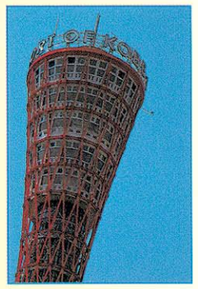


**The Earthquake Disaster Restoration Headquarters,
The Third Port Construction Bureau,
Ministry of Transport**

7-30 Onohama, Chuo-ku, Kobe 651 JAPAN
Telephone 81-78-331-6701, Fax 81-78-331-6332

REBIRTH

Building Stronger and More Resilient Ports in the Aftermath of the Great Hanshin-Awaji Earthquake

**The Earthquake Disaster Restoration Headquarters,
The Third Port Construction Bureau,
Ministry of Transpor**

The 1995 Southern Hyogo Earthquake (The Great Hanshin-Awaji Earthquake) that occurred at 5:46 a.m. on January 17, 1995 caused tremendous damage to the Osaka and Kobe areas of Honshu and to the island of Awaji. The Port of Kobe, which handled more container cargo business than any other port in Japan, suffered a devastating blow. Nearly all of the loading sites and the large quays sustained significant damage. Quay walls sank, yards were submerged, unloading facilities were shattered and quay sheds and warehouses collapsed. As a result, port facilities in the Port of Kobe were paralyzed and both domestic and international cargo handling operations were seriously affected.

●Mooring facilities

Gravity type quay walls were thrust forward (1 - 5m) and their crest height was lowered (1- 2.5m). At the Shinko and Hyogo piers, the pier ends collapsed and sank beneath the water. At the Maya Wharf, however, only very minor damage was done to the quay walls that had been designed to have increased resistance to earthquakes.

●Unloading facilities

All of the fixed jib cranes and movable gantry cranes were damaged. Gantry cranes went off their tracks and splintered due to the displacement of the quay wall face line. Mooring equipment, rails and other facilities were also damaged.

●Port traffic facilities

At the Harbor Highway and the Kobe and Maya Bridges, girders fell and bridge piers buckled, split, were sheared or collapsed. Roads on the offshore man-made islands, Port Island and Rokko Island, suffered liquefaction, splitting and other damage. On the automated Port Liner and Rokko Liner train lines, girders fell and bridge piers and station buildings were damaged.

●Breakwaters

Breakwaters suffered comparatively minor face line displacement, but the crest height sank by 1 - 2.5 meters, reducing the effectiveness of the breakwaters considerably.

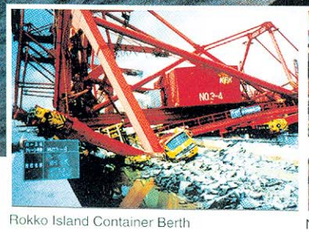
●Railways and expressways

The Kobe municipal subway system suffered damage to elevated bridges and to the central pillars in the tunnel. On the JR West Japan, Hanshin, Hankyu, Kobe Kosoku, Kobe Dentetsu and Sanyo railways, service was brought to a halt as station buildings were damaged and elevated bridges suffered fallen girders and other damage. One entire section of the Hanshin Expressway toppled over in spectacular fashion and the expressway also suffered fallen bridge girders and other damage.

●Other ports

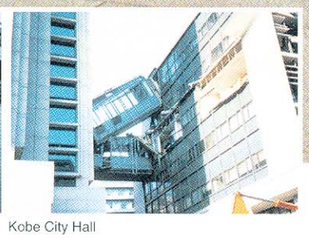
Sea walls were damaged at the Port of Amagasaki-Nishinomiya-Ashiya to the east and the Naruo region. The No. 1 Amagasaki Lock Gate was damaged and sank and the training jetty sank as well. The capping concrete on the new No. 2 Lock Gate was damaged and sank and the back filling sank. Face line displacement was also caused at the breakwater in the Tsurumachi region.

* Before the earthquake, there were 239 large quay berths, of which 186 were public berths, namely owned. Of the 186 public berths, 168 were for cargo handling (including 21 container berths) and 18 were for passenger ships. Prio[illegible] there were [illegible] shipping routes in the Port of Kobe.


Rokko Island Container Berth


Naka-tottei Pier


Port Island -4 meter loading site


Kobe City Hall


Amagasaki Lock


Warehouse at Shinko No. 8 Pier


Rokko Liner


Hanshin Expressway

Total Damage Caused by the Great Hanshin-Awaji Earthquake (1995)

Damage

(as of February 15, 1995)

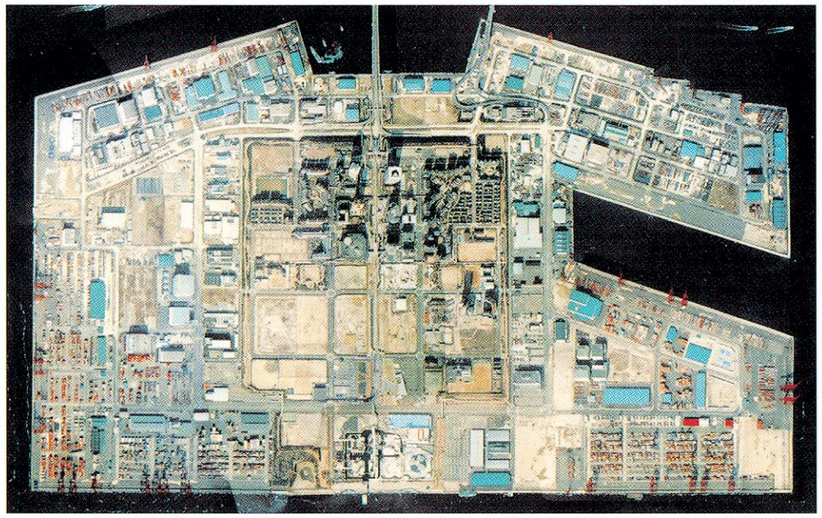
	Item	Sum	Description
1	Buildings	5.8 trillion yen	Collapsed buildings, buildings damaged beyond repair, etc. (estimated using the unit cost for construction found in statistics on buildings under construction)
2	Railways	343.9 billion yen	JR West Japan, Hankyu Railway, Hanshin Railway, Kobe Dentetsu, Sanyo Railway and other lines
3	Highways	600 billion yen	Hanshin Expressway, Chugoku Expressway, Meishin Expressway, etc.
4	Public works facilities (excluding highways)	313.8 billion yen	Roads: 109.9 billion yen Rivers: 26.3 billion yen Coastal facilities: 600 million yen Erosion control: 800 million yen Sewers: 106.2 billion yen City streets: 4 billion yen Parks: 13.4 billion yen Projects under the direct supervision of the national government: 52.6 billion yen
5	Ports	1.04 trillion yen	Port of Kobe-Amagasaki-Nishinomiya-Ashiya, etc. Public facilities: 800 billion yen Private facilities: 240 billion yen
6	Reclaimed land	6.4 billion yen	Sano and Shizuki areas: 700 million yen Minami-ashiyahama and Ashiyahama areas: 4 billion yen Nishinomiya and Koshien areas: 1.7 billion yen.
7	Educational institutions	322.8 billion yen	Prefectural schools: 14.1 billion yen Municipal schools: 170.5 billion yen Continuing education facilities: 32.6 billion yen Physical education facilities: 20.6 billion yen Cultural artifacts: 9.7 billion yen Prefectural universities: 300 million yen Private schools: 21.5 billion yen National universities: 9.1 billion yen Private colleges: 37.9 billion yen Cultural facilities (public halls, etc.) 6.5 billion yen
8	Agriculture, forestry and fisheries	111.7 billion yen	Farmland, reservoirs, etc.: 22.4 billion yen Forest conservation and flood control facilities: 8.2 billion yen Fishing ports: 19.9 billion yen Farming facilities, etc.: 10.5 billion yen Marine products facilities: 3.6 billion yen Forestry equipment: 1.5 billion yen Wholesale markets: 24.5 billion yen Food product facilities: 21.1 billion yen
9	Medical and social welfare institutions	168.9 billion yen	Hospitals: 63.4 billion yen Clinics: 26.7 billion yen Testing and research institutions: 900 million yen Nursing schools: 1.9 billion yen Crematoriums: 1.1 billion yen Health centers, etc.: 2.7 billion yen Welfare facilities: 40 billion yen Co-ops: 32.2 billion yen (excluding medical treatment)
10	Waste and sewage treatment facilities	4.1 billion yen	
11	Water supply facilities	56.1 billion yen	Waterworks: 51.3 billion yen Water facilities for industrial use: 4.8 billion yen
12	Gas and electrical facilities	420 billion yen	Gas: 190 billion yen Electricity: 230 billion yen
13	Telecommunications and broadcasting facilities	70.2 billion yen	Electrical communications facilities: 48.4 billion yen (of which NTT accounts for 30 billion yen) Broadcast facilities: 3.5 billion yen Cable TV: 17.5 billion yen Hyogo satellite broadcasts 800 million yen
14	Commercial and industrial facilities	630 billion yen	Machinery, equipment and other facilities: 630 billion yen (not including 1.77trillion in buildings)
15	Other public facilities	75.1 billion yen	Prefectural government offices, etc.: 13.6 billion yen Municipal offices, etc.: 51.5 billion yen Police departments, etc.: 10 billion yen
	TOTAL	9.963 trillion yen	

* From "One Month in the Life of Hyogo Prefecture:The Great Hanshin-Awaji Earthquake" published by The Great Hanshin-Awaji Earthquake Disaster Prefectural Restoration Headquarters (1995)

Damage to Port Facilities (Port of Kobe, etc.)

			Ports Administered by Hyogo Prefecture	Port of Kobe	Total
Public Facilities	Public port facilities		27.1billion yen	652.3billion yen	679.4billion yen
	Wharf ground improvement works, etc.		2.2billion yen	97.1billion yen	99.3billion yen
	Itemized costs	Wharf ground improvement works (wharf land rental) (unloading machinery/ warehouses)	400 million yen 1.1billion yen	26.3billion yen 67.3billion yen	
		Port facility works for particular uses	600million yen		
		Port environment improvement works	100million yen	3.5billion yen	
	Sub-total		29.3billion yen	749.4billion yen	778.7billion yen ＝(800billion yen)
Private Facilities	Private facilities (Kobe Steel, etc.)				240billion yen
TOTAL			**1.04 trillion yen**		

* Ports in Hyogo Prefecture that suffered earthquake damage : Port of Amagasaki-Nishinomiya-Ashiya, Port of Higashi-Harima, Port of Akashi, Port of Eigashima, Awaji area (11 ports in addition to the Port of Iwaya)



Rokko Island just after the earthquake

Plans for the Restoration of the Port of Kobe

Restoration and reconstruction efforts at the Port of Kobe have focused on enabling the port to better withstand future disasters as well as enhancing its capabilities as a central international port to enable it to accommodate the expansion of international contacts anticipated in the 21st century.
The Great Hanshin-Awaji Earthquake which occurred in 1995 dealt a devastating blow to the Port of Kobe, which had handled more container cargo than any other port in Japan. Intense concern and anticipation has focused on projects to restore and rebuild the port both at home and abroad.
On February 10, 1995, the Ports and Harbors Bureau of the Ministry of Transport created the "Preliminary and Basic Policy for Reconstruction of the Port of Kobe Damaged by the 1995 Great Hanshin-Awaji Earthquake." This is the basic plan for the reconstruction of the Port of Kobe. Subsequently the city of Kobe approved the "Plan for the Restoration of the Port of Kobe" and Hyogo Prefecture approved the "Plan for the Restoration of Ports in Hyogo Prefecture."

