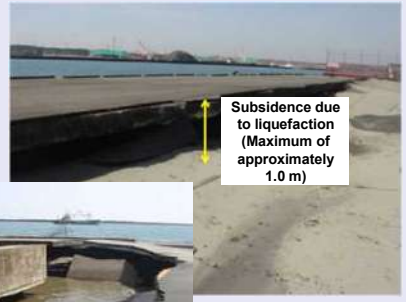
Damage due to floating debris

- Kamaishi Port

- Sendai-Shiogama Port

Damage due to liquefaction

- Ibaraki Port (Hitachi Port district)



The Importance of Marine Transportation Network Functions (the Great East Japan Earthquake)

○ At the Great East Japan Earthquake, ports facing the Sea of Japan were used to receive relief supplies in place of the ports on the Pacific Ocean side, which were heavily damaged.

Niigata Port

- Water and food were received as emergency relief supplies from South Korea at Niigata Port.

Akita Port

- Domestic ferries (chartered and regular scheduled ferries) were used to transport Self-Defense Forces' jeeps, fire department trucks and ambulances, along with personnel, vehicles and relief supplies from relevant organizations to stricken areas.

Tsuruga Port

- Existing RORO sea routes were used to receive emergency supplies (blankets, instant noodles) from South Korea to the Tsuruga Port.

○ Example of cooperation between ports during disasters
[**Fushiki-Toyama Port- Nagoya Port**]
(Basic agreement in July 2011)
- Established cooperative systems between ports at the event of a disaster, founded on the Great East Japan Earthquake.
- Mutual use of port facilities at disasters, sharing information of available quays and sea routes to realize swift transportation, etc. of relief supplies to mitigate disaster impact on local economies.

Source: Created by the Port and Harbor Bureau, Ministry of Land, Infrastructure, Transport and Tourism

Approaches Taken Toward Tsunami Prevention After the Great East Japan Earthquake

○ There are two levels of tsunamis that can be expected, as there is a need to clarify protection goals according to tsunami size and frequency of occurrence before developing preventive measures.

Tsunamis that occur more frequently

Tsunamis of a scale that occurs once every few decades or in a century or so

Largest class of tsunamis

Tsunamis of a scale that occurs once every few centuries or millennia

Disaster prevention goals

Disaster mitigation goals

Protection of human life

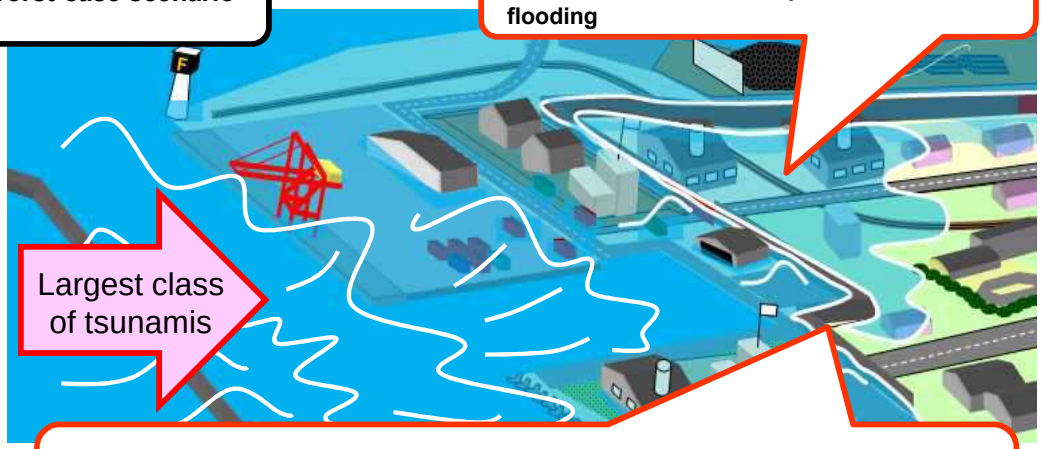
Protection of assets		Mitigation of economic losses
Maintaining important port logistic functions immediately after a disaster	In three major bays, developing firm protective standards against the largest class of tsunamis, with cost-effectiveness taken into account, are being deliberated	Swift restoration of important port logistics functions after a disaster

[Use of land]
Planned so that important port facilities are not damaged by disasters

[Evacuation plans]
Planned with the worst-case scenario in mind

[Disaster prevention facilities]
Planned to prevent inland flooding

[Use of land]
Planned under the assumption of inland flooding



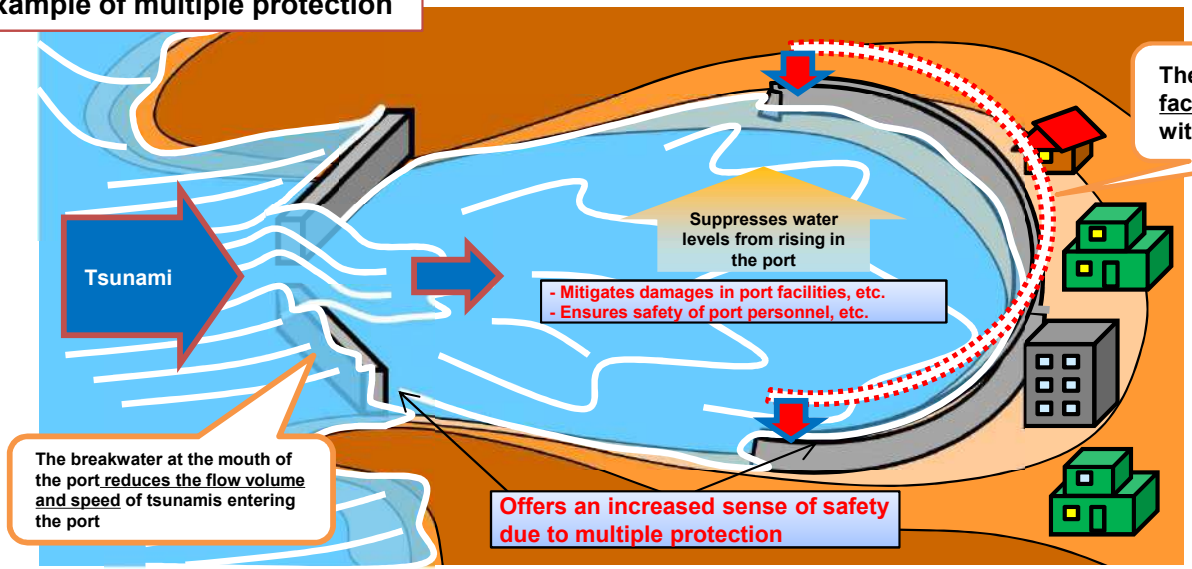
[Disaster prevention facilities]
Allows flooding inland but planned to prevent extensive damage by breaches, etc., by using multiple methods of protection as necessary.

