4-8 COUNTERMEASURES OF SAFETY AND PREVENTION OF DISASTER FOR PORTS AND HARBOURS

4-8 COUNTERMEASURES OF SAFETY AND PREVENTION OF DISASTER FOR PORTS AND HARBOURS

4-8-1 Introduction

Type of industries introduced in Mexican industrial ports include such heavy industries as steel, non-ferrous metal (aluminum, etc.), oil, petrochemical fertilizer manufacturing industries. Because of the siting of these heavy industries, large ships carrying raw materials and products and ships carrying dangerous cargo visit the ports.

As great disaster is liable to occur in case of accidents, safety and prevention of disaster measures must be carefully considered for preventing occurrence of accidents and minimizing damage.

For securing safety of ports, it will be necessary to arrange the port facilities considering safety and to accommodate full equipment at the planning stage. And also it will be necessary to establish safety and disaster prevention system from the standpoint of management and operation.

With regard to the policy of handling dangerous cargo excluding the petroleum, etc. in Japan, a report has already been prepared.

Therefore, we wish to discuss points to be noted in regard to safety of oil handling ports from the standpoint of planning and management and introduce actual conditions of safety and disaster prevention measures of oil tanker berths in Japan, to serve as reference for establishing safety and disaster prevention measures in Mexican ports.

4-8-2 Safe Ports

Ports have such function as (1) connection of sea/land transportation, (2) shelter/anchorage of marine transportation media, (3) industrial activities and (4) recreation area for citizens, etc..

Safe ports have an image "port activities are safely and conveniently carried out and various functions as above are smoothly displayed".

From this image, conditions of safe ports may be given as follows.

(1) Ships can safely enter/leave/stay and moor at the port.

(2) Loading/unloading of ships can be safely carried out.

(3) Necessary service for men and goods is provided and disaster prevention facilities are arranged.

(4) Necessary management and operation system for port activities is arranged.

4-8-3 Point of View to Consider Safety Measures of Ports

Elements which jeopardize the requirements of safe ports as given in the preceding section or elements causing safety problems are mostly included in following conditions.

(1) natural conditions

(2) conditions of facilities

(3) conditions of management and operation

(4) human conditions (ability)
(5) conditions of data communication system

For securing safety against these elements, countermeasures from the following three points of view must be prepared beforehand.

(1) Establishment of safety measures in port planning, such as layout of facilities within the ports and land use of surrounding the ports.

– In case ports are located in the center of coastal industrial area, surrounded by many industries and where industrial area and other areas coexist, danger will increase both in quantity and quality.

Therefore, in ports planning, adequate facilities must be developed as well as proper use of land to prevent damage to a minimum extent in case of accident.

(2) Establishment of safety measures from the standpoint of the level of improvement (sufficiency of facilities) of port facilities (water area, breakwater and mooring facilities, etc.)

– Level of the improvement of the facilities is determined in consideration of ship maneuverability as well as natural and social conditions of the projected area.
Facilities must be developed to create better ports consulting of users of ports and judging rational.

(3) Establishment of safety measures in port management and operation.

– As most marine accidents occur within the ports, safety and disaster prevention measures are important at the time of ships' entering/leaving ports and loading/unloading ships.
Also countermeasures must be established to minimize damage in case of accident.
Therefore, from the standpoint of management and operation, systems of vigilance, monitoring and etc. must be established as safety measures.

4-8-4 Safety Measures in Planning Port Facilities

To secure safety of ports, following matters must be checked in planning port facilities.

(1) Port entrance
a. Direction of port entrance considering maneuvering of ships against waves.
b. Water depth considering piloting ships.
c. Port mouth width.

(2) Channel
a. Channel width.
b. Water depth to maneuver ships for waves and navigating speed, etc..
c. Plane arrangement of channel considering bends, etc..
d. Allowance of stopping distance.
e. Anchoring operation at emergency considered.

(3) Anchorage

a. Anchorage area considering space for anchoring in bad weather.
b. Water depth.
c. Assessment of calmness.
d. Anchoring effect on sea bed.

(4) Tugboat

a. Necessary tugboat

(5) Disaster prevention facilities

a. Fire fighting boat, Oil fence, Neutralizer, Fire extinguishing agent, Fire hydrant and other equipment.
b. Disaster prevention system, Disaster prevention training and Data communication system.

(6) Handling of dangerous cargo.

a. Separation of dangerous cargo handling wharf from general cargo wharf.
b. Safety of channel leading to dangerous cargo handling wharf.
c. Adequate safety distance maintained from dangerous cargo handling wharf.

(7) Mooring post

a. Position and strength.

(8) Fender

a. Positioning and installation.
b. Size, and shock absorbency.

(9) Apron

a. Height of the top, slope and width.
b. Safety path and warning sign.

(10) Markings

a. Adequate markings.
b. Non-existence of confusing illumination or lamp.

(11) Life-saving equipment at the wharf

a. Stairs and boat hooks available.
b. Life-saving device, rope and ladder available at the wharf.
c. Scafolds with handrail.
d. Sufficient lighting at the wharf.

(12) Others

a. Installation of public phone.
b. Installation of public latrine.

c. Installation of rest room.
d. Installation of safe smoking place in the area where dangerous goods are handled.
e. Arrangement of plying boat, bus, hires, etc..
f. Installation of health center and clinic.
g. Integration of marine related agencies.

As mentioned above, notable points were given from the standpoint of the planning of facilities at ports in consideration of safety of ports. Some of these points can be solved by financial means and others are more difficult to solve because of the local conditions and may require detailed study from the technical standpoint.

These problems must be carefully studied to improve safety of the ports.

4-8-5 Safety Measures in Port Management and Operation

Following matters must be considered for safety measures on maneuvering and loading/unloading operation of the ship and to establish patrolling, monitoring and disaster prevention system.

(1) Safety measures for berthing.
a. Setting time zone for berthing.
b. Limiting berthing speed.
c. Setting worst berthing conditions (min. visibility, max. wave height, max. wind velocity, etc.)
d. Arrangement of adequate tugboat (capacity and number)
e. Arrangement of workboat for mooring, etc.

(2) Safety measures during loading/unloading.
a. Indication of off-limit area.
b. Indication of prohibited area for navigation and anchorage.
c. Management of fire.
d. Arrangement of persons in charge of cargo handling work and security staff.
e. Setting of rule to stop the cargo handling work.

(3) Safety measures for unberthing and emergency.
a. Arrangement of adequate tugboats for unberthing.
b. Setting of standards for refuge.
c. Arrangement of spare tugboats for emergency.

(4) Patrol. watch. communication systems
a. Arrangement of patrol boat.
b. Arrangement of fire-fighting boat.
c. Installation of fire-fighting equipment.
d. Patrol during oil handling.
e. Communication system between ship and shore.

(5) Disaster prevention system, recovering system and maintenance.

a. Establishment of individual disaster prevention system in each industry.
b. Establishment of organized disaster prevention system.
c. Waste oil removing materials and equipment.
d. Regular inspection.

4-8-6 Safety and Disaster Prevention Measures of Oil Tanker Berths in Japan

Japan depends on imports of crude oil as supply of energy and in 1979 she imported as much as 263 million tons in annual volume.

To receive such a large quantity of crude oil, many oil tanker berths are in operation and much caution is being paid at these berths for the prevention of disaster. Here, we wish to introduce the present condition of safety and disaster prevention measures at large tanker berths of 200,000 DWT in Japan from the standpoint of control and operation, because the master plan of Mexican industrial ports and plan for TUM inside the industrial ports are now being prepared and actually construction works have been started at Lazaro Cardenas, Dos Bocas and Altamira ports.

(1) Safety measures for berthing

Berthing time: Mostly from sunrise to sunset

Berthing speed: Max. speed 15cm/sec.
normal speed of approaching berth is slower.

Berthing condition: Min. visibility: Mostly 1 mile.
Max. wave height: Mostly 1.5m
Max. wind velocity: Mostly 15m/sec.

Tugboat: with P.S. of towing capability of 5–10% of tankers' DWT. 4–6 boats arranged.