Basic Objectives of the Ministry of Transport

Preliminary and Basic Policy for Reconstruction of the Port of Kobe Damaged by the 1995 Great Hanshin-Awaji Earthquake

1. Rapid restoration of port functions

- Effect a rapid recovery of port functions through quick restoration and rapid construction of temporary use facilities
- Rebuild permanent use facilities in stages
- Complete restoration of port functions within approximately 2 years
- Restore primary breakwaters and coastal conservation facilities before the beginning of the typhoon season

2. Making port facilities better able to withstand earthquakes

- Make facilities more earthquake-resistant in line with their importance (increasing the design seismic coefficient)
- Vary the type of structures (combining structural types with different seismic responses)
- Diversify access routes to man-made islands by using structures with different seismic responses
- Distribute high earthquake resistance quay walls while taking into account the direction in which they are facing

3. Coordination of activities with recovery efforts in urban areas

- Use rubble in landfills to help streamline efforts to rebuild urban areas
- Create new city centers in coordination with the port functions of unused land areas bordering the port

4. Restoration of the port as a center for international trade

- Redevelop the second phase of Port Island and the Wakihama area
- Redevelop existing outdated facilities
- Build high-grade container terminals and provide multipurpose berths

Basic Objectives of the City of Kobe

Plan for the Restoration of the Port of Kobe

1. Effect a total recovery of port functions within approximately 2 years (short-term recovery plan)

2. Create a new port for the 21st century that has recovered completely from the effects of the earthquake based on the Port Plan for the Port of Kobe (long-term recovery plan),(target date : approximately 2005)

- A port that will be the center of trade in Asia in the 21st century, one that has recovered completely from the earthquake
- A port that will help restore industry in Kobe
- A port that will help restore the appeal of Kobe

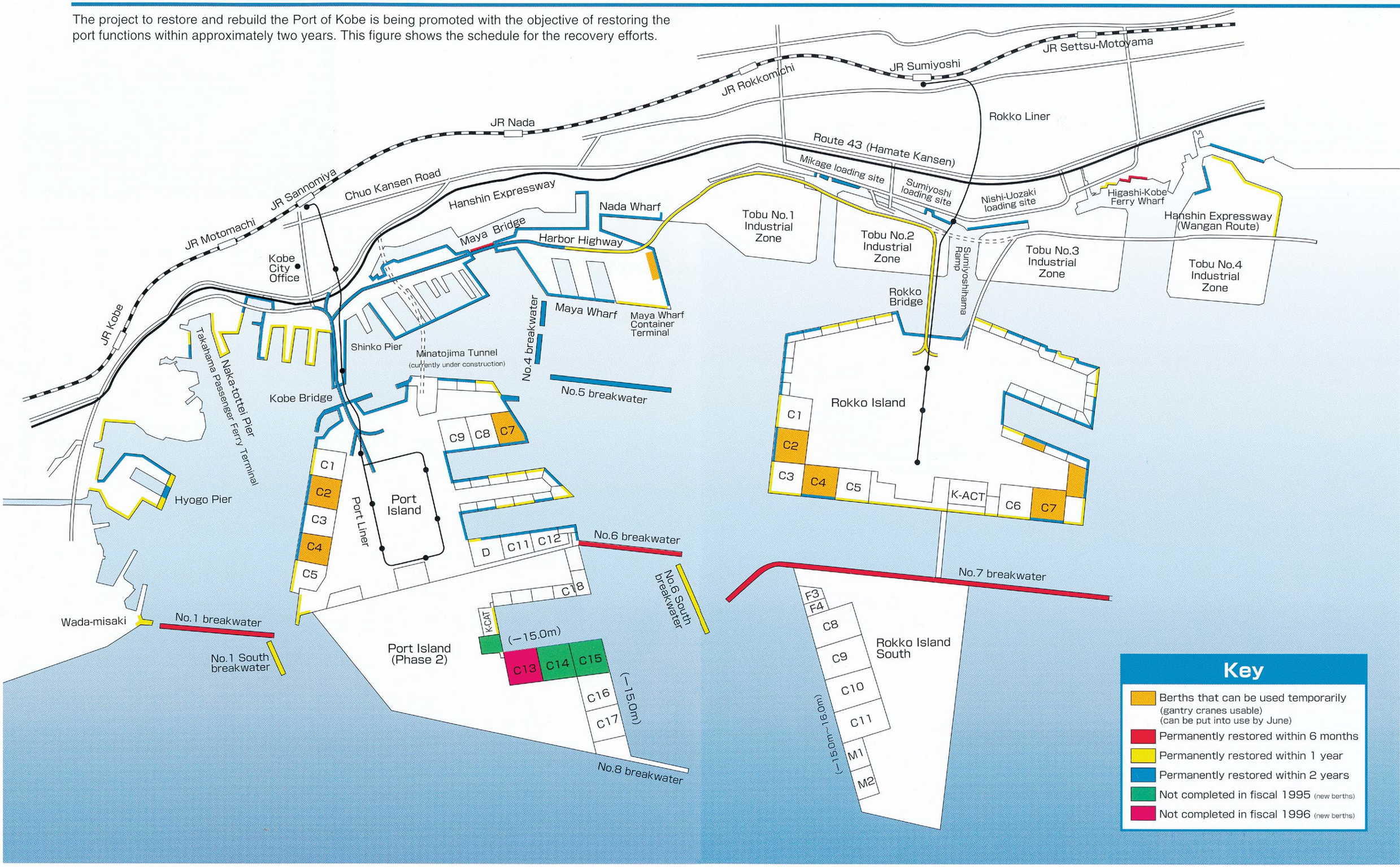
3. Establish an order of priority for restoration and plan for a rapid recovery based on improving crucial points

4. Create a port capable of withstanding disasters in order to improve the disaster mitigation of the city as a whole

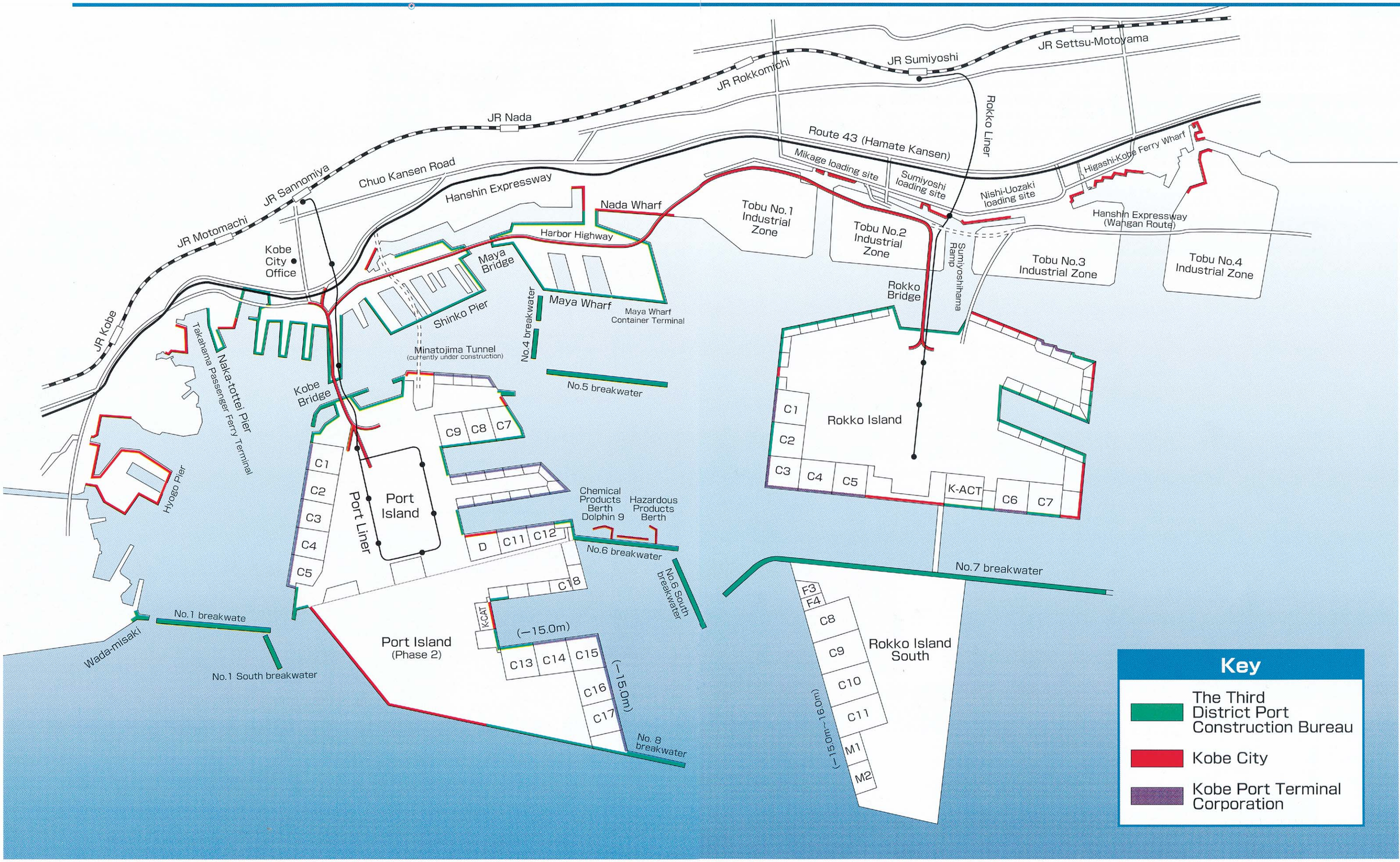
5. Establish a plan for port recovery that helps the urban areas recover as well

Recovery Schedule for Each of the Facilities

The project to restore and rebuild the Port of Kobe is being promoted with the objective of restoring the port functions within approximately two years. This figure shows the schedule for the recovery efforts.

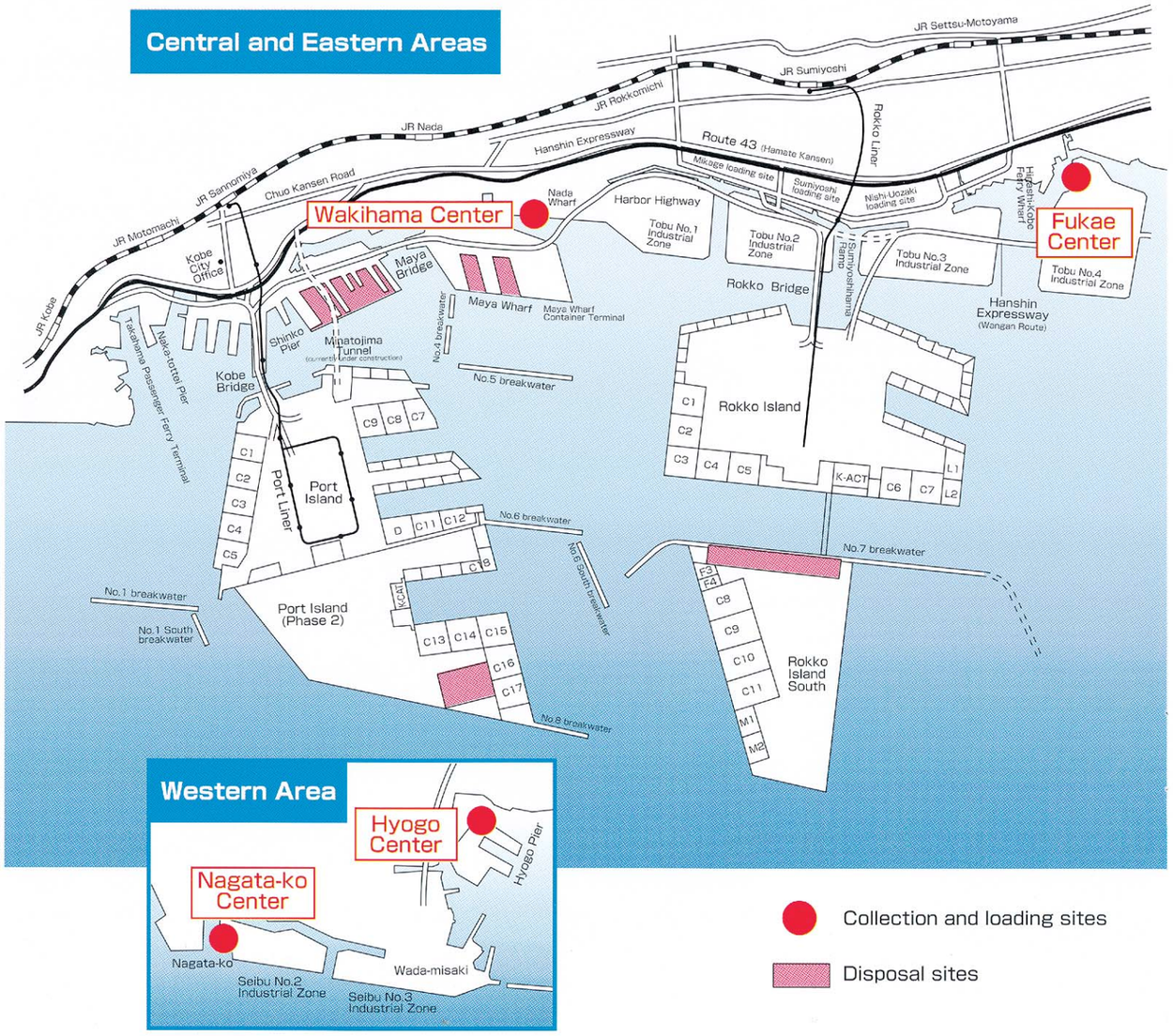


Restoring Organizations



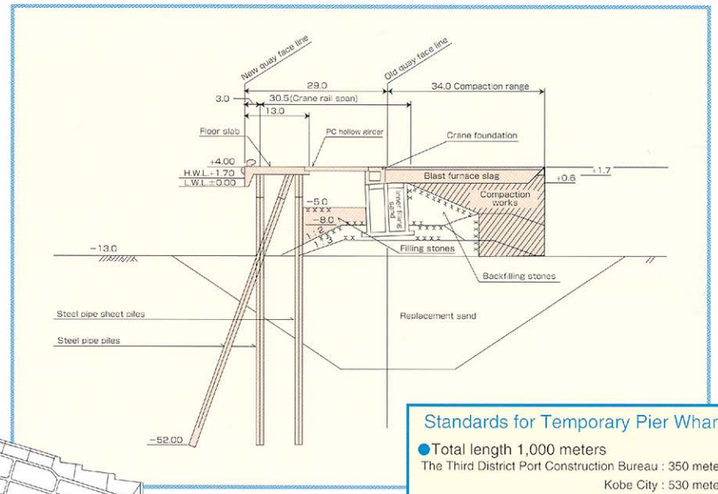
Earthquake Rubble Disposal Sites *(soil disposal sites)*