Promotion of Multiple Protection with Breakwaters and Levees

∘ Effects of multiple protection

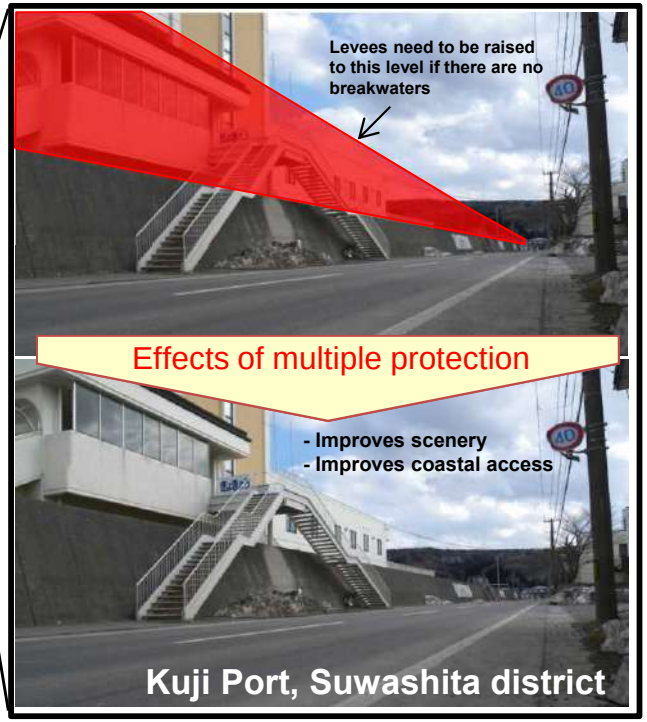
- Optimization of business costs
- Heightened safety within the port
- -Attenuation of tsunami energy
- Securing safe evacuation by delaying arrival of tsunamis, etc.
- - Improvement of scenery and use
- -Increased sense of safety due to multiple protection

Example of multiple protection

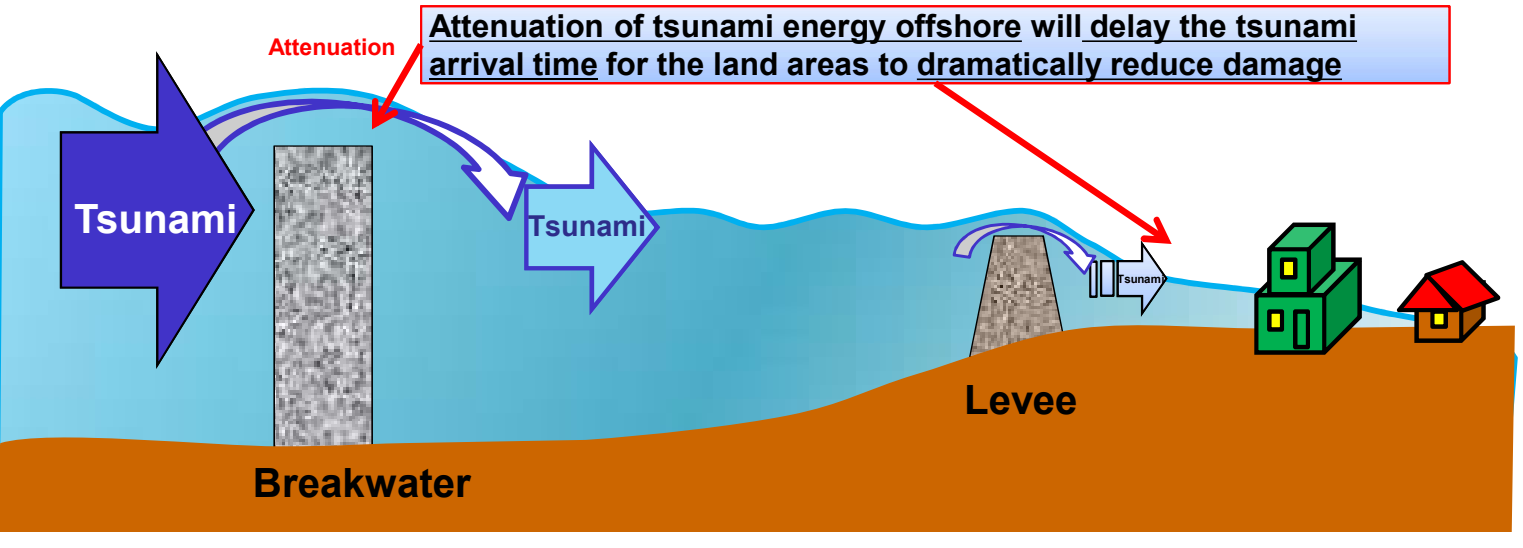


The height of levee facilities can be reduced with breakwater effects

Improves scenery and usability

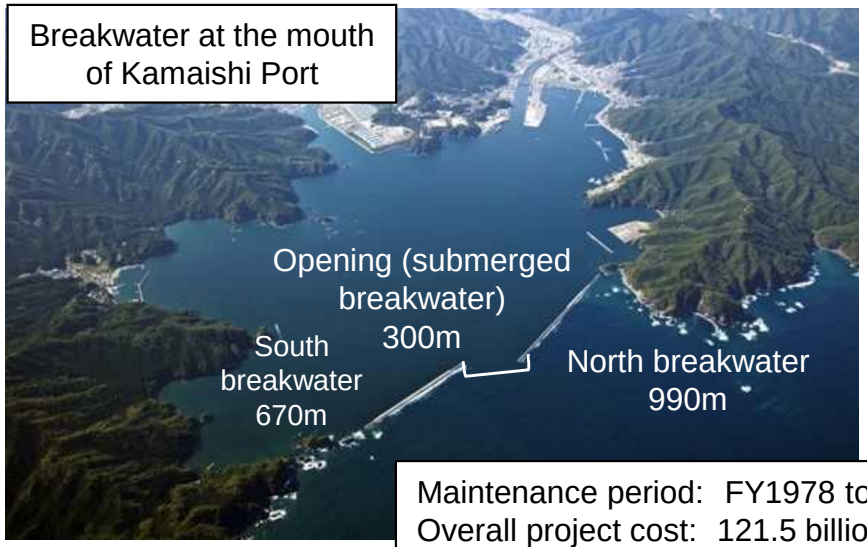


Disaster risk mitigation with multiple protection for tsunamis that exceed L1 tsunamis