(2) Safety measure for oil unloading.

Off-limit sign: Mostly posted

Indication of prohibited area for navigation and anchorage: Indicated on curtain, oil fence, buoy, patrol boat etc..

Rule to stop unloading: Max. wave height: Mostly 1.5 m
Max. wind velocity: Mostly 15–25 m/sec.

(3) Safety measures for unberthing and emergency.

Tugboat for unberthing: 3–4 tugboats of 3,000 ps class used.

Condition of refuge base: Max. wave height: mostly 1.5–2.0 m
Max. wind velocity: mostly 20–25 m/sec.

Spare tugboat for emergency: 1–2 tugboats of 3,000 ps class arranged.

(4) Patrol, watch and communication system

Patrol boat: Mostly 1 boat

Fire-fighting boat: Mostly 1 boat

Fire-fighting equipment:	Fire pump, Proportioner, Fire hydrant, Water curtain, Air foam nozzle, Remote monitor nozzle, etc. installed.
Watch system:	Patrol during oil unloading and watch of pipe joint part, carried out at all berths.
Communication system:	Communication between ship and shore mostly by means of telephone, loud speaker, alarm whistle, transceiver.

(5) Disaster prevention system, recovery system and maintenance.

Disaster prevention system:	Individual disaster prevention system and organized disaster prevention system specified at all berths.
Recovery system:	Oil fence, Neutralizer, Absorbent, Oil recovery boat, etc. are arranged for waste oil removing equipments and materials.
Maintenance:	General inspection, inspection of loading arm and pipeline are carried out.

Table 4-8-2 – 4-8-6 show the content of safety measures at each berth.

Table 4-8-1 Operating large tanker berth of 200,000 DWT in Japan

No.	Name of Port	Subject Ship Size	Type of Berth
1	Tomakomai	280,000 DWT	Pile type dolphin
2	Kashima	200,000	ditto
3	Chiba	260,000	ditto
4	Kawasaki	265,000	Single Bouy Mooring
5	Kawasaki	250,000	Pile type dolphin
6	Shimizu	250,000	ditto
7	Yokkaichi	275,000	Single Bouy Mooring
8	Yokkaichi	230,000	Single Bouy Mooring
9	Owase	210,000	6 Point Bouy Mooring
10	Sakai	205,000	Pile type dolphin
11	Wakayama–Shimozu	236,000	ditto
12	Wakayama–Shimozu	255,000	ditto
13	Himeji	258,000	IMODCO Bouy
14	Mizushima	235,000	Pile type dolphin
15	Mizushima	200,000	Cellular type dolphin
16	Tokuyama–Kudamatsu	275,000	7 Point Bouy Mooring
17	Ube	250,000	Single Bouy Mooring
18	Ohita	270,000	Pile type dolphin
19	Kiire	500,000	ditto
20	Kiire	500,000	ditto
21	Kin	360,000	ditto
22	Nakagusuku	250,000	Single Bouy Mooring