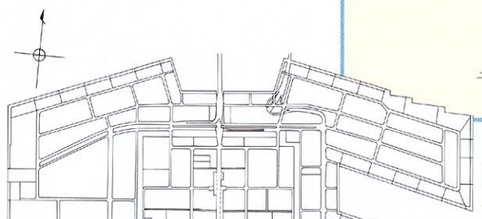
Shinko Pier (between No. 5 and No. 8 piers), Maya Pier and other existing finger piers were severely damaged by the earthquake. As the facilities were showing signs of age and had become outdated, they will not be restored to the same status as before; the port facilities will be restored in line with a redevelopment plan to give added functionality to the wharves. In implementing the restoration work, the enormous amounts of rubble from the earthquake will be used in landfills to streamline the restoration of city areas which sustained such tremendous damage. Parts of the Rokko Island South just south of the No. 7 breakwater will also be used as a disposal site for rubble.



Building Emergency *(Temporary)* Container Pier Wharves

The Rokko Island Emergency (Temporary) Container Wharves were constructed on The South-east side of Rokko Island in line with the emergency measures proposed by the Hanshin-Awaji Reconstruction Committee, an advisory body to the Prime Minister. These wharves were constructed as temporary substitutes for the container terminal now being rebuilt, as it had been predicted that complete restoration of the port would take about two years. In order to shorten the period of time required for construction, a pier structure construction was used. In this method, steel pipe pilings were laid in front of the existing caissons and filling stones were placed in the gaps in between to stabilize the existing caissons. Precast blocks were placed on the top of the pier and these were connected with PC hollow girders. Soil improvement was done to prevent liquefaction behind the caisson, and blast furnace slag was used for the surface layer to reduce earth pressure.



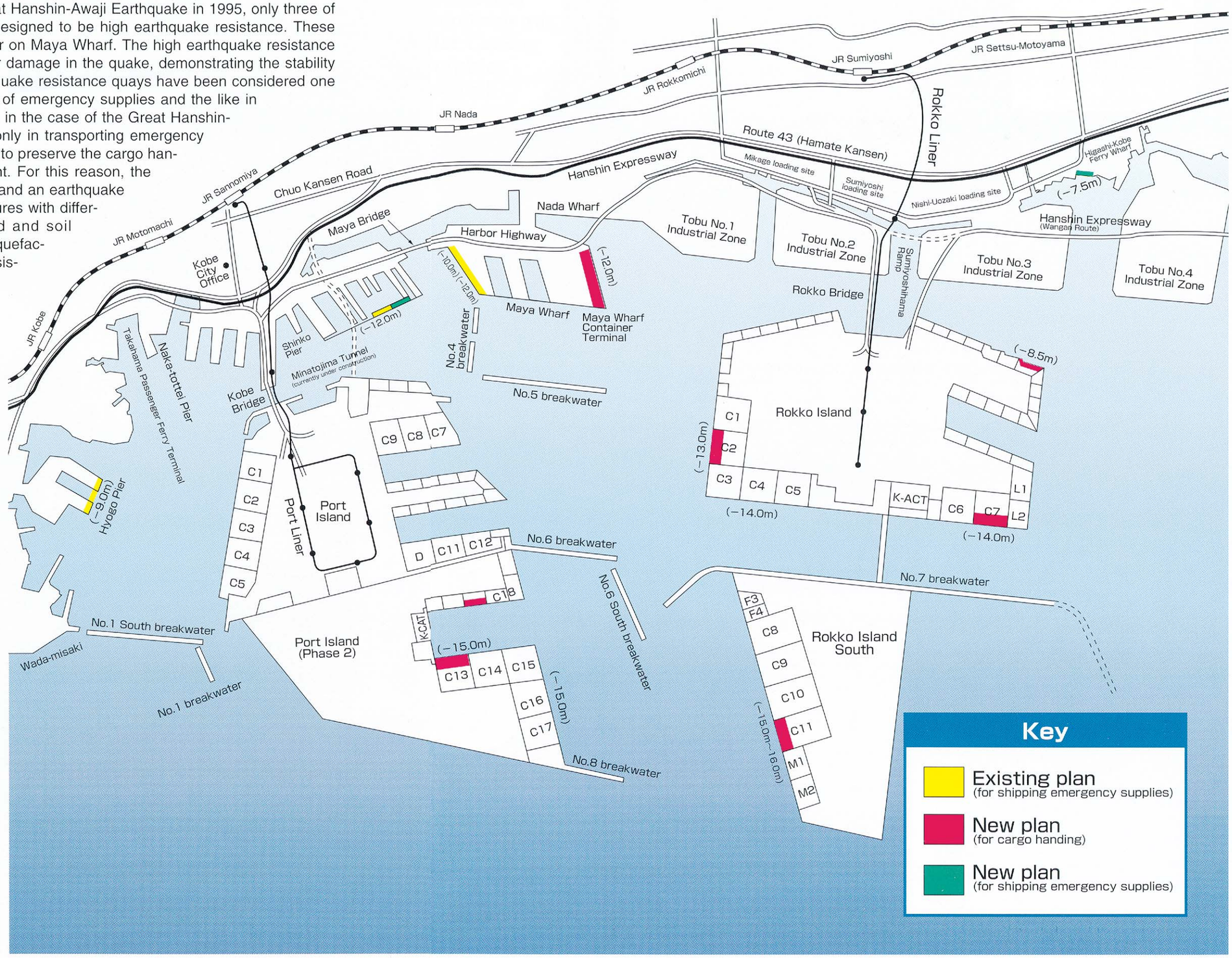


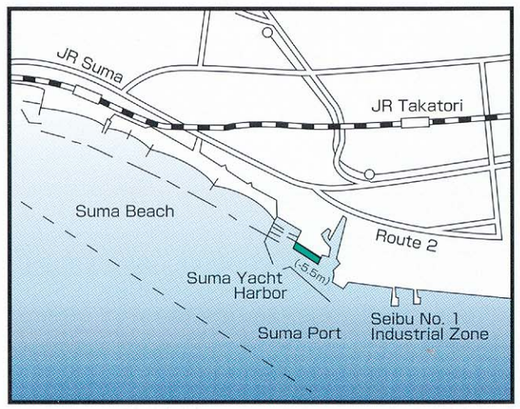
Standards for Temporary Pier Wharf

- Total length 1,000 meters
  - The Third District Port Construction Bureau : 350 meters
  - Kobe City : 530 meters
  - Kobe Port Terminal Corporation : 120 meters
- Water depth13-14 meters
- 2 berths for foreign container ships
- 2 berths for offshore feeders

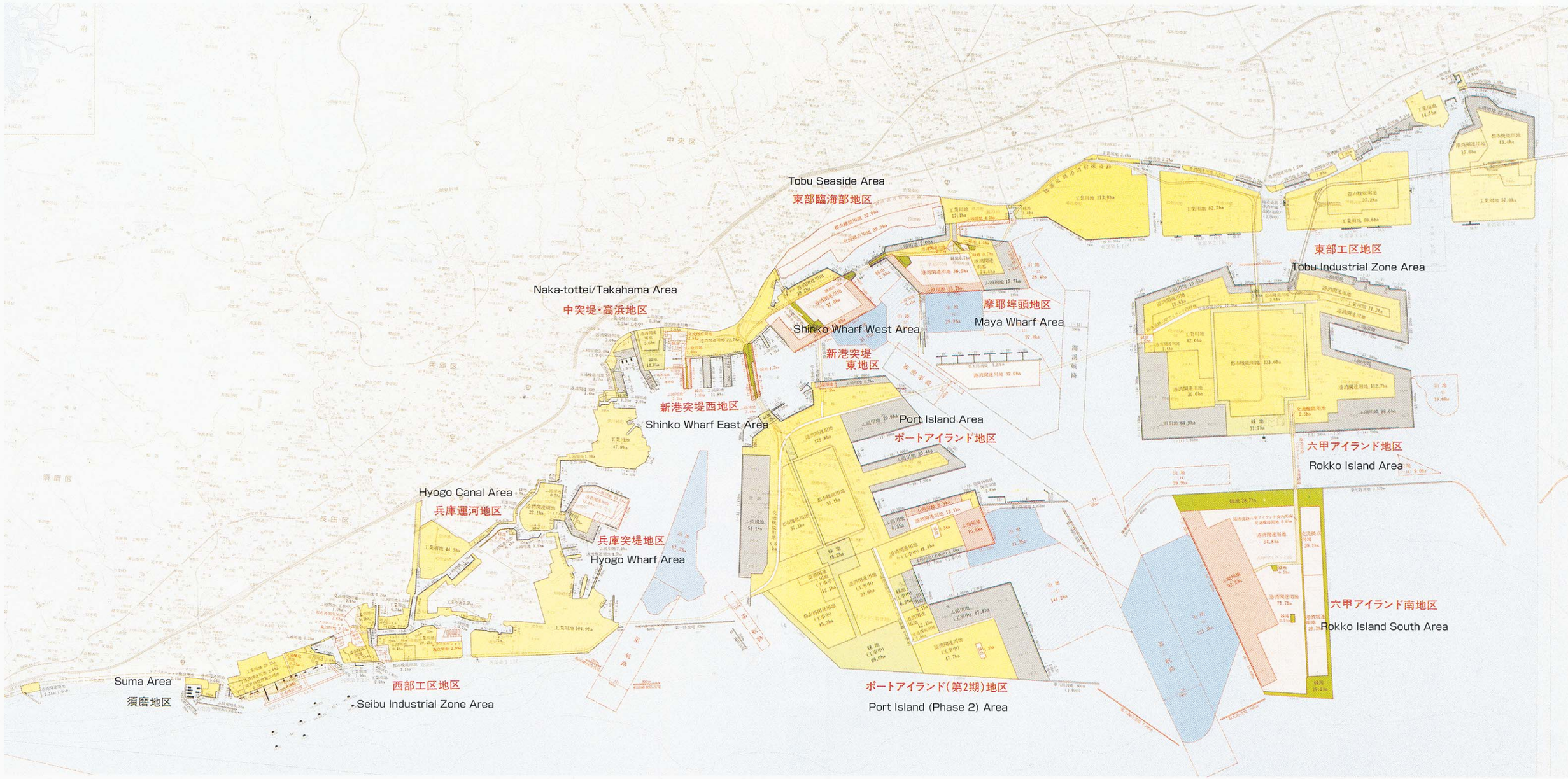
Arrangement of High Earthquake Resistance Quay Wall

Increasing the earthquake resistance of port facilities is one of the priorities for restoration efforts at the Port of Kobe. Before the Great Hanshin-Awaji Earthquake in 1995, only three of the berths in the Port of Kobe had been designed to be high earthquake resistance. These three berths were located on the No. 1 pier on Maya Wharf. The high earthquake resistance quays at Maya Wharf sustained only minor damage in the quake, demonstrating the stability of this type of quay. Up to now, high earthquake resistance quays have been considered one of the facilities necessary for the transport of emergency supplies and the like in the event of a major earthquake. However, in the case of the Great Hanshin-Awaji Earthquake they proved useful not only in transporting emergency supplies after the quake but also in helping to preserve the cargo handling capabilities of the port to some extent. For this reason, the restored facilities will be designed to withstand an earthquake of even greater intensity. Diversified structures with different earthquake responses will be used and soil improvement measures taken to prevent liquefaction of the ground, and high earthquake resistance quay walls will be built at both existing wharves (mainly container berth) and passenger ferry wharves. These high earthquake resistance quay walls will be positioned carefully, taking into account their orientation and the use of diversified structures, as an additional measure to prevent all of them from being damaged simultaneously. The number of high earthquake resistance berths in the Port of Kobe will be increased from three to 17 berths. Improving the disaster mitigation and earthquake resistance of the port will provide a focal point for the disaster preparedness of the city as a whole.