Damage Mitigation Effects of Breakwaters at the Mouth of Kamaishi Port During the Great East Japan Earthquake

Breakwater at the mouth of Kamaishi Port



Maintenance period: FY1978 to FY2008
Overall project cost: 121.5 billion yen

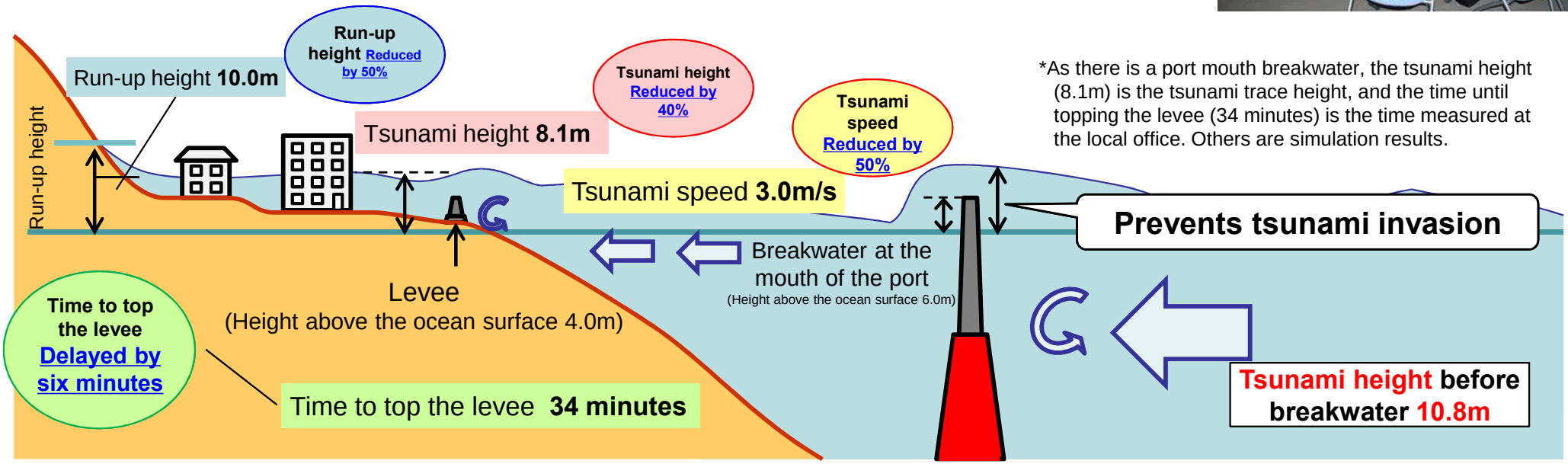
Arrival of the tsunami within Kamaishi City

March 11, 2011
Photo taken from the Kamaishi Port office

Citizens evacuating in the Kamaishi Port office

Effects of the port mouth breakwater against the tsunami

Although the city of Kamaishi suffered grave damage with the Great East Japan Earthquake, the breakwater at the mouth of Kamaishi Port was able to mitigate the damage.

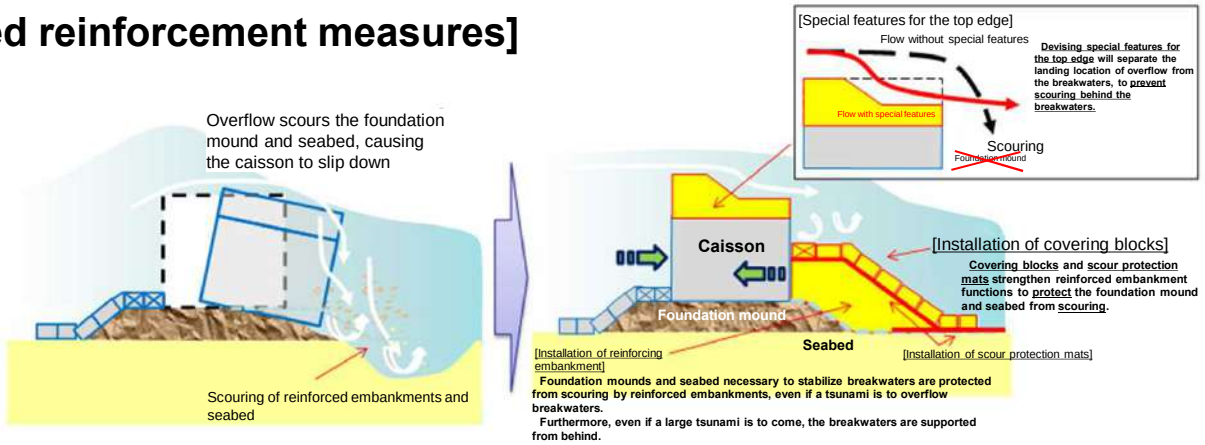


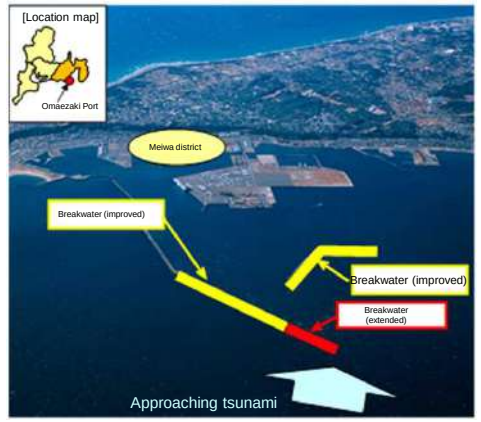
*As there is a port mouth breakwater, the tsunami height (8.1m) is the tsunami trace height, and the time until topping the levee (34 minutes) is the time measured at the local office. Others are simulation results.

Development of breakwaters with steadfast structures

∘ Breakwaters ensure calm waters and mitigates damages at disasters such as tsunamis, but they also take long periods of time to restore. There are concerns that port functions will stall due to this. For this reason, steadfast reinforcement measures to maximize facility effects are necessary.