Fig. 4-8-1 Large tanker berths of 200,000 DWT in Japan

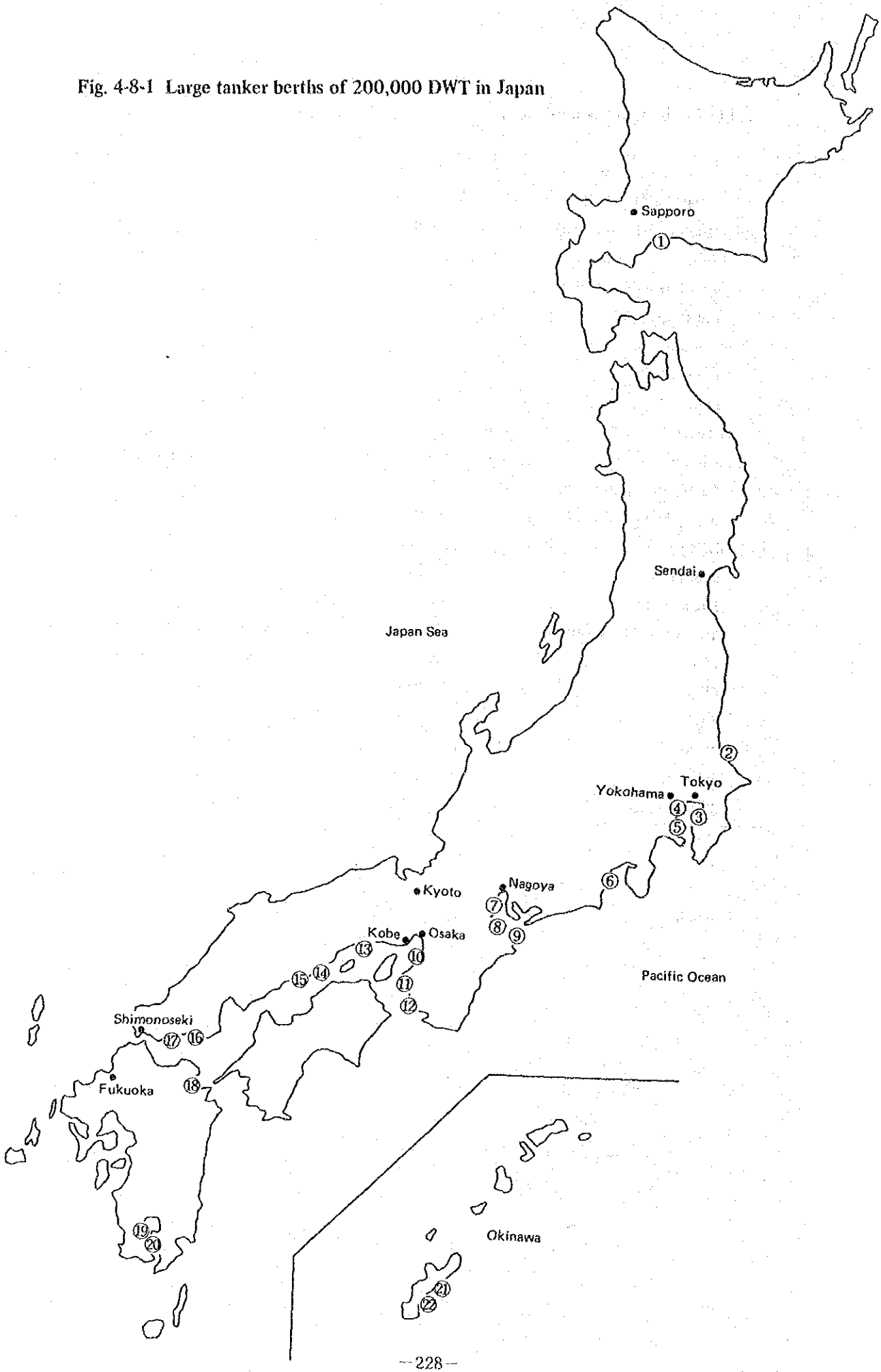


Table 4-8-2 Safety measures for berthing

No.	Name of port	Berthing time	Berthing type	Berthing speed	Berthing condition				Arrangement of tugboats			Line handling work			Remarks
					Unberthable condition	Min. visibility	Max. wave height	Max. wind velocity	Subject ship size	Power of tugboats	Number of tugboats	Working craft	Number of ships	Labour	
1	Tomakomai	from sunrise to sunset	mooring head in	15 cm/sec	b, c, d, e, f, g	1,000 m	0.7 m	12 m/s	250,000 D/W 150,000	3,200 PS 3,200	6 4	Tons 38	1	8	(Unberthable conditions) a. When strong-wind and high-wave warnings issued. b. When electric storm has occurred or threatened to occur. c. When port captain has issued refuge advise to ships in port. d. When manager of refinery has decided that berthing is dangerous. e. When the captain has decided that safe operation cannot be carried out. f. When berthing is found dangerous upon consultation with persons concerned. g. When port captain has so instructed. h. Others.
2	Kashima	from 1 hr after sunrise to 1 hr before sunset	ditto	5	b, c, d, e, h f,g,h	1 sea mile	2	15	200,000	2,200 2,880 1,660	3 2 1	5	2	14	
3	Chiba	from sunrise to sunset	ditto	10~12	b, c, e, f	1 sea mile	0.8	13	100,000 258,000	8,000 20,000	(4) (5)		2	12	
4	Kawasaki	ditto	Approach speed at 0.3–0.5 knots from about 350 m to arrival speed of '0'		a, b, c, d, e, f, g night and course of typhoon	1 sea mile	1.5	15	250,000	3,500	2	80	1	14	
5	Kawasaki	ditto	mooring head in	10	c, d, e, f, g	by judgement of pilot	1.5	15	228,000 74,000	3,400 3,600	5 3	12, 5~36, 96	2	15	
6	Shimizu	ditto	mooring head out	10	c, d, e, f, g, night	1 sea mile	–	15	max 250,000 as directed by pilot	3,900 2,900 1,900	1 1 3	4.8	2	14~17	
7	Yokkaichi	from 8:30 AM to 2 hrs before sunset	mooring head in	–	a, b, c, d, e, f, g	1 sea mile	1	13	275,000	3,500	1	96	1	6	
8	Yokkaichi	from sunrise to sunset	ditto	15	a, c, d, e, f, g	by judgement of captain or pilot	1.5	15		3,200	1~2	83	1	13	
9	Owase	ditto	ditto	–	c, d, e, f	1 sea mile	1.5	15	150,000 210,000 Secure towing P.S of 5~10% of DWT of the entering tanker	2,400 3,200 3,200	1 3 4	4.8 9.74		12	
10	Sakai	ditto	ditto	11 (205,000 D/W)	c, d, e, f, g	0.5 sea mile	1.5	15	150,000 50,000	3,000 2,000	4 2	10	2	15	

No.	Name of port	Berthing time	Berthing type	Berthing speed	Berthing condition				Arrangement of tugboats			Line handling work			Remarks
					Unberthable condition	Min. visibility	Max. wave height	Max. wind velocity	Subject ship size	Power of tugboats	Number of tugboats	Working craft	Number of ships	Labour	
11	Wakayama – Shimozu	from sunrise to 1 hr before to sunset	mooring head out	10 cm/sec	a, b, c, f, g	1 sea mile	1.5 m (determined upon consultation with persons concerned)	15 m/s	50,000~150,000 D/W 150,000~200,000 (increase/decrease the number of tugboats according to wind velocity, tide and load)	3,000 PS 3,000	4~5 5~7	Tons 20	2	15	
12	Wakayama – Shimozu	from sunrise to sunset	mooring head in or head out	12	a, c, d, e, f, g swell within the range of securing safety	0.5 sea mile	2	12	230,000	1,600~3,000	6	19.38	2	13	
13	Himeji	ditto	mooring headin	6~7	a, b, c, d, e, f, g, h night and when unloading cannot be started untill 1 hr before sunset	1 sea mile	1	10		3,000	2~4	105.94 10.80	1 1	average 15	
14	Mizushima	ditto	ditto	5	b, c, d, e, f, g	1 sea mile	1.5	15	235,000 100,000	3,000 2,500	5 4	5	2	8	
15	Mizushima	ditto	ditto	10	b, c, d, e, f	2,000 m	–	15	100,000 200,000	2,500 3,000	4 5	5 6	1 1	8	
16	Tokuyama –Kudamatsu	ditto	mooring head out	–	c, d, e, f, g	–	–	15	275,000 200,000	3,200 3,200	5 4				
17	Ube	ditto	mooring head in	–	b, c, d, e, f, g	0.5 sea mile	1.2	13		3,000	2	118.72	1	6	
18	Ohita	ditto	mooring head in or head out	10	a, b, c, d, e, f, g		1.5	15				56	2	20	
19	Kiire	ditto	mooring head in	5	a, b, c, d, e, f, g	0.5 sea mile	1.5	15	150,000~450,000	3,200 4,200	2 2	17	2	10	
20	Kiire	ditto	ditto	5	a, b, c, d, e, f, g	0.5 sea mile	1.5	15	150,000~450,000	3,200 4,200	2 2	17	2	10	
21	Kin	ditto	ditto	3	a, c, d, e, f	VLCC 3 others 1.5 sea mile	1.5	15	360,000 250,000	13,800 11,200	(5) (4)	32	2	2	
22	Nakagusuku	ditto	mooring head in or head out	10	c, d, e, f, g, h standard height of swell less than 1 m	1.5 sea mile	1.5	15		1,900 2,100	1 1	19.07	1	3	

Table 4-8-3 Safety measures for oil handling

No.	Name of port	Indication of OFF-LIMIT areas	Prohibited area for navigation and anchorage	Indication of prohibited area navigation and anchorage		Management of fire (note 1)	Chief person of unloading and number of security staff	Berth master	Rule to stop the unloading work and disconnecting pipe			Remarks
				daytime	nighttime				Conditions of discontinuing unloading work (note 2)	Max. wave height	Max. wind velocity	
1	Tomakomai	Yes.	30 m	sign (curtain) oil fence	sign (curtain) oil fence	b, c	handling section chief 13 persons	No.	a, b, c, d, e, f, h, i, j, l	1.5 m	15 m/s	Note 1. Management of fire a. indicate points to be observed b. patrol regularly c. indicated fire prohibited area and fire restricted area Note 2. Conditions of discontinuing the oil handling a. earthquake sensor, when more than ____ is felt b. ordered by port captain c. dangerous gas leak is sensed d. abnormal pressure of liquid line e. fire occurs on the berth, aboard ship or in the neighbourhood f. electric storm has occured or threatens to occur g. ships which may endanger the ship are navigating nearby h. refuge advice is issued to ships by port captain i. manager of refinery finds it necessary j. the captain finds it necessary
2	Kashima	Yes.	30	light bouy	light bouy	a, b, c	stevedore head 5 persons	Yes.	b, c, d, e, f, g, h, i, j, k, l	2	15	
3	Chiba	Yes.	30	floating/sinking type oil fence	light bouy	b, c	unloading chief 6 persons	Yes.	b, c, d, e, f, g, h, i, j, k, l	1.5	15	
4	Kawasaki	Yes.		patrol boat sign	patrol boat sign illuminated	a, b, c	berth master 6 persons	Yes.	a, b, c, d, e, f, g, h, i, j, k, m occurrence of oil leak	3.0	25	
5	Kawasaki	Yes.	30	painted on the wall of the pier	painted on the wall of the pier	a, b, c	oil handling man 6 persons	No.	b, c, d, e, f, h, i, j, k, l, m abnormal conditions on shore	–	15	
6	Shimizu	Yes.	50	indication to the pier	watch for berthing of other ships	a, b, c	port head 5 persons	Yes. (crew is only foreign)	b, c, d, e, f, g, h, i, j, k, l, m when ships move fore and aft and alarm started	–	15	
7	Yokkaichi	No.	500	–	–	b	superivsor 5 persons		b, c, d, e, f, g, h, i, j, k	1.5	15	
8	Yokkaichi	No.	300	–	–	a, b, c	head of crude section 5 persons	No.	b, c, d, e, f, g, h, i, j, k	1.5	15	
9	Owase	No.	250	–	–	b, c	manager of marine dept., Owase port service Co., Ltd. 16 persons	No.	b, c, d, e, h, i, j, k	1.5	20	
10	Sakai	Yes.	120	flashing light bouy, installed 11 places	flashing light bouy, installed 11 places	a, b, c	assistant chief or head 10 persons	No.	b, c, e, f, g, h, i, j, k, l	1.5	15	
11	Wakayama –Shimozu	Yes.	50	sign board surrounded by oil fence	light bouy installed at the oil fence	a, b, c	handling section chief 4~6 persons	Yes.	b, c, e, f, g, h, k, l	1.5 (decided upon consultation with persons concerned)	15	