Port Plan for the Port of Kobe (as of Feb.1995)



Long-term Recovery Plan for the Port of Kobe

The current reconstruction effort will transform the Port of Kobe into a key port for the Asian region in the 21st century. The Port of Kobe is working to increase its international competitiveness as a port for international trade by expanding and improving its capabilities even beyond their level prior to the earthquake. The new Port of Kobe will be a center for cargo handling and maritime transport and a port that is state-of-the-art in terms of disaster mitigation.
To restore the Port of Kobe as a center of international trade, high-grade deep-water container terminals are being constructed on Port Island Phase 2 and Rokko Island South. Work is also progressing on multipurpose berths and the Minatojima Tunnel and the redevelopment of existing outdated port facilities.

1. Construction of high-grade container terminals

To ensure that the Port of Kobe fulfills its function as a central port, work is progressing on improving the functions of the container berths.

- On Port Island Phase 2, high-grade container terminals will be built at a depth of 15 meters.
- On the Rokko Island South, a high-grade container terminal will be built at a depth of 16 meters.

2. Changing the mode of transport

On Port Island (Phase 2) and Rokko Island South, feeder berths will be built to make it possible to switch the mode of transport.

3. Improving transport facilities along the harbor

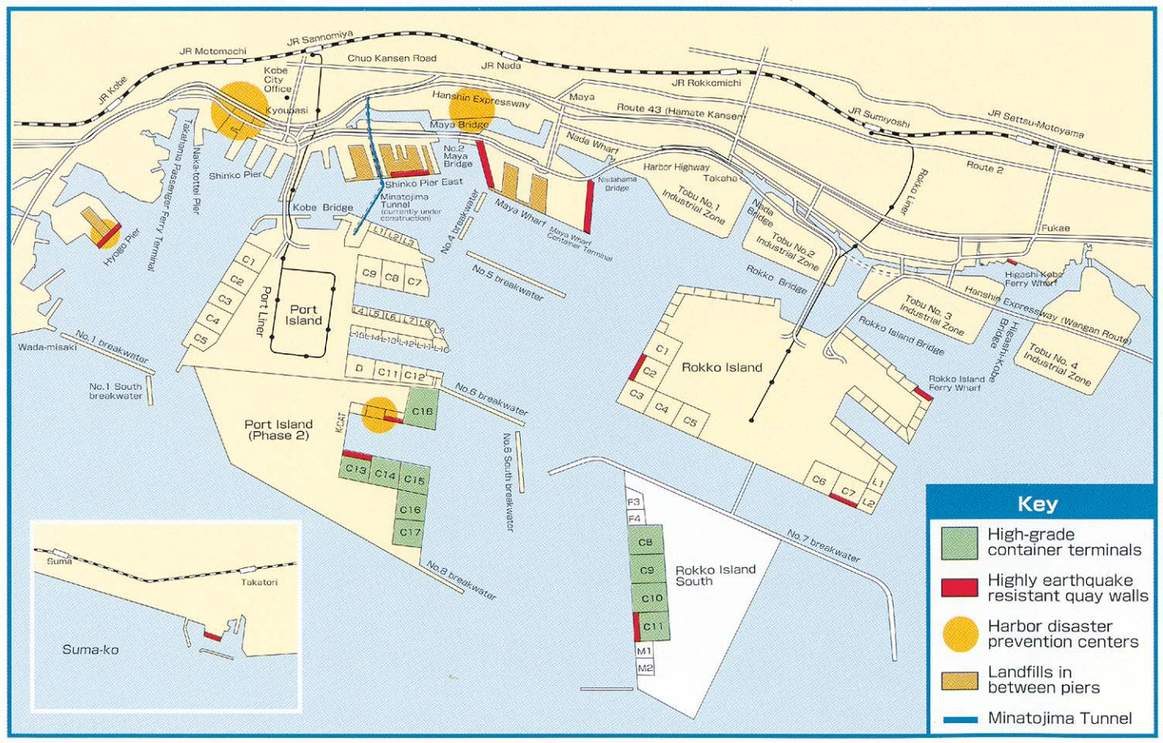
Along with the construction of the high-grade container terminal at Port Island Phase 2, the Minatojima Tunnel (Phase 1) will be built as an access road to cope with the anticipated increase in the amount of traffic. This access road will be an undersea tunnel built using the immersed tunnel construction method and will link Port Island with the Shinko No. 6 pier.

4. Redevelopment of port facilities

In the Maya Pier, Shinko Pier east and other areas, the old and outdated wharf facilities will be redeveloped in order to restore and modernize port functions.

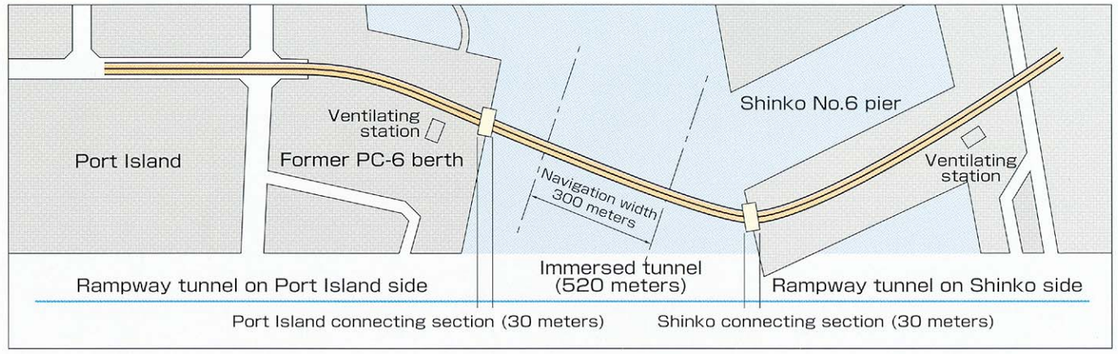
5. Placement of disaster prevention centers

Disaster prevention centers with disaster relief functions will be built to store emergency supplies, ensure space for evacuation and provide lifestyle support services and medical care. These centers will be one part of the system designed to cope with any disasters that may occur in the future.

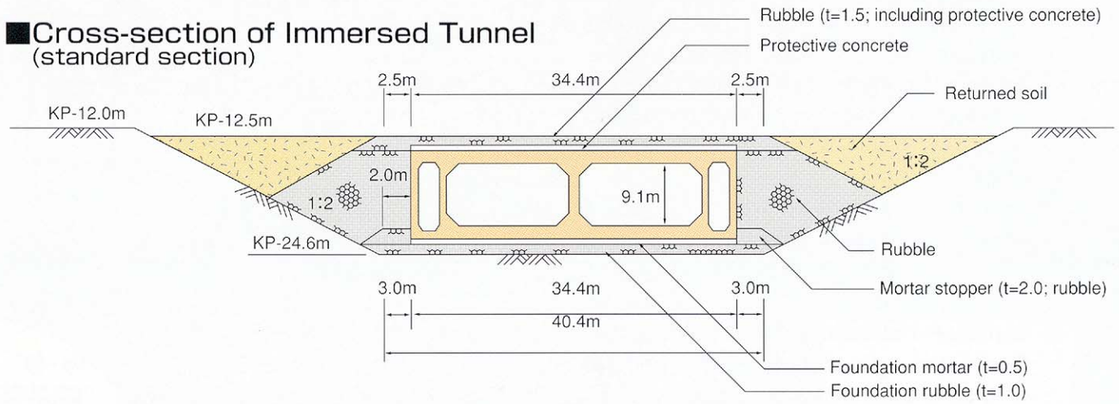


Minatojima Tunnel

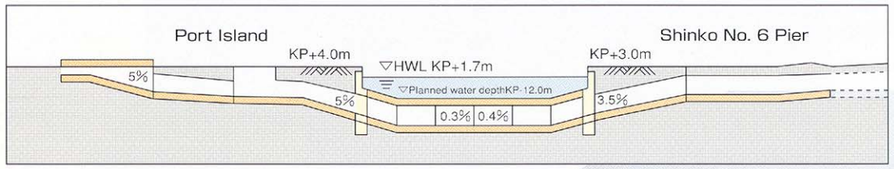
■Plane View of Planned Construction



■Cross-section of Immersed Tunnel (standard section)

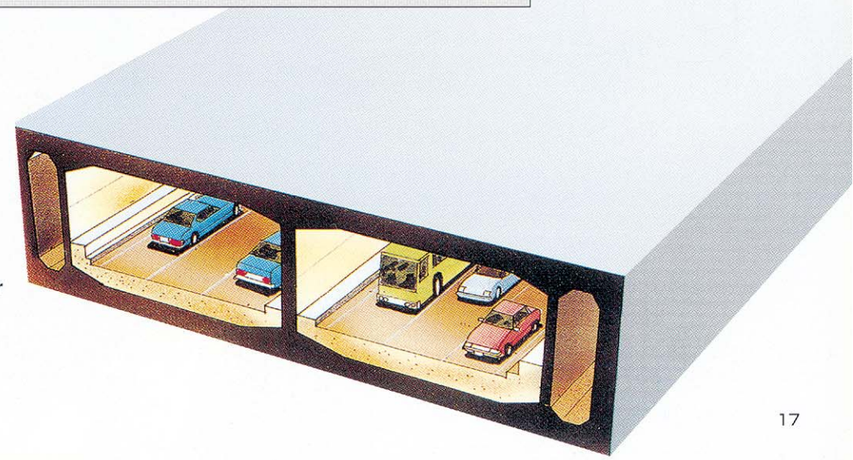


■Longitudinal Cross-section of Planned Construction



■Basic Conditions

- **Lane width / number of lanes**
  3.25 meters x 4 - 6 lanes
  (lanes going in opposite directions separated)
- **Road standard: Class 4 Level 1**
  (equivalent to Class 2 Level 2)
- **Design speed: 60 kilometer / hour**
- **Steepest gradient: 5.0%**



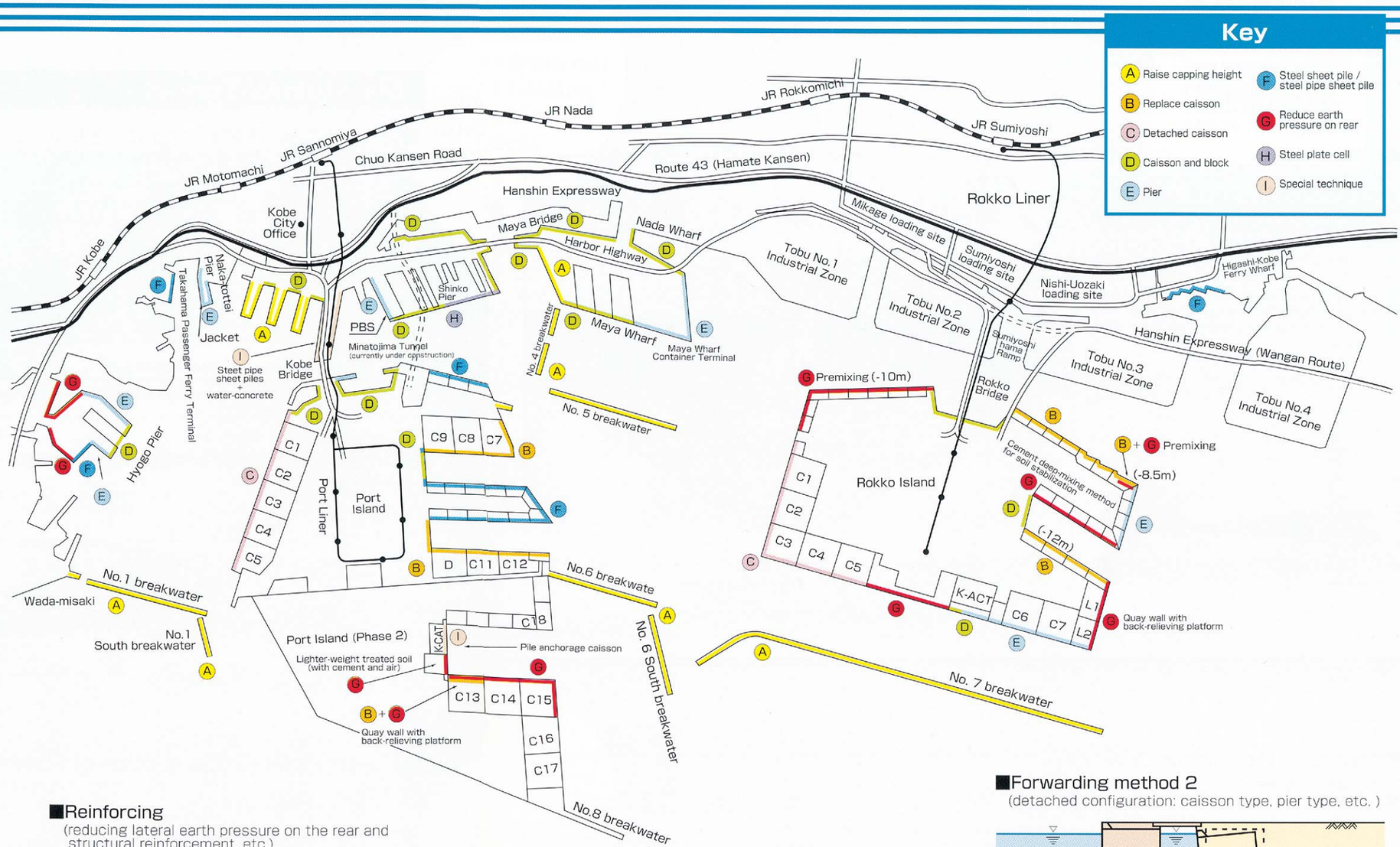
Methods to Repair Earthquake Damage at the Port of Kobe