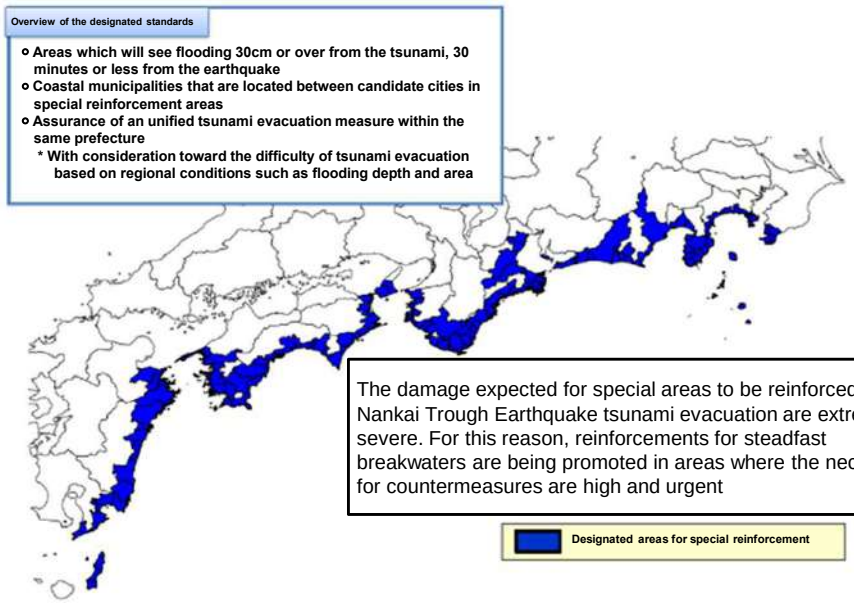
[Detailed reinforcement measures]



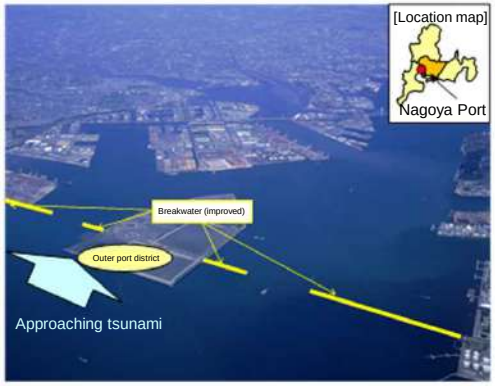


Omaezaki Port

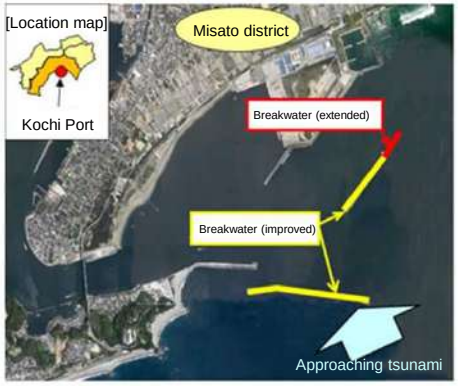
[Designation of special areas to be reinforced for the Nankai Trough Earthquake tsunami evacuation]



The damage expected for special areas to be reinforced for the Nankai Trough Earthquake tsunami evacuation are extremely severe. For this reason, reinforcements for steadfast breakwaters are being promoted in areas where the necessity for countermeasures are high and urgent



Nagoya Port



Kochi Port

Enhancement of Evacuation Measures

[Evacuation measures for ports]
- Establishing guidelines related to evacuation for port personnel and visitors
- Reviewing evacuation systems for the port such as securing evacuation facilities and conducting drills
- Enhancing information provision systems related to evacuation, using the wave measurement network

Reviews, etc. of evacuation arrangements in the port

Securing evacuation facilities

Maintenance of information versions

Conducting evacuation drills

Considerations of speakers, etc. that will communicate evacuation information

Developing guidelines related to port evacuation

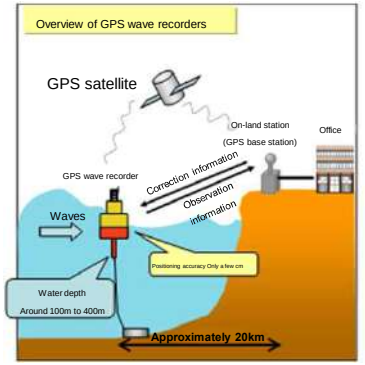
Developing guidelines to in order to deliberate overall hardware/software necessary in evacuation measures for ports

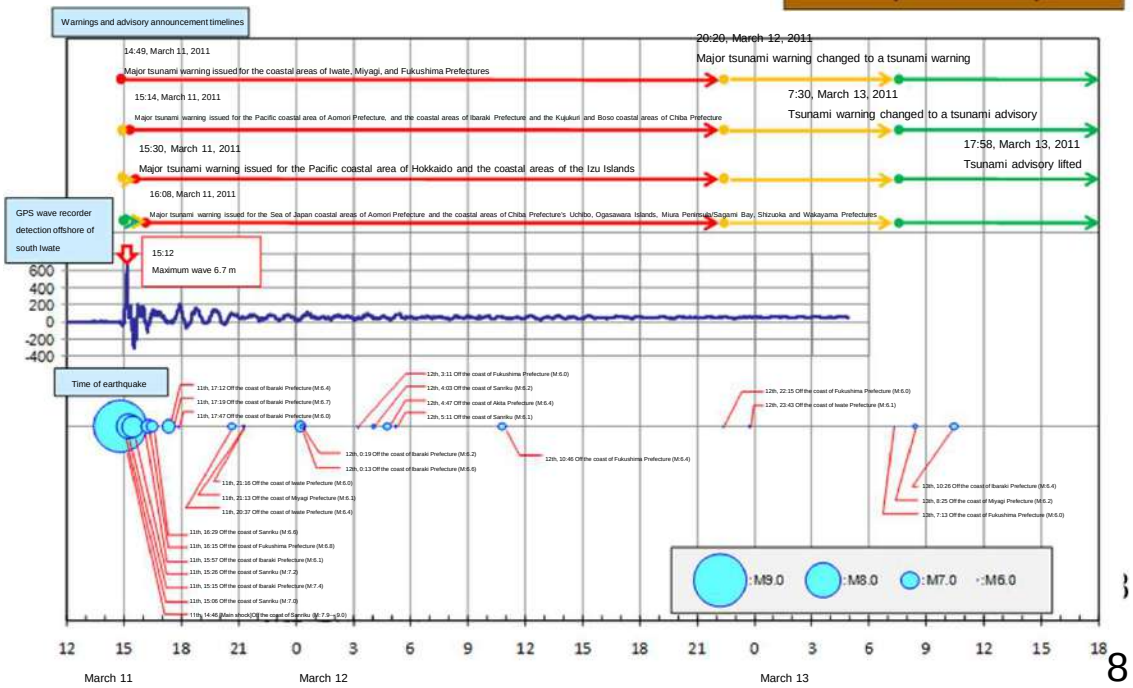
[Examples of items up for deliberation in guidelines]
- Consideration of evacuation facilities, evacuation routes, etc.
- Response measures for areas with evacuation difficulties
- Methods of communicating information
- Installation of tsunami evacuation signage
- Promoting awareness and methods of education etc.