No.	Name of port	Indication of OFF-LIMIT areas	Prohibited area for navigation and anchorage	Indication of prohibited area navigation and anchorage		Management of fire (note 1)	Chief person of unloading and number of security staff	Berth master	Rule to stop the unloading work and disconnecting pipe			Remarks
				daytime	nighttime				Conditions of discontinuing unloading work (note 2)	Max. wave height	Max. wind velocity	
12	Wakayama –Shimozu	Yes.	50 m	oil fence	oil fence light bouy		head of oil storage base 8 persons	No.	b, e, h, i, j, l	2 m	15 m/s	k. decided necessary upon consultation of persons concerned
13	Himeji	Yes.	radius 410	patrol and watch by patrol boat	patrol and watch by patrol boat	a, b, c	berth master 2 persons	Yes.	a, b, c, d, e, f, g, h, i, j, k m Tension of more than 90 tons works on mooring rope and motor siren buzzes	–	15	l. the ship is pulled off the berth m. others
14	Mizushima	Yes.	30	curtain and oil fence (flashing bouy installed)	curtain and oil fence (flashing bouy installed)	b, c	chief of oil handling section 4 persons	Yes.	b, c, e, f, g, h, i, j, k	–	15	
15	Mizushima	Yes.	30	curtain	curtain oil fence light bouy	a, b, c	chief of oil handling section 5 persons	Yes.	b, c, d, e, f, h, i, j, k oil leak discovered and ship shifts	–	15	
16	Tokuyama –Kudamatsu	No.	–	–	–	a, b, c	chief of oil handling section 5 persons	No.	b, c, d, e, g, h, i, j, k	–	15	
17	Ube	Yes.	around the berth	berth master permits berthing		a, b, c	berth master 8~11 persons	Yes.	b, c, d, e, f, g, h, i, j, k	2.0	15	
18	Ohita	Yes.	50	signboard	signboard (fluorescent paint)	a, b, c	loading master 2 persons	Yes.	b, c, d, e, f, h, i, j, k	1.5	20	
19	Kiire	Yes.	100	section curtain	red lamp	a, b, c	operation chief of marine service 4 persons	Yes.	b, c, e, f, h, i, j, k, l when typhoon certainly approaches	2	25	
20	Kiire	Yes.	100	section curtain	red lamp	a, b, c	operation chief of marine service 4 persons	Yes.	b, c, e, f, h, i, j, k, l when typhoon certainly approaches	2	25	
21	Kin	Yes.	50	signboard	sign lamp	b, c	manager of technical dept. 2 persons	Yes.	b, d, e, g, h, i, j, k	1.5	15	
22	Nakagusuku	Yes.	50	signboard	sign lamp	a, b, c	chief of handling section 1 person	Yes.	b, d, e, h, i, j, k, l	1.5	18	

Table 4-8-4 Safety measures for unberthing and emergency

No.	Name of port	Tugboats for unberthing			Base of refuge		Spare tugboat for emergency			Average berth occupying time					Remarks
		Subject ship size	Power of tugboats	Number of tugboats	Max. wave height	Max. wind velocity	Subject ship size	Power of tugboats	Number of tugboats	Subject ship size	berthing time	unloading time	unberthing time	total	
1	Tomakomai	D/W 250,000 150,000	PS 3,200 3,200	 4 3	m 2.0	m/s 30	D/W 250,000 150,000	PS 3,200 3,200	 1 1	D/W 250,000	hrs 4	hrs 31	hrs 1	hrs 36	
2	Kashima	200,000	2,200 2,880	3 2	2	20	200,000	2,200 2,880	3 2	200,000	1.5	42	1.5	45	
3	Chiba	100,000 258,000	5,000 12,000	(2) (3)	–	–	100,000 ~258,000	3,900 1,000	1 1	100,000 ~258,000	2	32	10	44	
4	Kawasaki	all ships	3,500	1~2	by judgement of the captain		all ships	3,500	1	122,000	1.5	29.0	0.5	31	
5	Kawasaki				by judgement of the oil handling section		–	–	–	250,000	2	33	1	36	
6	Shimizu	max. 250,000 as directed by pilot	3,900 2,900 1,900	1 1 2	–	15	–	2,900	1	–	2	21	1	24	
7	Yokkaichi	–	–	–	1.5	15	275,000 100,000	900 350	1 1		2	35~40		37~42	
8	Yokkaichi	–	–	–	1.5	15	–	600	1	230,000				40	
9	Owase				2.0	24					2	20	0.5	22.5	average of past 5 years
10	Sakai	150,000 50,000	3,000 2,000	3 2	2.0	20	–	–	–	150,000	3	30	2	48	about 48 hours for filling ballast water and waiting for unberthing at night
11	Wakayama –Shimozu	50,000~ 150,000 150,000~ 250,000	3,000 3,000	3~4 4~5	2.0 determined upon consultation with persons concerned	20	100,000 ~ 250,000	3,000	1	200,000	2	16~36	1.5	19.5~ 39.5	except hours from berthing to unloading and from finished unloading to unberthing
12	Wakayama –Shimozu	230,000	1,600 ~3,000	4	3	20	230,000	3,000	1		2	24	2	28	
13	Himeji	all ships	3,000	1~2	determined upon consultation with the captain		all ships	3,000	2	all ships	4	46	2	52	
14	Mizushima	235,000 100,000	3,000 2,500	4 3	–	20	more than 200,000	3,000	1	–	0.5	43.0	0.5	44.0	
15	Mizushima	100,000 200,000	2,500 3,000	4 4	–	–	200,000	3,000	1		0.5	40	0.5	41	
16	Tokuyama –Kudamatsu	275,000 200,000	3,200 3,200	3 2	–	–	–	3,200	1	275,000	3	36~48	1	40~52	

No.	Name of port	Tugboats for unberthing			Base of refuge		Spare tugboat for emergency			Average berth occupying time					Remarks
		Subject ship size	Power of tugboats	Number of tugboats	Max. wave height	Max. wind velocity	Subject ship size	Power of tugboats	Number of tugboats	Subject ship size	berthing time	unloading time	unberthing time	total	
17	Ube	D/W all ships	PS 3,000	1	m 2.5 (light draft)	m/s 18	D/W all ships	PS 2,000	1	D/W all ships	hrs 2~2.5	hrs 22~45	hrs 0.5~1.0	hrs 24.5~ 48.5	average 48 hours in case unloading of 200,000 t
18	Ohita				1.5	20				200,000	2	40	1	50	
19	Kiire	150,000 450,000	3,200 4,200	2 2	2	25	all ships	3,200 4,200	2 2	300,000	3.5	30	1	34.5	
20	Kiire	150,000 450,000	3,200 4,200	2 2	2	25	all ships	3,200 4,200	2 2	400,000	3.5	38	1	42.5	
21	Kin	360,000 250,000	13,800 11,200	(5) (4)	1.5	15	360,000 250,000	13,800 11,200	(5) (4)	150,000	2	30	24	56	
22	Nakagusuku				1.5	18		1,900 2,100	1 1	270,000	1.5	35	0	36.5	