State-of-the-art construction techniques are being used to restore the earthquake-damaged facilities in the Port of Kobe.

A jacket type structure, normally used as a petroleum excavation platform, was used for the first time in Japan, on the quay walls for the Naka-tottei Pier, and the piles and blocks structure (PBS) method was used for the western quay walls of the Shinko No. 5 pier.

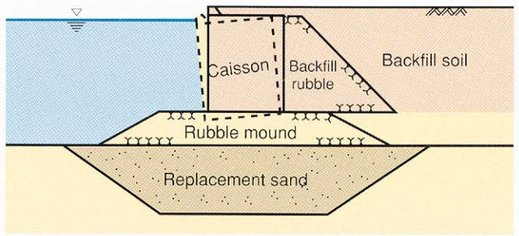
Shinko piers No. 1 through No. 4 are historical port buildings constructed in the Meiji and Taisho eras (prior to and just after the turn of the century). These structures use piled bloks of granite for the capping of the quay walls. These quay walls made of granite show what the Port of Kobe was like when it was first built, and therefore they have great historical value. Restoration efforts must bear this in mind to ensure that these structures are passed on to future generations as historical and cultural treasures.

Four methods have been used in the restoration effort. The method used depends on such factors as the degree of damage suffered, the need to increase earthquake resistance, the restricting conditions that apply (if any), the cost and the amount of time needed for completion.



■Reinstallation

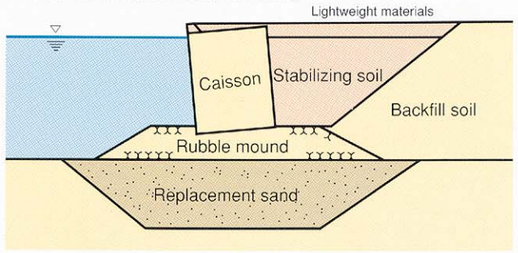
(removal and new installation)



This method is used to repair damage when there are severe restrictions on the water area at the front of the damaged facility (when the facility is inside a slip, when a waterway must be secured, etc.). In the case of a caisson reinstallation, the caisson is replaced; in the case of a steel configuration, the old facility is removed and a new one installed in line with the nature of the damage. As this method involves excavating the foundation to the rear, etc., it cannot be used when there are warehouses or other structures near the rear of the facility.

■Reinforcing

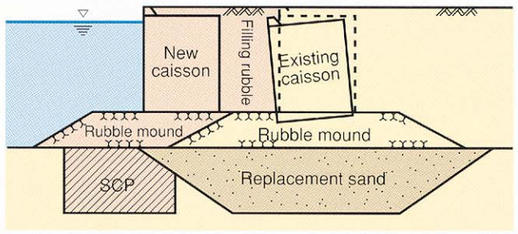
(reducing lateral earth pressure on the rear and structural reinforcement, etc.)



In this method, the damaged or deformed facility is used as is. This method is used when the damage is comparatively slight and the face line after the damage has been sustained is still comparatively straight. There are two ways of applying this method: one in which the lateral earth pressure on the rear is reduced to alleviate the external force during an earthquake, and another in which structural resistance is increased through the use of pile anchorages, passive piles, etc..

■Forwarding method 1

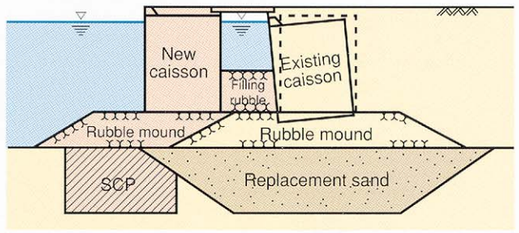
(new construction and backfill configuration: caisson type, block type, sheet pile type, etc.)



In this method, new structures are built in front of the damaged facilities. This method is used when there is enough water area in front of the damaged facility. The type of structure to be newly installed can be changed or the forwarding amount can be adjusted in line with the restrictions on the facilities. The existing structures are buried.

■Forwarding method 2

(detached configuration: caisson type, pier type, etc.)

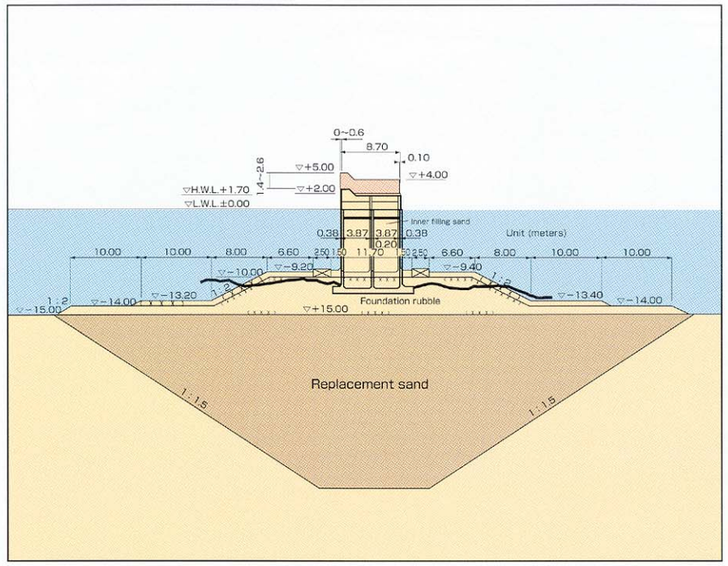


In this method, new structures are built in front of the damaged facilities. As the existing structure is used as a retaining wall, filling rubble is inserted to the height that will ensure the stability of the existing structure during an earthquake. As the height of the filling rubble is restricted, the stability of the new caisson is increased due to the reduction of the lateral earth pressure. The new and existing structures are linked with hollow PC girders or other type of connecting beam plate. The forwarding amount of the new structures can be adjusted by the length of the hollow girders. This method is used when there is enough water area in front of the damaged facility.

Restoration Methods Used for Each of the Dam aged Facilities 1

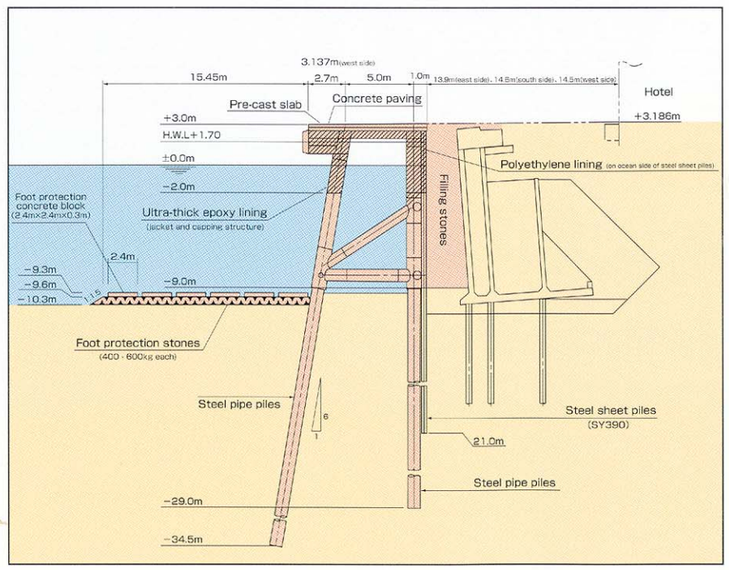
■Breakwater

There was little differential displacement of the face line of the breakwaters, but they had sunk for their entire length for up to 2.5 meters. As these breakwaters are designed to protect the city in the event of a tidal wave or the like, The restoration work focused on repairing them quickly before the start of the typhoon season, by raising the capping concrete and pouring in rubble or the like to secure the function (both inside and outside the harbor for the No. 1 breakwater and only inside for the No. 6 and 7 breakwaters).



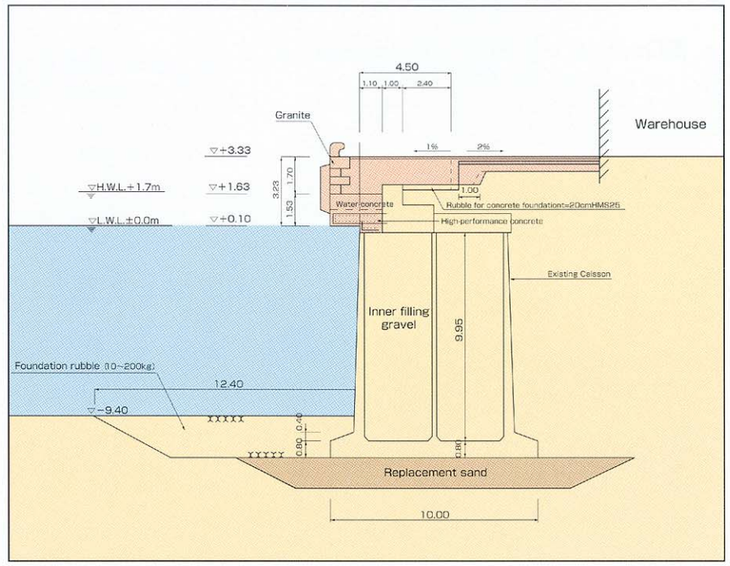
■Naka-tottei Pier -9meter Quay

The berths at Naka-tottei Pier are used for passenger ships. As (a) there was a hotel at the rear of the quay wall and the water area in front was narrow; (b) the passenger terminal had to be put back into operation quickly; and (c) the work had to be done in coordination with the repairs to the Takahama Pier on the opposite shore, jacket structures were used so the repairs would be finished as quickly as possible.



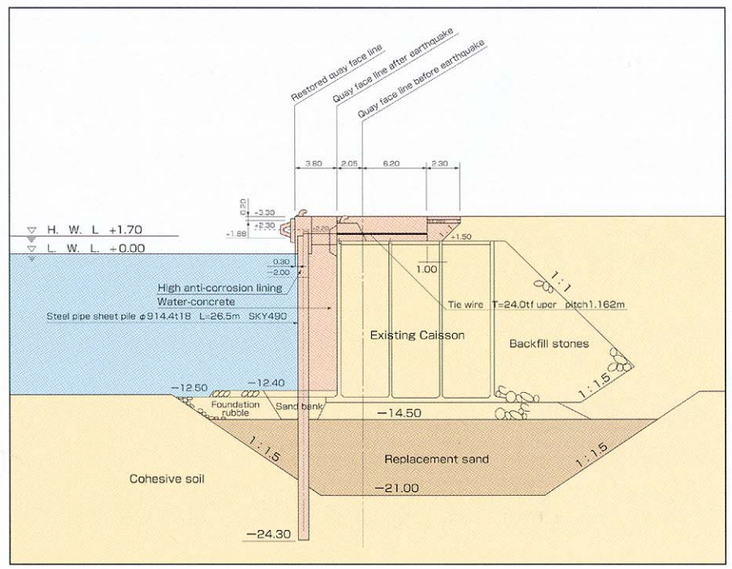
■Quay at the Shinko No.2 Pier

The No. 2 pier was built during the Taisho era early in this century with a capping of granite, and therefore it has great historical value. There were restrictions on the amount of forwarding that could be done due to the fact that the quay was located in the slip, and there were warehouses located nearby. For these reasons, the existing granite capping was removed and the level was raised using concrete, after which a granite capping was placed on top.