Raising tsunami warnings with GPS wave recorders

At the Great East Japan Earthquake, multiple GPS wave recorders along the Tohoku Pacific coast detected the first tsunami wave 10 minutes before it hit the coast. The Japan Meteorological Agency saw this and raised tsunami warnings.

GPS wave recorder





Promotion of Large-scale Floodgates/Land Lock Automation and Remote Operations

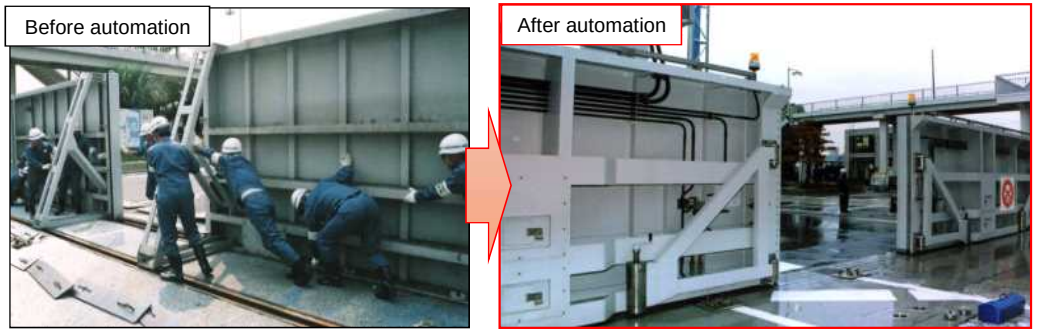
∘ It is important to ensure that elements such as floodgates and land locks are securely closed before a tsunami hits.

∘ Reorganization, constant closure, automation and remote operation of floodgates, land locks, etc. should be promoted to minimize damages.

[Example of reorganization (Wakayama-Shimotsu Port: Wakayama Prefecture)]

Land locks were eliminated, and stairs installed in adjacent areas for more convenience

[Example of land lock automation (Nagoya Port coast: Aichi Prefecture)]



[Example of constant closure (Kochi Port coast: Kochi Prefecture)]

Constant closure of land locks which are rarely used

[Establishment of a management and operation system that prioritizes the safety of the operators]

"Floodgates/Land Locks Management System Guideline for Tsunami and High Tides" was revised in April 2016 with the aim of establishing guidelines for further safety and appropriate floodgate/land lock operation and management by coastal management staff. This promotes a management and operation system that puts the safety of operators as its highest priority.

Land locks being closed by on-site operators (Osaka Prefecture)

Ensuring Transport Functions for Emergency Goods --Development of Earthquake-resistant Quays and Major Wide-area Emergency Management Bases--

- In the event of a disaster, ports function as bases for restoration by receiving emergency relief supplies to be relayed to stricken areas, among other activities.
  - It is necessary to promote the development of earthquake-resistant quays to enable reception of emergency relief supplies during disasters.
- Major wide-area emergency management bases are to be established and operated by the government in the event of a widespread disaster.

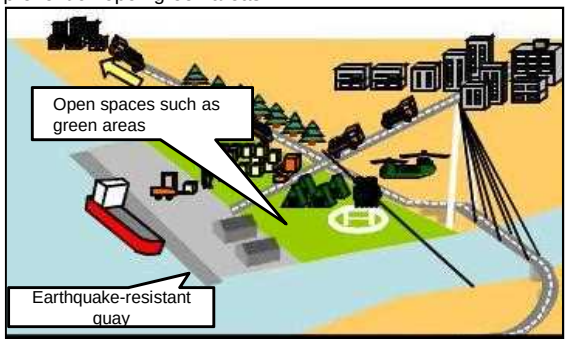
Promotion of the establishment of emergency management bases in coastal areas

- Promotion of emergency management bases with ports at their cores, based on regional disaster plans.
- Development of earthquake-resistant quays to enable these ports to receive emergency relief supplies as emergency management bases in the event of a disaster.

Reinforcing operation systems of major wide-area emergency management bases

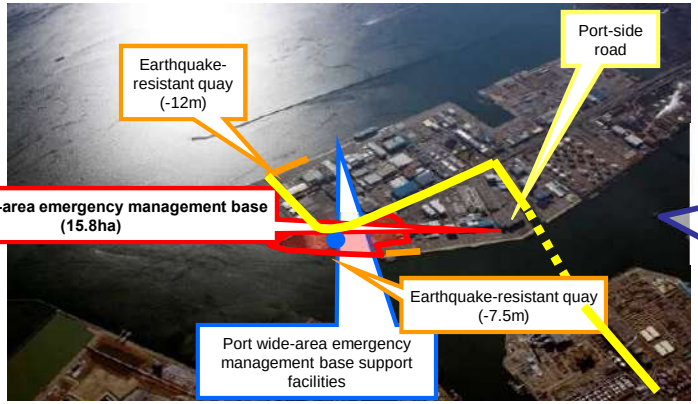
- Creation of major wide-area emergency management bases in the Tokyo metropolitan area and Keihanshin area, to act as base camps for wide-area support units and relay bases to transport emergency relief supplies in the event of a major disaster which affects multiple prefectures
- To be used as green areas open to citizens during normal conditions, but to be operated by the government during disasters
- Relevant organizations are to cooperate and conduct drills for emergency relief supplies, etc. to reinforce operational systems in the event of a disaster

∘ Emergency management bases with space for wharfs integrated with earthquake-resistant quays and disaster prevention open green areas



Utilization of earthquake-resistant quays in the Great East Japan Earthquake

Use of “Miura”, the patrol vessel for the Japan Coast Guard (March 19, 2011)



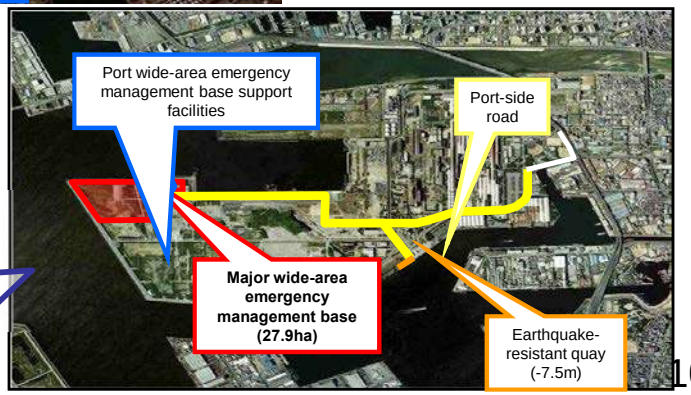
<Port of Kawasaki, Higashi-Ogishima district>