Table 4-8-5 Patrol system, watch system and communication system

No.	Name of port	Arrangement of patrol boat	Arrangement of fireboat	Capacity of fireboat	Fire fighting equipment (for berth)			Patrol during oil handling	Remote watch on berth and aboard ship (note 1)	Objects of remote watch (note 2)	Watch of joint part	Method of communication between ship and shore (note 3)	Remarks
					Type	No.	Capacity						
1	Tomakomai	1	1	8,000 ℓ/min	foam monitor nozzle water hydrant foam hydrant air foam liquid tank	2 4 1 1	1,900 ℓ/min 450 ℓ/min 450 ℓ/min 3,000 ℓ	Yes.	–	c	No.	a, b, c by radio	(note 1) Remote watch on berth and aboard ship a. by industrial TV. b. by binoculars c. No. (note 2) Objects of remote watch a. fire b. gas leak c. pressure d. others (note 3) Method of communication a. wire telephone b. microphone c. alarm buzzer d. buzzer e. others
2	Kashima	1	1	4,000 ℓ/min	fire pump proportioner fire hydrant water curtain air foam nozzle remote monitor nozzle	1 2 28 6 4 2	330 t/hr × 14 kg/cm² 500~4,000 ℓ/min 250 ℓ/min 1,600 ℓ/min 2,000 ℓ/min	Yes.	b		Yes.	a, b, c	
3	Chiba	2	1	12,000 ℓ/min	fire pump fire extinguisher fire extinguisher	1 23 2	80 t/hr 20 LB 100 LB	Yes.	b	a, b, c	Yes.	a, b, c, e	
4	Kawasaki	3	2	3.6 t/min × 2				Yes.	b and visual	a, c, d and oil leak	Yes.	e radio ship's telephone	
5	Kawasaki	1 (common use)		fire pump 2.5 m³/min, mixing seawater with chemical 0.5 m³/min, chemical pump 0.07 m³/min	vacuum pump fire fight pump water gun foam fire extinguisher gun air foam liquid pump	1 1 4 2 1	120 m³/hr, 7.5 KW 100 m³/hr × 75 hrs, 37 kw 400 ℓ/min 5.5 kℓ/hr, 3 KW	Yes.	–	a, b, c	Yes.	a, b, c transceivers 3~4 sets	
6	Shimizu	1	–	–	air foam extinguisher gun water gun fire extinguisher fire hose large and small type fire extinguisher	9 6 2 6 4	3,400 ℓ/min 350 ℓ/min 460 ℓ/min 21/2B × 2 × 350 ℓ/min 21/2B × 2 × 400 ℓ/min	Yes.	c	b, c, d	Yes.	a, b, c	

No.	Name of port	Arrangement of patrol boat	Arrangement of fireboat	Capacity of fireboat	Fire fighting equipment (for berth)			Patrol during oil handling	Remote watch on berth and aboard ship (note 1)	Objects of remote watch (note 2)	Watch of joint part	Method of communication between ship and shore (note 3)	Remarks
					Type	No.	Capacity						
7	Yokkaichi	1 (common use)		air foam liquid content 30 m³, fire pump 12,500 ℓ/min × 2 fire extinguisher gun 50 mm × 100 m × 4 25 mm × 100 m × 2				Yes.	b	a, d	Yes.	c	
8	Yokkaichi	1	1		–	–	–	Yes.	a, b	a, c, d	Yes.	c	
9	Owase	1 (common use)		366.5 m³/hr				Yes.	b	–	Yes.	b, c radio	
10	Sakai	1	–		foam powder (fixed) powder (portable)	8 1 50	1,380 t/hr 2,000 kg	Yes.	a	a, b, d	Yes.	a, e	
11	Wakayama –Shimozu		1 tugboat for waiting has 5,000~7,000 ℓ/min	1,800 ~3,000 ℓ/min	air foam extinguisher gun (fixed) (semi-fixed) water curtain powder	 2 6 1	 3,000 ℓ/min 800 ℓ/min 4,120 ℓ/min	Yes.	a	a, d	Yes.	a, b, c, d, e portable radio	
12	Wakayama –Shimozu	1	1 (only nighttime)	7,000 ℓ/min fire extinguisher liquid content 6t	fire monitor water curtain foam and water extinguisher	3 44 4	3,000 ℓ/min × 3 3,040 ℓ/min 200 ℓ/min × 4	Yes.	a, b	a, d approach of other ships	Yes.	a, b, e radio	
13	Himeji	3	2~3	max 27.7 kℓ/min	diesel fire pump BC fire extinguisher	1 6	0.5 kℓ/min 48 kg	Yes.	c	–	Yes.	e radio	
14	Mizushima	1 (common use)		2,000 ℓ/min	powder extinguisher gun water gun air foam and water extinguisher gun powder extinguisher	2 2 2	2t 1,600 ℓ/min 1,800 ℓ/min	Yes.	a	a	Yes.	e transceiver	

No.	Name of port	Arrangement of patrol boat	Arrangement of fireboat	Capacity of fireboat	Fire fighting equipment (for berth)			Patrol during oil handling	Remote watch on berth and aboard ship (note 1)	Objects of remote watch (note 2)	Watch of joint part	Method of communication between ship and shore (note 3)	Remarks
					Type	No.	Capacity						
15	Mizushima	1 (common use)		2,000 ℓ/min	water gun fire hydrant fire fighting equipment (semi-fixed) fire extinguisher (powder) ditto (foam)	2 2 mouth × 2 2 mouth × 2 5 1	500 ℓ/min × 7 kg/cm² 800 ℓ/min × 9 kg/cm² 1,000 ℓ/min	Yes.	c	–	Yes.	b	
16	Tokuyama –Kudamatsu	3	1 (other 2 ships waiting in the port)	fire pump 2,000 ℓ/min × 2 3,000 ℓ/min × 1 fire extinguisher liquid 15,000ℓ	tugboat fireboat	1 1	fire pump 3, 7,000 ℓ/min fire pump 1, 3,300 ℓ/min	Yes.	b	a	Yes.	e transceiver	
17	Ube	2	1		fireboat patrol boat assistant boat		1,500 t/hr 170 t/hr 60 t/hr	Yes.	by visual	d shock and electric line	Yes.	e radio or ship's telephone	
18	Ohita	1	1	960 kℓ/hr	fire hydrant fire extinguisher fireboat tugboat for fire fight	4 4 1 1	280 kℓ/hr 960 kℓ/hr	Yes.	b	–	Yes	a, b, c, e	
19	Kiire	1	1 waiting where accessible in 15 min.	3,000 ℓ/min (foam) 1,000 ℓ/min (water)	fire hose fire nozzle fire hydrant foam extinguisher gun	10 5 5 1	400 ℓ/min – 3,000 ℓ/min	Yes.	b	a	Yes	a, b, c, e radio	
20	Kiire	1	1 waiting where accessible in 15 min.	3,000 ℓ/min (foam) 1,000 ℓ/min (water)	fire hose fire nozzle fire hydrant foam extinguisher gun	12 6 6 1	400 ℓ/min – 3,000 ℓ/min	Yes.	b	a	Yes	a, b, c, e radio	

No.	Name of port	Arrangement of patrol boat	Arrangement of fireboat	Capacity of fireboat	Fire fighting equipment (for berth)			Patrol during oil handling	Remote watch on berth and aboard ship (note 1)	Objects of remote watch (note 2)	Watch of joint part	Method of communication between ship and shore (note 3)	Remarks
					Type	No.	Capacity						
21	Kin	1	1	7,500 ℓ/min	fire pump sprinkler fire hydrant	3 7 14		Yes.	b	a, c, d	Yes.	a, d, e	
22	Nakagusuku	1	1	10,000 ℓ/hr equipment of tugboat is used				Yes.	c		Yes.	portable radio	

Table 4-8-6 Disaster prevention system, Recovery system and Maintenance

No.	Name of port	Disaster prevention system		Responsibility of recovery	Waste oil removing equipments and materials		Periodical inspection			Committee for safety operation of berth
		individual	organized		Type	No.	general inspection	loading arm	pipeline	
1	Tomakomai	established	established	oil receiving factory	treating chemical oil fence (submerging/floating type) straw mat absorbent	20,980 ℓ 1,548 m 500 sheets 3,760 sheets	times/year 15	times/year 15	times/year 15	Yes.
2	Kashima	ditto	ditto	oil receiving factory	oil fence emulsifier absorbent	900 m 100 cans 50 cases	2	before berthing	2	
3	Chiba	ditto	ditto	oil handling company	oil fence (submerging/floating type) portable oil fence neutralizer oil absorbent	1,454 m 400 m 18 ℓ x 498 cans 1,000 kg	1	1	1	Yes.
4	Kawasaki	ditto	ditto	oil receiving factory oil handling company (captain)	oil fence treating chemical absorbent oil recoverer	6,400 m 27,520 ℓ 4,100 kg 4 sets	1	1	1	Yes.
5	Kawasaki	ditto	ditto	oil receiving factory	chemical oil catcher fence	18 ℓ x 50 1,000 sheets x 50 cases 400 m	4~5	6	4~5	Yes.
6	Shimizu	ditto	ditto	oil receiving factory or oil handling company	oil fence treating chemical oil catcher	2,500 m 12,600 ℓ 20,000 sheets	2	20	48	
7	Yokkaichi	ditto	ditto	oil receiving factory	emulsifier oil fence absorbent	16,400 ℓ 2,000 m 3,900 kg	¼		1	Yes.
8	Yokkaichi	ditto	ditto	oil recieving factory oil handling company (captain)	oil fence treating chemical absorbent	2,660 m 13,626 ℓ 3,550 kg	1	–	365	Yes.
9	Yokkaichi	ditto	ditto	oil receiving factory			¼		1	
10	Sakai	ditto	ditto	oil receiving factory captain	oil fence absorbent treating chemical	3,220 m 5,000 kg 5,400 ℓ				Yes.
11	Wakayama –Shimozu	ditto	ditto	causer	oil fence treating chemical absorbent other workboats	4,300 m 5,000 ℓ 4,400 kg	95 inspect during oil handling against check list	95	95	