■Quay at the Shinko No.4 Pier

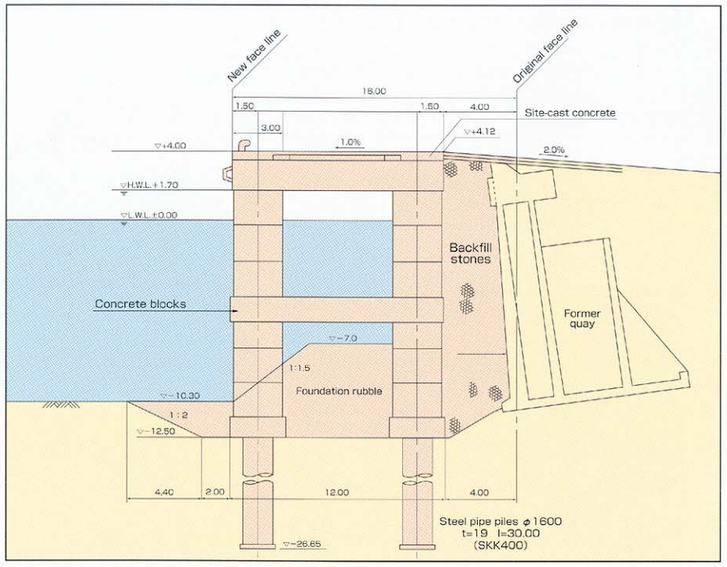
The berths at the Shinko No. 4 pier are used for international passenger liners. There were restrictions on the water area in front due to the location of the quay in the slip, and there were warehouses nearby to the rear. As a result, steel pipe sheet piles, which were anchored to the caissons, were driven in front of the existing caissons, and water-concrete was used to fill the area between the piles and the caissons.



Restoration Methods Used for Each of the Dam aged Facilities 2

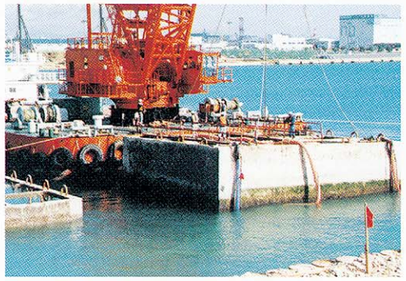
■Quay at the Shinko No.5 Pier

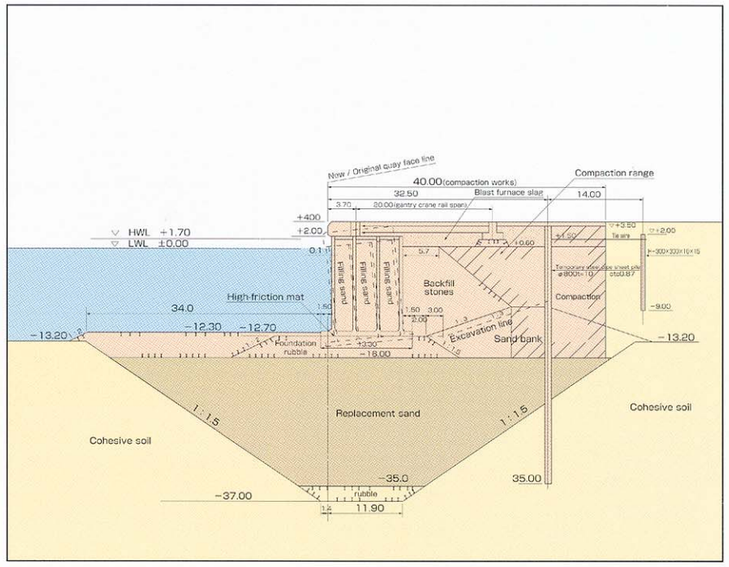
There were restrictions on the water area in front due to the location of the quay in the slip, and there were warehouses nearby to the rear. As a result, restoration was done by means of the PBS method, in which steel pipe piles were driven in front of the existing caissons and concrete blocks were placed onto the piles and fastened in place, after which backfill stones were poured in and the capping concrete was cast.



■Rokko Island -12meter Quay

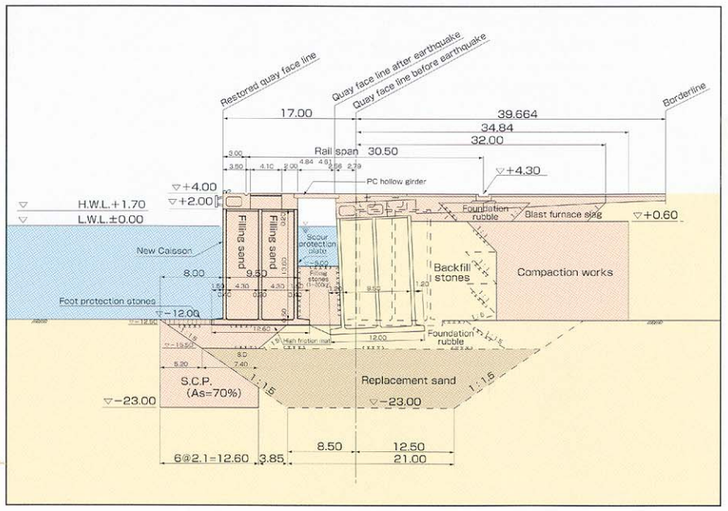
These berths are used as tramper berths. Since the quay was located in the slip, there were restrictions on the amount of water in front. However, as there was enough room behind the quay wall, the quay was restored by replacing the caissons. Soil improvement measures to prevent liquefaction were taken for the area at the rear.





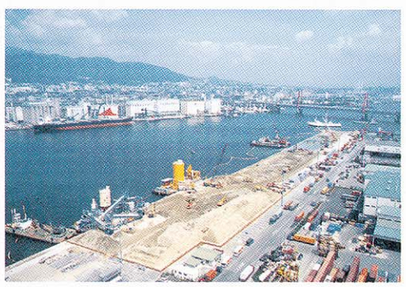
■Port Island -12meter Quay (PC1)

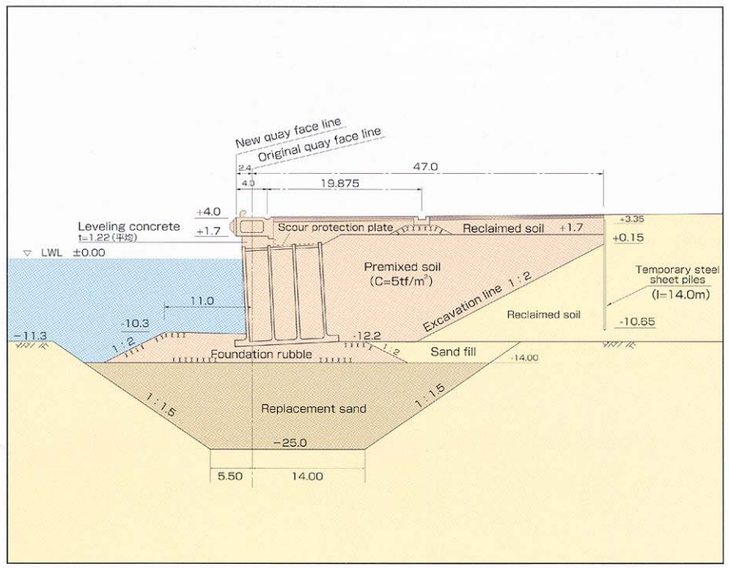
These berths are used as container berths by the Kobe Port Terminal Corporation. Primary emphasis in restoration was placed on finishing the work as quickly as possible. For this reason, a detached caisson construction was used in which new caissons were placed in front of the existing caissons and the caissons were connected with PC hollow girders. Filling stones were poured in between the caissons to ensure the stability of the existing caissons. Soil improvement measures to prevent liquefaction were taken for the area behind the existing caissons, and blast furnace slag was used on the surface layer to reduce lateral earth pressure. This method was also used to repair the container berths on Rokko Island.



■Rokko Island -10meter Quay

As the damage to this quay was comparatively slight, it was restored by reusing the existing facilities as is. The backfill stones and soil at the rear of the quay wall were excavated and the area was filled in with premixed soil (cement and backfill soil mixed together) in order to reduce the lateral earth pressure.



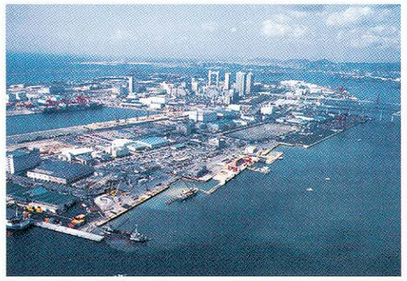


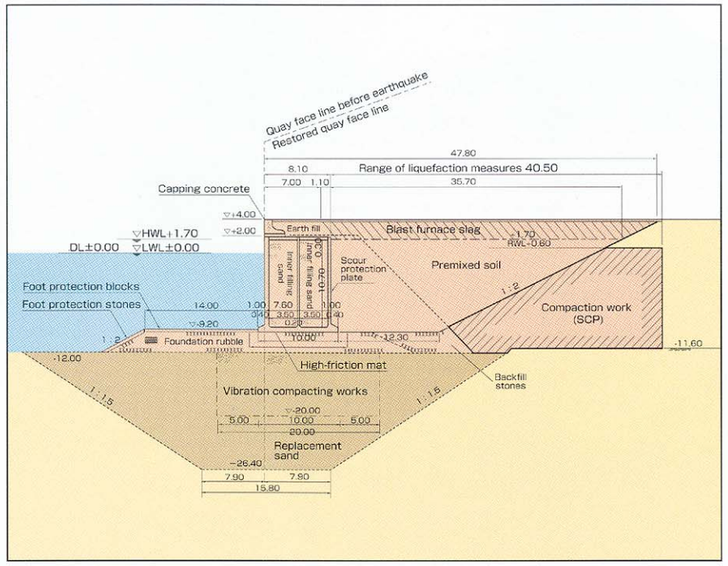
Restoration Methods Used for Each of the Damaged Facilities 3

■Rokko Island Ferry Berth -8.5meter Quay (RF3)

(High Earthquake Resistace Quay Wall)

The berths at this facility are used for ferries docking at Rokko Island. Since the quay was in a line with the neighboring ferry berth (RF2), it was restored by replacing the caissons. In order to increase the earthquake resistance of the quay, it was necessary to greatly reduce the lateral earth pressure at the rear of the quay wall. Accordingly, premixed soil (cement treated soil) was used for the backfill at the rear of the quay wall, and blast furnace slag was used for the surface layer to reduce the lateral earth pressure. In addition, vibrational compacting (densification) was done to improve the replacement sand under the caisson.

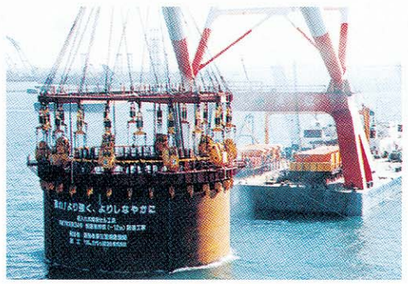


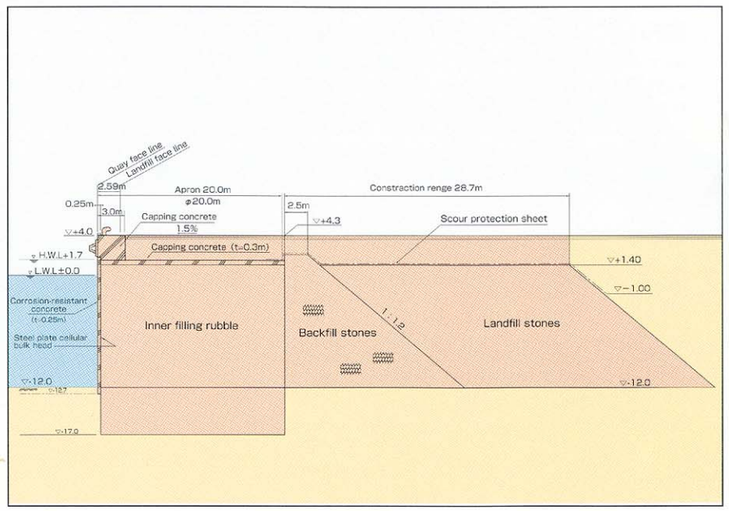


■Shinko Area East Quay (-12meter)

(High Earthquake Resistance Quay)

This facility was one of the large new quays constructed by means of a landfill on the south side of the eastern part of the heavily damaged Shinko area between the Shinko No. 5 and No. 8 piers. It was constructed by using the steel plate cellular bulkhead method with foot penetration for a distance of approximately 580 meters between the No. 6 and No. 8 piers. This is one of the quay walls considered to be high earthquake resistance.