Opened for common use on April 26, 2008

∘ Damage to an earthquake-resistant quay and a standard quay at the Great East Japan Earthquake (at the Port of Onahama)

<Port of Sakai-Semboku, Second District>

Opened for common use on April 1, 2012

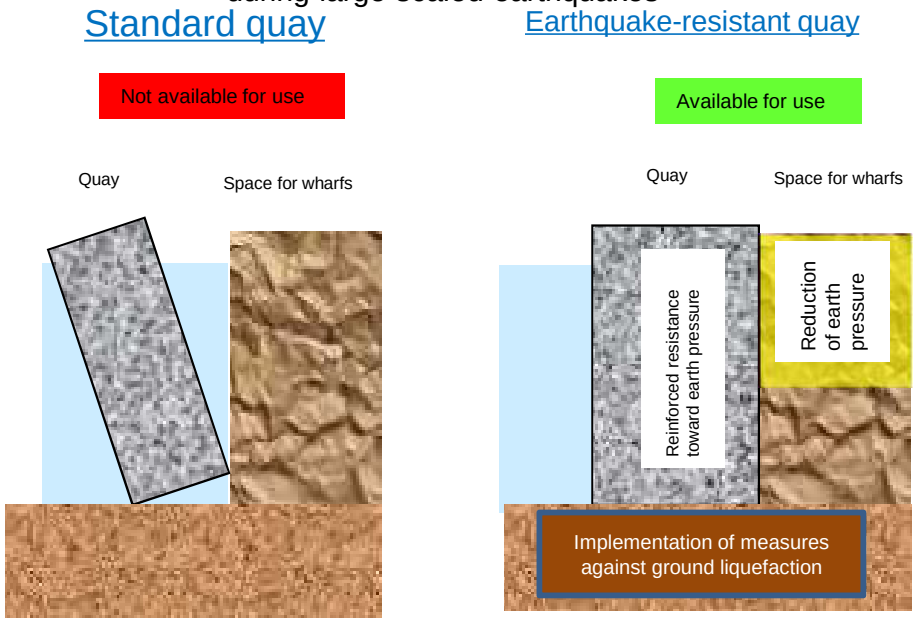


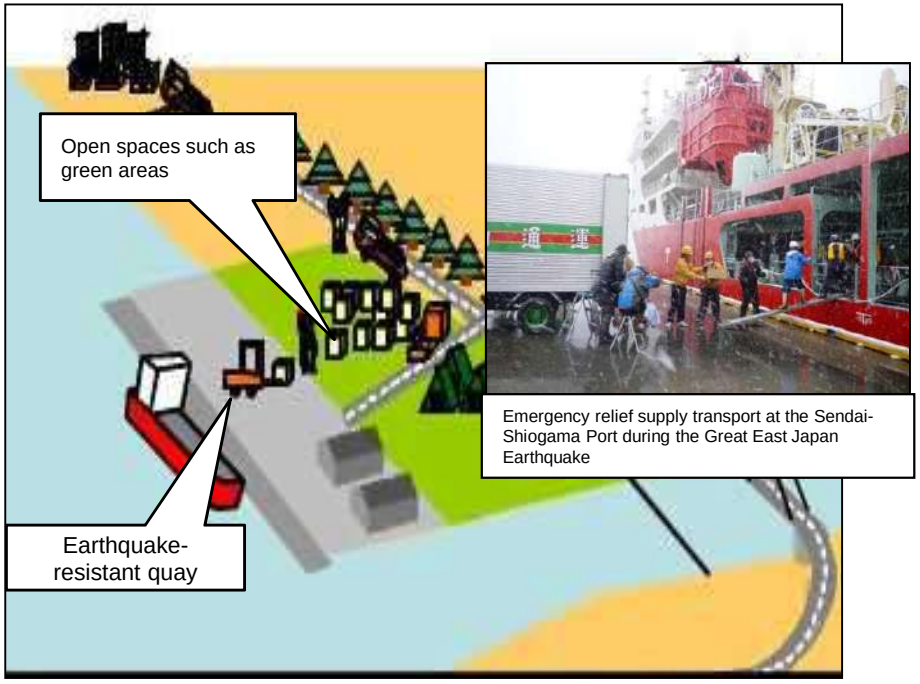
Overview of earthquake-resistant quays

About Earthquake-resistant Quays

- Earthquake-resistant quays are mooring facilities that have reinforced strength toward earthquakes when compared to standard quays, to ensure the transport of emergency relief supplies immediately after disasters and ensure economic activities in the event of a large-scaled earthquake.
- Earthquake-resistant quays are integrated with open spaces such as green areas behind them, to function as emergency management bases including base camp for support units and for the handling/temporary storage of emergency supplies.

Behavior of standard quays and earthquake-resistant quays during large-scaled earthquakes