No.	Name of port	*Disaster prevention system*		Responsibility of recovery	Waste oil removing equipments and materials		Periodical inspection			Committee for safety operation of berth
		individual	organized		Type	No.	general inspection	loading arm	pipeline	
12	Wakayama	established	established	causer	oil fence absorbent surfactant	2,200 m 3,016 kg	times/year 1	times/year 1	times/year 1	
13	Himeji	ditto	ditto	oil receiving factory	oil fence absorbent treating chemical	2,500 m 6,000 kg 20 kℓ	1	1	1	
14	*Mizushima*	*ditto*	ditto	oil receiving factory	oil fence A type B type treating chemical absorbent	4,500 m 1,200 m 18,738 ℓ 4,335 kg	2	1	365	Yes.
15	Mizushima	ditto	ditto	oil receiving factory oil handling company	oil absorbent treating chemical oil fence (B type)	11,400 kg 22,700 ℓ 5,000 m	before berthing			Yes.
16	Tokuyama —Kudamatsu	ditto	ditto	oil receiving factory oil handling company	oil fence others	1,110 m	1	12	12	Yes.
17	Ube	ditto	ditto	oil receiving factory ship's owner	oil fence oil absorbent treating chemical	1,500 m 2,320 kg 2,800 ℓ	1	floating arm 30	submarine hose 24	Yes.
18	Ohita	ditto	ditto	oil receiving factory	oil fence (B type) (others) treating chemical oil absorbent	1,200 m 2,000 m 10.8 kℓ 2,175 kg	72	72	72	
19	Kiire	ditto	ditto	ditto	treating chemical oil absorbent oil fence	720 ℓ 2,000 sheets 1,240 m	1	12	12	Yes.
20	*Kiire*	*ditto*	ditto	ditto	treating chemical oil absorbent oil fence	900 ℓ 2,000 sheets 1,704 m	1	12	12	Yes.
21	Kin	ditto	ditto	oil receiving factory oil handling company			1	2	1	
22	Nakagusuku	ditto	ditto	oil receiving factory	oil fence absorbent treating chemical	2,200 m 4,039 kg 6,200 ℓ	1		1	

4-8-7 Suggestions for Safety and Disaster Prevention Measures at Industrial Ports in Mexico

Based on matters mentioned before, we will present below subjects to be studied for safety and disaster prevention measures for the industrial ports which are currently developed.

(1) Safety Countermeasures in Port Planning

As port layout planning and facility planning are prepared to display effectively various functions, there may arise safety problems.

For instance at the port entrance, while it is required to secure safe and wide waterways for maneuvering ship against wind, wave and current, etc., narrow waterways are desirable to secure calmness in the port.

In most cases, size of facilities are decided by experience and various experienced units. In Japan, study from the standpoint of safety such as study of range of disaster caused by expansion range of oil surface, dispersion of combustible gas, radiation heat by surface fire has been carried out recently using computer simmulation, etc. and using above data arrangement from the standpoint of sufficient safety space is provided.

In planning industrial ports in Mexico, technology assessment may be carried out by computer simmulation as mentioned above.

A study of port planning with an emphasis upon environment and safety will become necessary.

In most cases, ports are put on service before they are completed and in such cases countermeasures for safety will be necessary because it is liable to be forgotten.

(2) Safety Countermeasures in Management and Operation

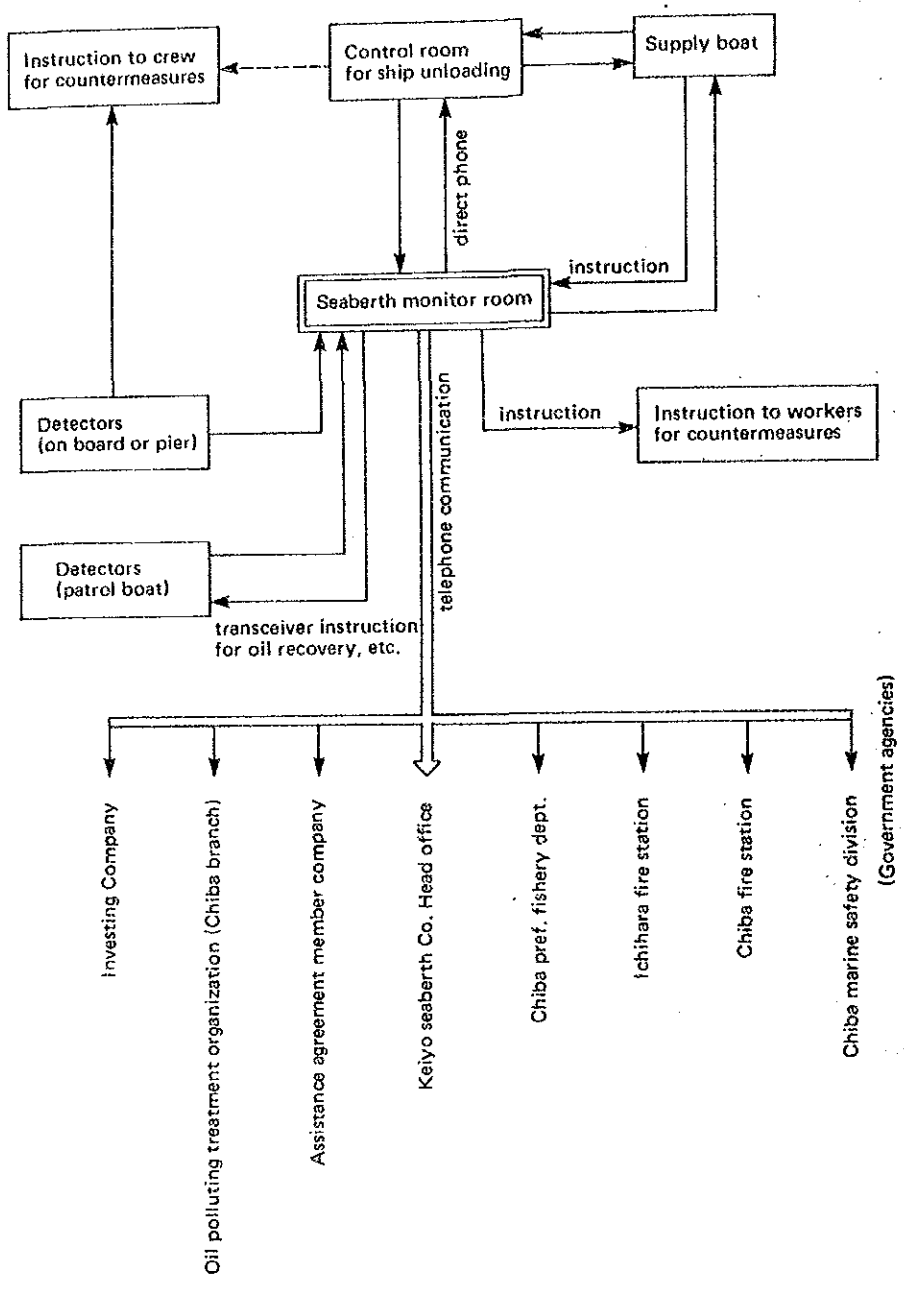
Safety problems of ports cannot be solved by development of port facilities alone, but proper management and operation are necessary to accomplish their effects. Many agencies are involved in ports such as administrator, users, etc.. For securing safety of ports, it will be necessary for related agencies to cooperate closely and meet customers' requirements. For enforcing detailed safety control, each port must set its safety standards and carry out work based upon these standards and patrol of ports and provide close communication system.