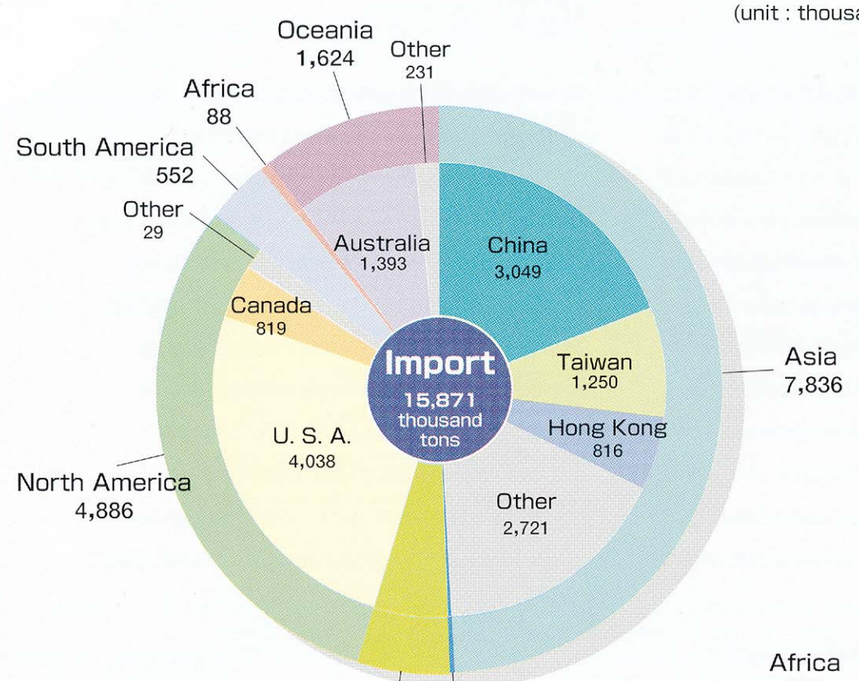


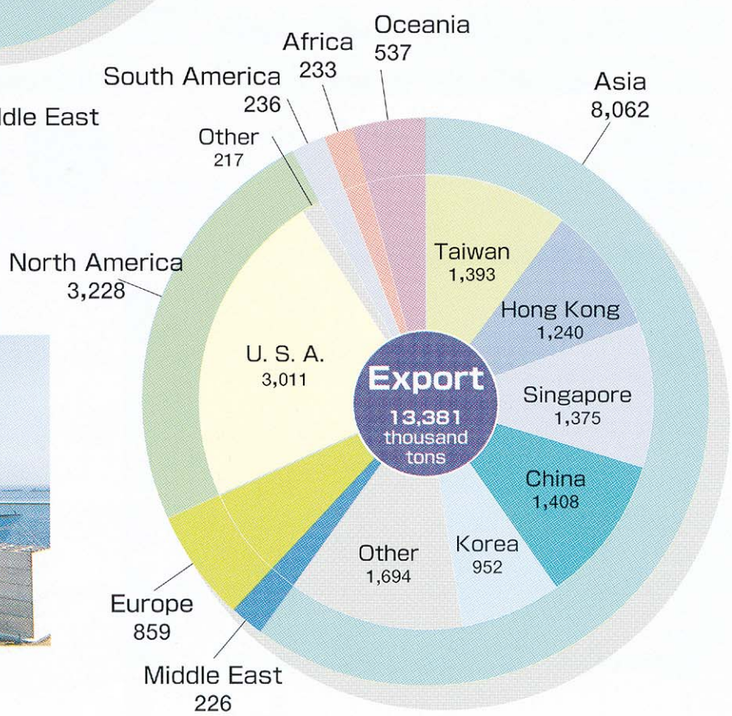


Amount of Cargo Handled at the Port of Kobe

◆Amount of Foreign Trade Cargo Handling Between Kobe and Major Trading Nations◆

(unit : thousand tons)





Changes in the Amount of Cargo Handled at the Port of Kobe and the Number of Ships Entering the Port (compared to the previous year)

◆Changes in the Number of Ships Entering the Port◆

Domesetic

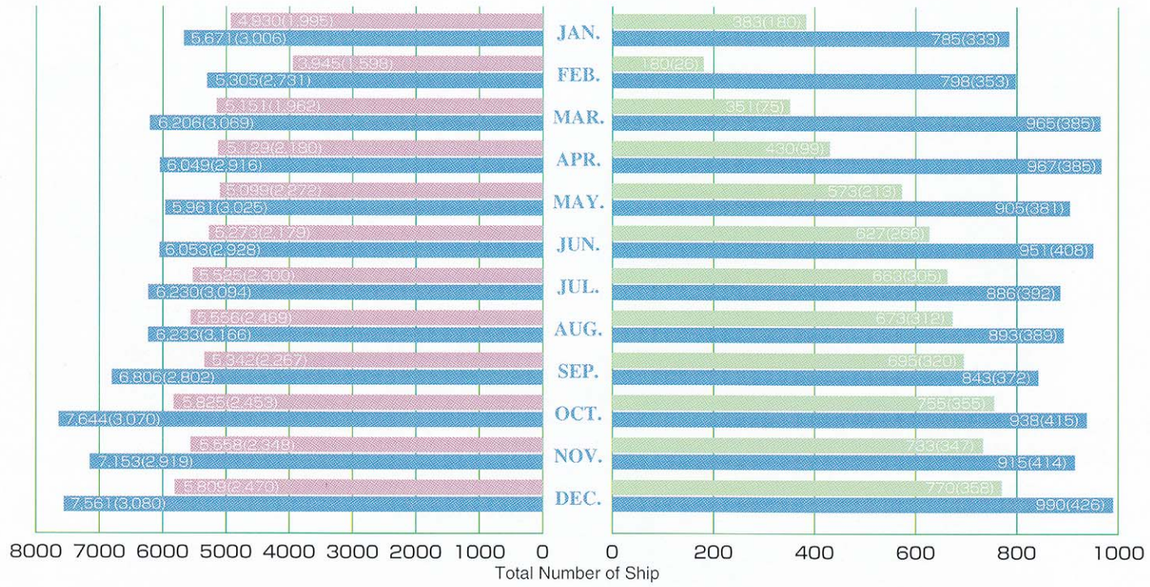
1995 63,142 (no.of ferries ; 26,493)

1994 76,872 (no.of ferries ; 35,806)

International

1995 6,833 (no.of full container ; 2,856)

1994 10,836 (no.of full container ; 4,653)



◆Total Tonnage for Each Type of Ship (Use) Entering the Port◆

Domesetic

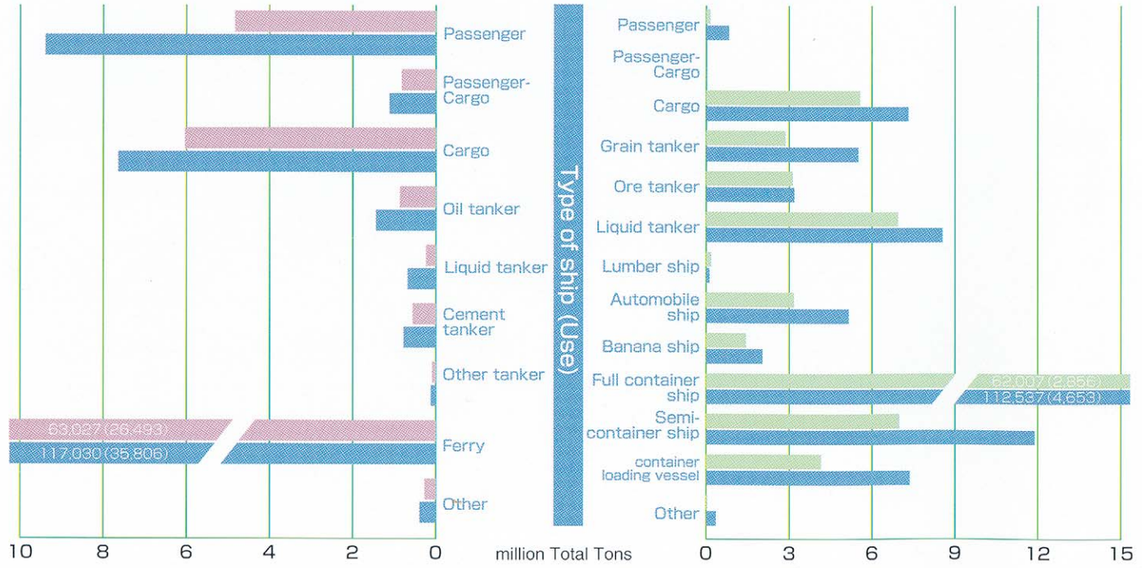
1995 76,702,000tons (for 63,142 vessels)

1994 138,592000tons (for 76,872 vessels)

International

1995 96,609,000tons (for 6,833 vessels)

1994 164,846,000tons (for10,836 vessels)



◆Changes in the Amount of Container Cargo Handled◆

Import

1995 11,192,000 tons

1994 21,384,000 tons

Export

1995 9,809,000 tons

1994 20,800,000 tons

Current Status of Restoration Work at the Port of Kobe (as of March 1996)

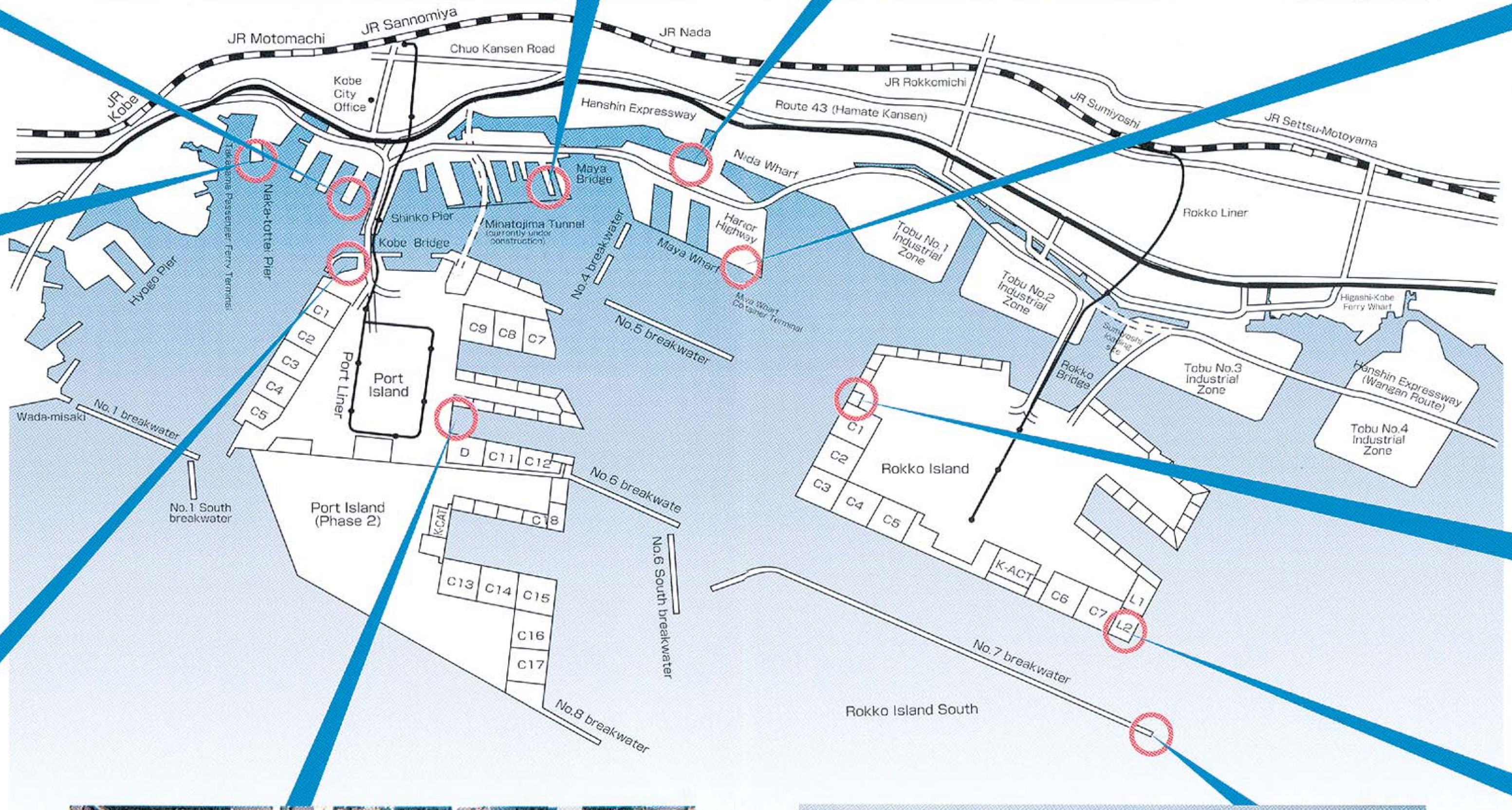
●Shinko West: No. 3 Pier

●Shinko East: Quay (−12 meter)