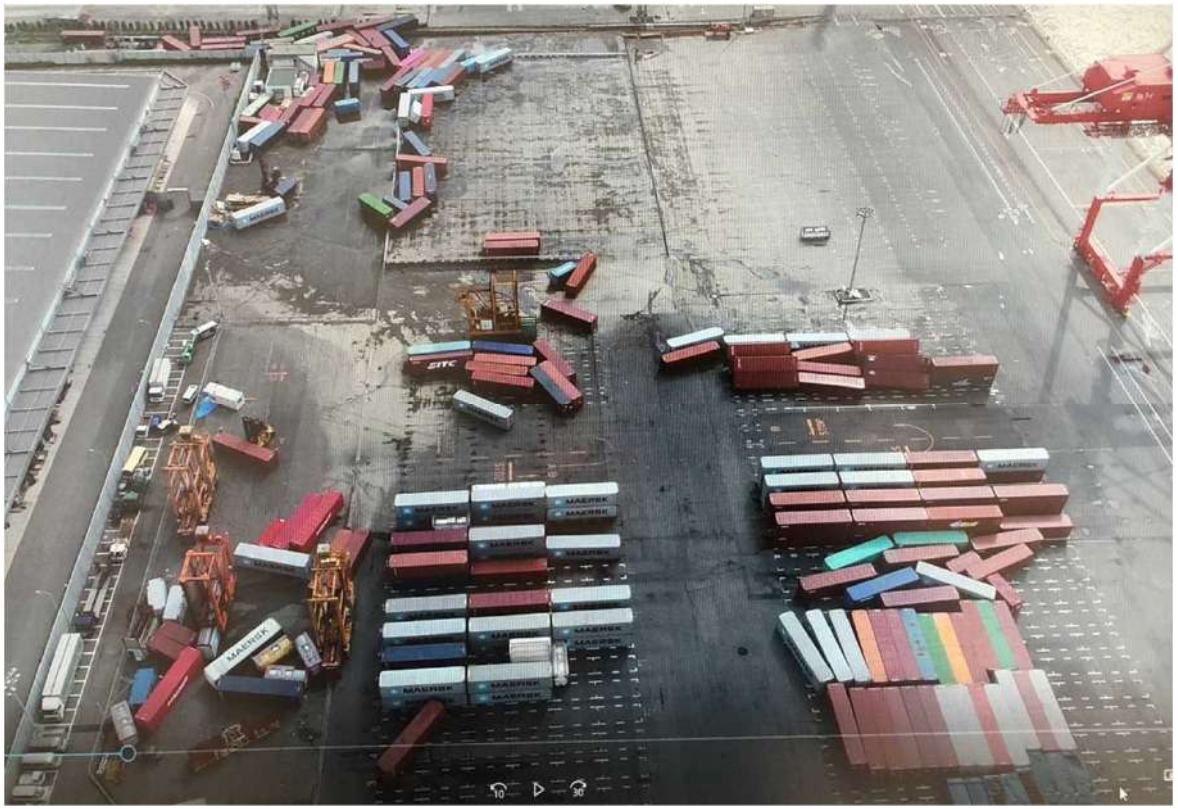
Emergency relief supply transport at the Sendai-Shiogama Port during the Great East Japan Earthquake

2. Response to the Increasing Frequency and Severity of Typhoon Damage

Damage in Ports due to Typhoon No.21 in 2018

Collapsing/Drifting Containers

- Severe typhoon winds caused stacked containers within yards to collapse.
- Due to flooding, etc. by high tide and waves, empty containers in Kobe Port and Osaka Port spilled out to sea routes and mooring basins. Port functions stopped for two days at Kobe Port and three days at Osaka Port until the safety of ships navigating these waters could be confirmed.
- Vehicles necessary to handle cargo, such as trailer heads within the terminal, became inoperable, delaying the reopening of the terminal.



Kobe Port Rokko Island

Container Fires

- Flooding at the Kobe Port Rokko Island container terminal caused magnesium within containers to ignite. It took approximately 50 days to extinguish these fires, forcing the terminal to close during this period.

Ship Collision to the KIX Int'l airport bridge

KIX Int'l Airport

Mainland

KIX Int'l Airport

Response to the Increasing Frequency and Severity of Typhoon Damage

Ensuring safety of facilities against waves and other elements

◆ Performance of wave resistance, etc. have been reviewed for design offshore waves updated with the latest scientific findings, and facilities with higher importance and urgency have been elevated and reinforced.

Image of reviews

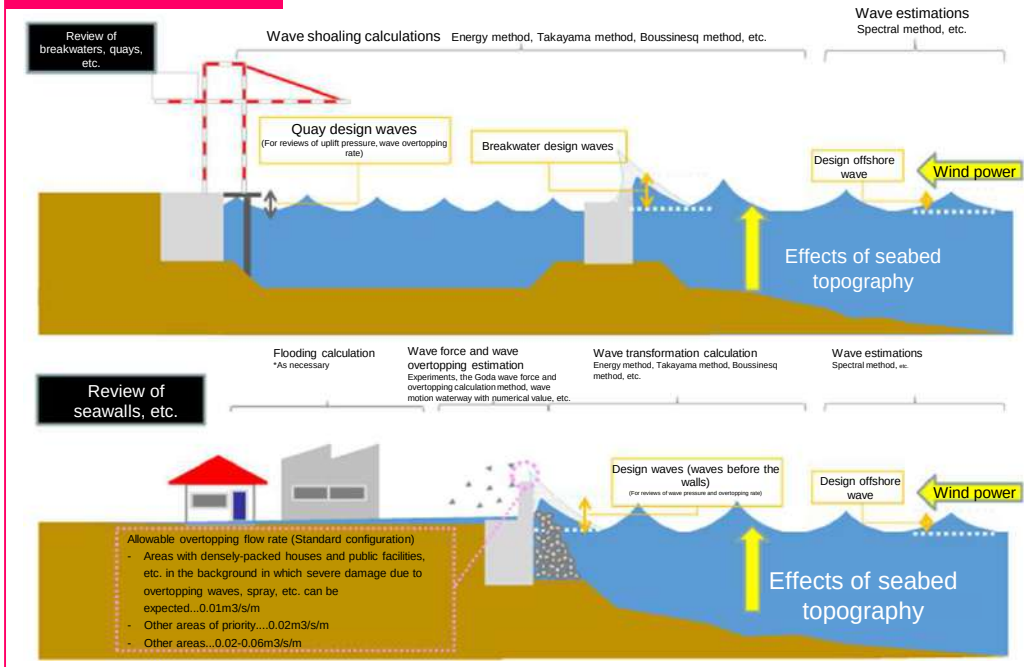
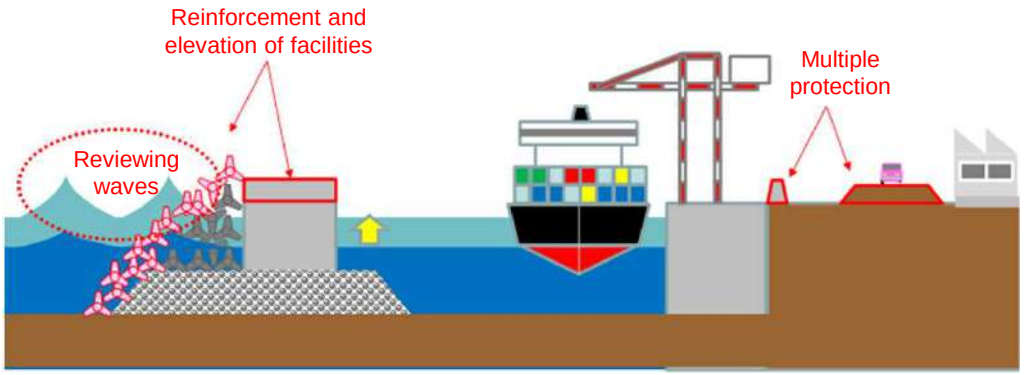