As an example of safety standards of large tanker berth, an outline of CHIBA Port Seaberth Safety and Disaster Prevention Countermeasures is attached for your reference.

(Reference)

Outline of safety and disaster prevention countermeasures at port of Chiba

(1) Emergency communication system diagram



(2) Safety Standards

Safety control of work on board the ship berthing at this terminal must be undertaken by you, captain of this ship under your full responsibility.

However, in case disaster occurs aboard the ship, we request your full cooperation and understanding with regard to the safety standards listed in ship/shore check list before starting the work in view of possible grave damage to be inflicted upon our employees, properties and other ships.

These safety standards have been prepared by International Terminal Operator in cooperation with the representative of International Tanker Industry and are based on the provisions of safety work rule presently adopted by petroleum and tanker industries.

Therefore, we expect you and your men working under your direction strictly observe the safety standards while the ship is berthed at the terminal.

We also wish to do our best in securing safety and extend full cooperation for our mutual benefit of safe and efficient performance of work.

In order to confirm your observance of these safety standards, we intend to send our men to your ship from time to time and to inform you of such intent and to inspect the loading deck and living quarters in certain order accompanied by one of your officers.

In the event any violation of these safety standards is discovered aboard the ship, it will be immediately notified to you or your agent for immediate attention and correction. Should such immediate correction be not carried out, action we consider most appropriate for the occasion will be taken and you will be so notified.

In the event you find terminal attendant violating these standards either on the pier or aboard the ship, you are required to immediately notify the terminal personnel in charge of the ship.

You shall be given full right to immediately discontinue work, should our action or equipment under our control threaten immediate safety of your ship.

Terminal personnel in charge of the ship _ _ _ _ _ _ _ _ _ _ _ _

Telephone No. _ _ _ _ _ _ _ _ _ _ _ _

In case of serious violence of these safety standards by your ship or in case such is not corrected immediately, we shall reserve the right to discontinue the whole work and remove the ship concerned from the berth and request the charterer of the ship concerned or the owner of the ship to take measures deemed appropriate.

(3) Table of Confirmation of Ship's Safety

Ship's name _____ Date _____

Confirmed by the ship _____

Confirmed by the berth side _____

Item	Content of confirmation	Confirmed by ship	Confirmed by the berth side
1	Whether smoking rule observed.		
2	Safety standards of gallery observed.		
3	Safety standards of naked fire observed.		
4	Whether power supply disconnected from wire connected to portable equipment.		
5	Whether power supply 'OFF' for aerial of ship masters' transmission and rader.		
6	Whether torch lamp approved type.		
7	Whether portable wireless type approved.		
8	Whether doors of central residential area facing outside and openings all closed.		
9	Whether doors and openings all closed in the residential area at the stern which are required closed.		
10	Whether the ship safely moored and the use of tension winch discussed.		
11	Whether loading line correctly attached and blind plates placed over the line not in use.		
12	Whether seavalve and outlet valve closed and fastened securely while not in use.		
13	Whether scupper effectively plugged.		
14	Whether communication system between ship/shore established.		
15	Whether cargo tank and fuel tank all covered.		
16	Whether cargo tank opened to the air through ventilation system agreed upon, during loading/unloading.		
17	Whether fire hose and equipment readily usable.		
18	Whether emergency tug boat wire correctly installed.		
19	Whether the ship readily movable by itself.		
20	Whether treatment equipment ready in case of oil leak.		

Notes.

1. In confirming each item as above listed must be strictly done attended by personnel in charge of safety from both ship and berth side.
2. This table shall be confirmed by signature or seal of the respective party.
3. A copy of this table is kept by the ship and by the port.

(4) Instruction in case of fire

Do not hesitate to sound alarm.

Fire alarm of the ship at berth at the terminal

Besides continuous sounding of general alarm signal, sound a whistle more than 3 times. Each sound should continue more than 10 seconds.

Fire alarm at the terminal

Fire alarms at the terminal are as follows.

1. Transceiver, direct telephone between ship and shore
2. Long continuous sound by motor siren

Actions to be taken by the ship

Fire aboard the ship

- Sound alarm
- Fire fighting work and prevention of fire expansion
- Notice to the terminal
- Discontinue loading/unloading and close all valves
- Be ready to remove hose or arm
- Engine ready

Fire on other ships or at the terminal.

After fire is notified, the following actions are directed if necessary.

- Discontinue loading/unloading work and close all valves.
- Remove hose or arm.
- Engine ready and posting crew for unberthing operation.

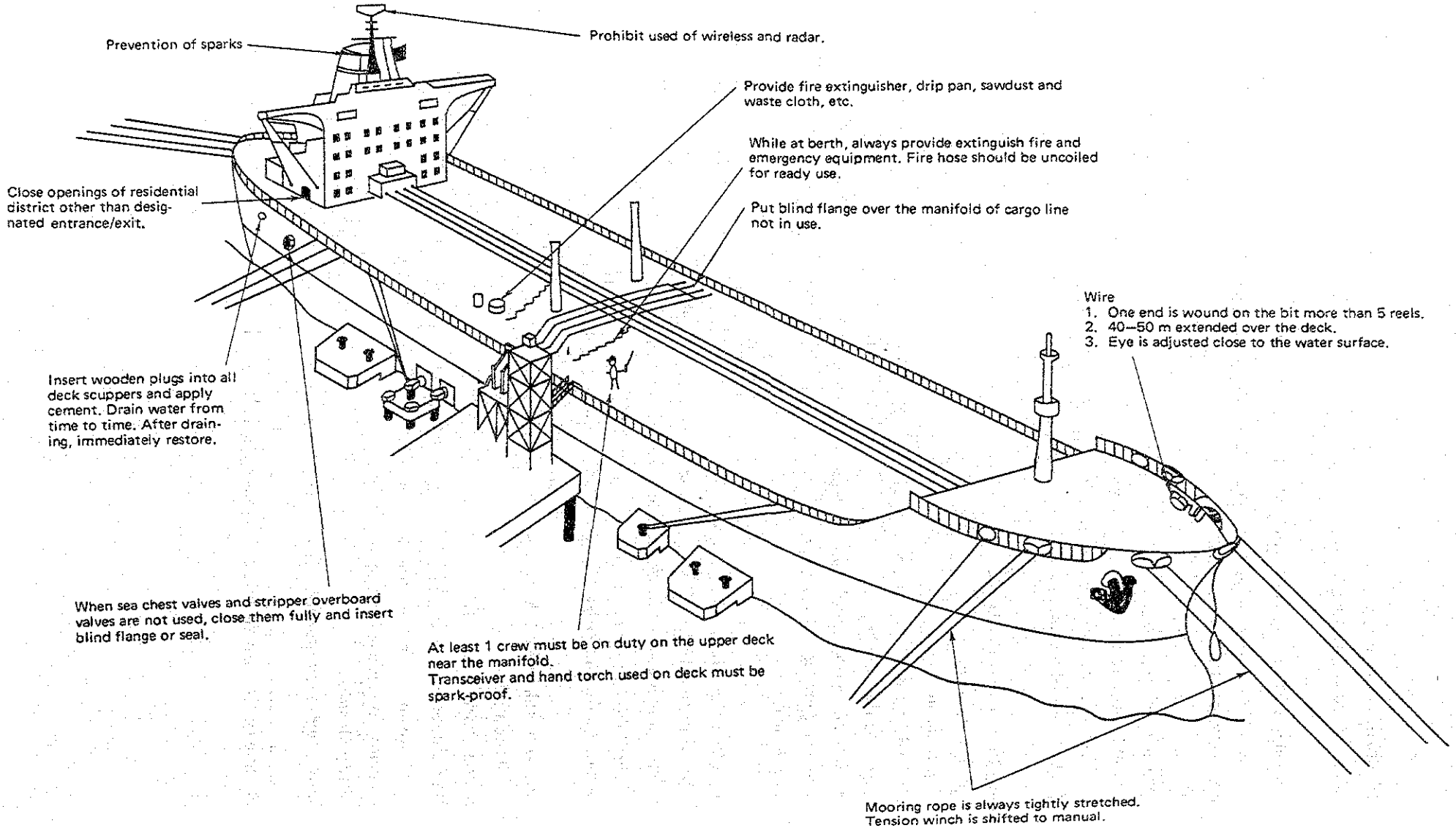
Actions to be taken by the shore side

Fire at the terminal

- Sound alarm
- Discontinue all loading/unloading and close all valves
- Fire fighting work and prevention of expansion of fire.
- Be ready to remove hose or arm if required.
- Notify all ships.
- Issue emergency measure for the terminal

At the time of fire, traffic control is encorced at the terminal.