●Maya: −4 meter Loading Site④

●Maya: Quay② (−12 meter)

●Naka-tottei Pier



●Rokko Island: Quay (−7.5 meter)

●Port Island: −4meter Loading Site② (Kita Koen Park)

●Port Island: −4 meter Loading Site④

●Eastern End of No.7 Breakwater

●Rokko Island: Emergency Container Pier

Looking Back: One Year After the Great Hansh in-Awaji Earthquake of 1995

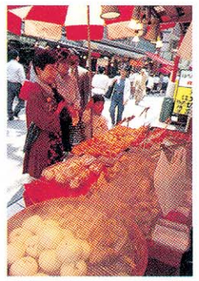
January 17, 1995. With a tremendous "BOOM," the earth began to shake violently.
One year after the greatest earthquake to strike a major urban area in the postwar period, let us look back at the major events in the recovery effort.

1. Emergency restoration efforts

The damage done to the Port of Kobe, the symbol of the city of Kobe, was beyond anything that could have been imagined. Almost all of the facilities in use before the quake were unusable, and only seven berths could be used for docking in any capacity. Initially the most urgent task was to make it possible to unload goods. To enable emergency supplies to be received, sand was poured on the rear of the quay walls whose ground surface had sunk and rendered them unusable. Thanks to these emergency recovery efforts, by March 107 berths had been made available for provisional use. The gantry cranes were repaired as well, and unloading of container cargo at Maya Pier resumed on March 20.

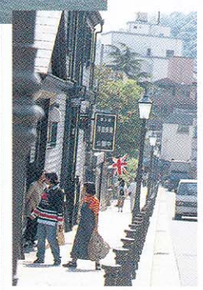
2. Work continues around the clock to prepare for the government assessment of earthquake damage

The main restoration work could only be begun after the official in charge of assessing earthquake damage from the Ministry of Transport Ports and Harbors Bureau, Coastal Disaster Prevention Division had done an on-site inspection (damage assessment) and consultations with the Ministry of Finance had been held. In order to prepare for this damage assessment, many things had to be done: the status of the damage had to be ascertained, the objectives for restoration determined, restoration plans designed, quantities calculated, costs estimated and a Damage Assessment Report created. Work proceeded around the clock for days to establish a restoration plan for almost all of the facilities. The aid teams that came from all parts of Japan assisted in this effort, and work proceeded at a furious pace from the first assessment done at the end of February to the fourth assessment done at the end of April. In this manner, the project to restore the damage caused by the earthquake was finalized.



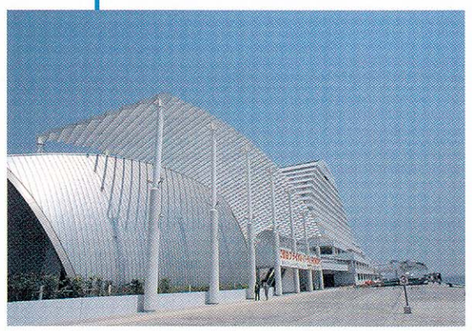
3. Establishment of the Great Hanshin-Awaji Earthquake Disaster Restoration Headquarters

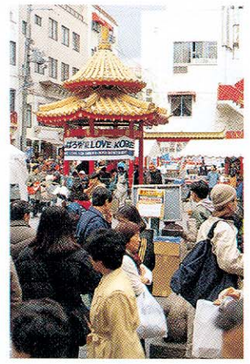
In the 130 years since the Port of Kobe was opened to maritime traffic, many different port facilities have been built there and the port has grown to handle the largest volume of cargo of any port in Japan. It would be no easy task to restore these facilities and make the Port of Kobe an even more attractive and functional port than befor the quake. In order to accomplish this goal, the Great Hanshin-Awaji Earthquake Disaster Restoration Headquarters was established in April 1995 by order of the Ministry of Transport. With the assistance of aid teams dispatched by various construction bureaus and other agencies, a powerful organization was built to implement the main reconstruction work.



4. Use of different structural types

The restoration of damaged port facilities is normally done using the same shapes and cross-sectional configurations as the original facilities. However, almost all of the port facilities that were damaged in the earthquake were gravity structures, and the pattern of the damage was similar for all of the facilities. For this reason, structural types with different seismic responses were used in the restoration, and risk dispersion measures were adopted to prevent all of the new facilities from sustaining damage simultaneously.



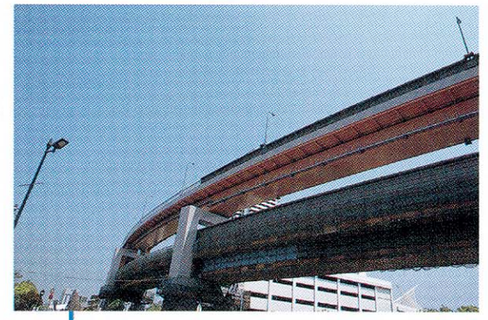


5. Preventing the "hollowing" of the port

Even though restoration work at the Port of Kobe is currently being implemented at a fever pitch, it is estimated that two years will be required to restore port functions completely. To minimize as much as possible the "hollowing" of the port that might occur as ships shift to using other ports to handle their cargo, the work effort is a cooperative one in which ships use the port facilities while restoration efforts are in progress nearby. To prevent this "hollowing" from occurring for container cargo as well, it was decided to construct a temporary pier wharf that could take over the functions of the container terminals currently being repaired, in line with a suggestion by the Hanshin-Awaji Reconstruction Committee. The 350-meter-long single-berth wharf was completed in only six months to widespread acclaim and an opening ceremony attended by the Transport Minister was held in November.

6. Preventing secondary disasters resulting from typhoons

As a result of the earthquake, the breakwaters in the Port of Kobe sank up to 2.5 meters, which greatly reduced their effectiveness. To prevent secondary disasters in inland regions from occurring as a result of storm surf and high waves, top priority was given to restoring the primary breakwaters before the beginning of the typhoon season. This task was completed in early August with the raising of a breakwater extending 6.5 kilometers in length.

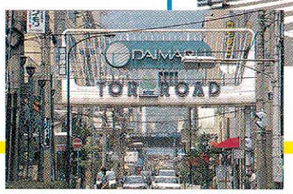


7. Resolving problems in the restoration effort

With the commencement of restoration efforts in the Port of Kobe, many different problems have come to the fore, for example the problem of securing sites to dispose of the earth materials produced by restoration work in the port and that of securing sites for the manufacture of caisson blocks. Work is progressing as these problems are resolved one by one.

8. Toward Recovery

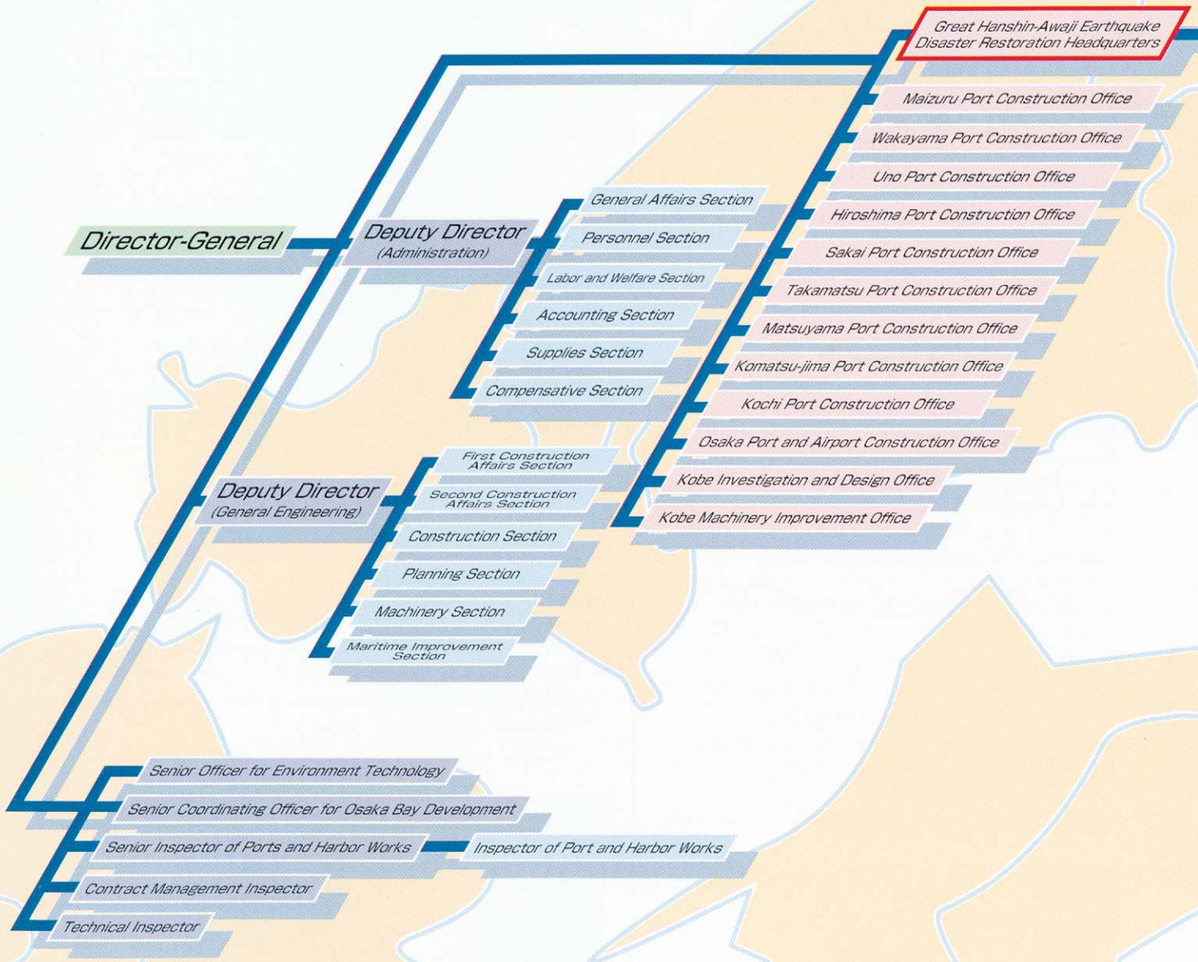
Following the rebuilding of the primary breakwaters and the construction of an emergency (temporary) container pier wharf, restoration work has proceeded rapidly. So far permanent restoration work has been completed for a total of 13 berths in the Port of Kobe. The Third District Port Construction Bureau is making every effort to ensure that recovery and restoration are completed as quickly and efficiently as possible.



Organization of the Great Hanshin-Awaji Earth quake Disaster Restoration Headquarters

The Great Hanshin-Awaji Earthquake Disaster Restoration Headquarters was set up in April 1995, by order of the Ministry of Transport to take charge of overall earthquake recovery operations in the Port of Kobe. The Great Hanshin-Awaji Earthquake Disaster Restoration Headquarters will be in existence for the two years that the restoration operations to repair the damage from the earthquake will be conducted. The facility is staffed by employees from the Third District Port Construction Bureau as well as those dispatched from port construction bureaus and other agencies throughout Japan to help in the restoration and reconstruction of the Port of Kobe.

■ SYSTEM / The Third Port Construction Bureau, Ministry of Transport



■ SYSTEM / The Earthquake Disaster Restoration Headquarters
The Third Port Construction Bureau, Ministry of Transport (as of April.1.1995)