Image of countermeasures



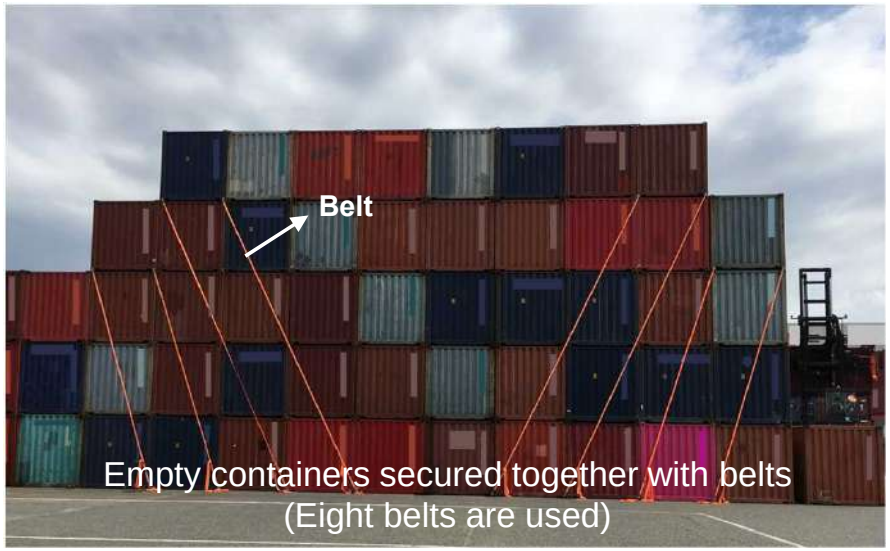
Measures for dredging anchors

◆ Protective facilities should be installed to mitigate damage in the event of vessel collision.

Example of a measure taken to mitigate collision damage (pile-type collision prevention construction)

Measures to prevent scattering of containers

◆ Technical deliberations should be continued along with sharing good practices for measures to prevent containers from scattering.



Empty containers secured together with belts (Eight belts are used)

3. Promotion of Disaster Prevention/Mitigation and Reinforcement of Land

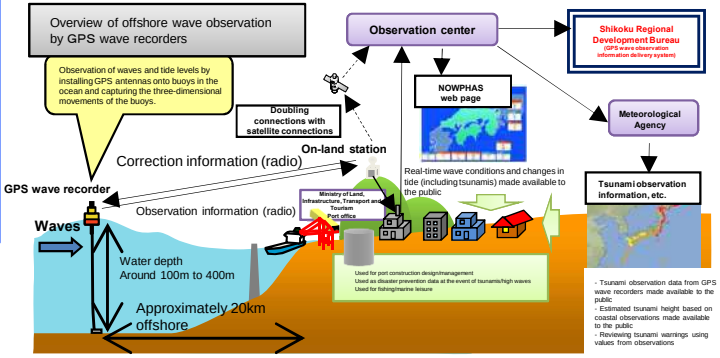
Promotion of Port Disaster Prevention/Mitigation and Reinforcement of Land for Large-scaled Disasters

○ Promotion of port disaster prevention/mitigation and measures to reinforce land with the full mobilization of software and hardware, to prepare for disasters due to large-scaled earthquakes, tsunamis, high tide and waves, etc., caused by the factors such as the Nankai Trough Earthquake and large-scaled typhoons.

Protecting ports and hinterlands

■ Clarifying port disaster risks

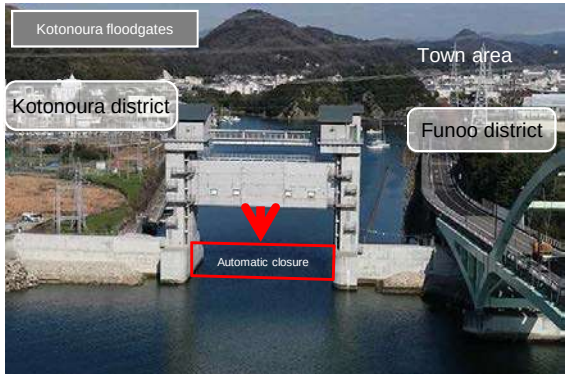
Indicate ground height on port plans, etc. to clarify flooding risks due to high tide, etc. for waterside lands. Provide real-time information on waves and wind speed.



Example of real time information delivery by GPS wave recorders

■ Promotion of reorganization, automation, etc. of elements such as flood gates and land locks

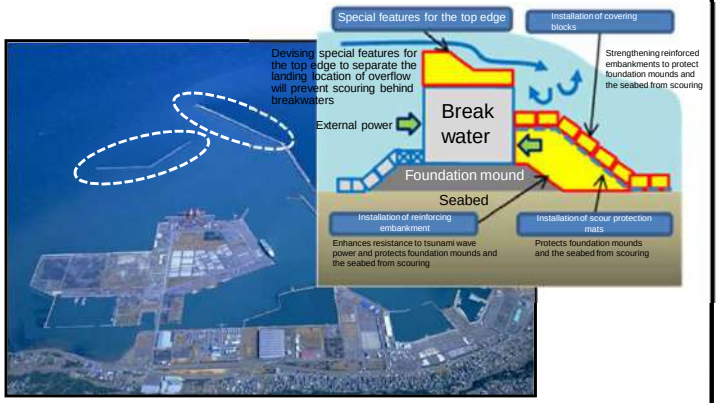
Reduce the number of facilities needing management through reorganization/constant closure, and promote automation/remote operation for the other facilities as well to ensure safe and reliable closure of flood gates and other facilities in the event of a tsunami.



Kotonoura floodgates (Wakayama-Shimotsu Port)

■ Incorporation of "steadfast structures" for breakwaters and levees

Strengthening structures to be steadfast in order to mitigate damages by securing evacuation times and reducing the scope of flooding, even in the event a large-scaled tsunami overflows embankments.



Breakwaters with steadfast structures (Omaezaki Port)

Maintaining marine transport networks

■ Establishing Port BCP (Business continuity plan for ports)

Clarify port BCP, including disaster response and implementation systems for port staff, and reinforce effectiveness through drills, etc. to maintain port functions and attempt a swift recovery after a disaster strikes.

Integrated emergency response drill for large-scaled tsunamis (drills to draw up marine transportation routes)

■ Reinforcing national systems to secure marine networks

Reinforcing national systems such as the management of major wide-area emergency management bases, drawing marine transportation routes to secure emergency routes, and alternative management of port facilities, etc.

Major wide-area emergency management bases (image)

■ Promoting the development of earthquake-resistant quays, etc.

Promoting the development of earthquake-resistant quays and port-side roads, etc. to secure the transportation of emergency supplies and mainline logistics functions after a large-scaled earthquake.

Earthquake-resistant quay(Port of Onahama)