(5) Ship's safety rule diagram



4-9 EXECUTION AND SUPERVISION OF PORT CONSTRUCTION

4-9 EXECUTION AND SUPERVISION OF PORT CONSTRUCTION

4-9-1 Precautions in Port and Harbor Works

Generally, the master plan for port and harbor works is formulated, first of all. Then, the design for the plan is conducted and, after it is completed, the execution of works is started. For the execution of the works, in order to realize the slogan "Better, Faster and Cheaper", the scheme of execution as preliminary preparation is discussed and, in order to complete the works as scheduled, the supervision of the works is conducted. In the execution scheme and supervision of the works, the following matters shall be discussed:

(1) Scheme of Execution

a. How to supply construction materials, such as cement, sand, stone and steel materials.
b. How to execute the works
c. Preparation of time schedule of work and setting-up of construction equipment and crafts.
d. How to furnish the construction equipment and crafts.
e. Setting-up of the yard for the production of caissons, blocks and others; and Establishment of operation base.
f. Forecasting system for atmospheric and marine phenomena.
g. Control system of working crafts.
h. Safety control system for the construction

(2) Executive control of Works

In the supervision of works, the progress of the construction is chedked as to whether or not it is done as scheduled for the completion of the work within the construction period and, besides, as to whether or not it is done as designed. The supervision of works is generally carried out as follows:

a) Preparation of management scheme of the construction schedule for the supervision

In order to conduct the supervision of works in an affective manner, the management scheme of the construction schedule should be prepared as follows:

① The order in the execution of works are indicated.
② The period required for the execution of works can be grasped
③ The progress of works can be grasped
④ The major processes to be controlled is clarified.

For the preparation of the execution control, there are several methods such as guntt chart, bar chart and network (PERT CPM). The comparison of these methods are shown in Table 4-9-1. As apparent from the table, the network method is superior to the others in the comprehensive evaluation. Especially in the construction having many works, its characteristic features are displayed so that it is favorable in the execution control.

On the other hand, even the bar chart can be effectively utilized in a comparatively simple

construction having less works of execution. Therefore, it is necessary to use their respective methods according to the type of construction. However, in large-scale works such as the construction of industrial ports in Mexico, it is necessary to carry out the execution control using the network system.

Table 4-9-1 Comparison of Execution Control Method

	Gantt chart	Bar chart	Network (Arrow diagram)
Order of execution	×	△	○
Period	×	○	○
Progress of works	○	△	○
Critical works	×	×	○

Note: ○ known × unknown △ middle

b) Instruction of Works

For the execution of works, it is necessary that arrangement should be made as to the progress of works through the meeting by the engineers of both parties (client and contractor). Further, when any problem takes place, arrangement should be made by the engineers for a better progress of works. For every day's operation, construction superviors give instructions to the operators according to the work schedule, and it is preferable to give instructions with management scheme of construction schedule, if possible.

c) Control of Operational Volume

When any deviation is found between the actual volume of operation and the standard volume of operation, the causes of the deviation shall be investigated and the countermeasure against the delay of operation shall be taken for the maintenance of the standard volume of operation. As the main causes for the variation of operation, the following can be considered, so it is desirable to investigate those problems.

① Variation of operation due to atmospheric and marine phenomena
② Change in the conditions of soils and others
③ Failure in work crafts and machines
④ Accidents and lowering of ability in operators
⑤ Fatigue of laborers
⑥ Insufficient equipment

d) Control of Work Progress

Comparison should be made between the actual progress of works and the schedule of works, taking proper time intervals, such as 1 day, 1 week and 1 months.

In dredging work, check is often done every week or every ten days; and in placing of concrete, it is done every other day in most cases.

When the operation is delayed, the cause should be investigated and proper measures, such as

the increase of work crafts, change of operators and increase of divers, should be promptly taken.

e) Safety Measure

In Japanese waters, there still remain considerable mines used during the World War II. Further, there are several waters where cannon balls and others were thrown in. Therefore, the standard for the detection of mines is established and the magnetic detection is carried out to ensure the safety. In addition, the conditions of operation limit (wind velocity, wave height, etc.) is set and the refuge base is planned for the safety of working crafts on a stormy weather.

f) Execution Precision and Inspection

Execution precision shall be set so as to realize the designer's intention and work is conducted in such a manner. Then, the completion of inspection shall be the completion of construction.

4-9-2 Problems and Suggestion on the Construction of Industrial Port in Mexico

Through several field surveys, the construction of Altamira port and Dos Bocas port could be observed. Therefore, the problems that were felt through the observation, and the measures to be taken for those problems will be described below.

(1) Planning for the works

Works should be carried out until the completion of the studies and planning. In other words, the detailed design is required in order to be able to bid the work and select the contractors, before the construction is carried out. In order to have harmonic progress, the genral programme should be coordinated and reviewed.

A very good project management system has been achieved in C.P.D. using network method two important aspects are remarked:

a. Wide study and cautious determination of the lay-out.
   If you have a defective study and planning, the general project will have mistakes, even if the coordination system is ideal.
b. Monitoring function.
   In the reports that will be given to the highest authorities on the progress of each section, the recommendations are also of great importance.
   The high authority should have enough leadership to strictly perform the necessary measurements in each section in accordance to review and investigate the reports.

(2) Carrying out of Port and Harbor Construction

Prior to the start of port and harbor works, sufficient survey should be done for the execution of the work and, besides, the scheme of execution should be prepared. In order to accelerate the progress of the whole process, if the works are allowed to start before the survey is completed or reliable design and estimation are prepared, finally the construction is liable to be

delayed due to the obstacles generating during the several works.

If the construction work has to be accelerated, the work should be commenced, carefully, from the part where you have experienced and can execute confidently. On the other hand, the field surveys of natural conditions and hydraulic model studies are to be conducted to finalize a port plan.

Once the works are started, these should be carried out without any hesitation. If layout is not decided after commencing the work by the contractors, they will get worried.

(3) Safety of Construction Work

Large dredgers have to be employed to excavate huge amount of sand in the Altamira port area. But special caution will be required at the dredging of entrance area, since the area is exposed to the open sea. It is also necessary to consider rough sea conditions due to cyclones and nothern winds. In the same case in Japan, usually a sheltered small basin is constructed first in keeping a safety-anchorage for the dredgers and work vessels.

Furthermore, there should organize a system whereby the construction director could learn the whole matter and the line of commanding orders are clearly established. Meteological data is constantly collected and appropriate instructions be given to the working vessels for their going into shelters by order through this organization.

In some Japanese construction offices, each 24 hours and one week forecast of coming wave characteristics are provided or obtained from the specific firm under a contract.

(4) Work Supervision Structure

The resident supervisor will be given the necessary power by the superior authority; nevertheless the responsibility will be shared by both parties in the case of any lack of construction material required in the design, because this would create a defect during the construction period.

Even you have a very well prepared design, it will not have any significance, if the works are not executed in accordance. For that purpose a strict supervision is required. In the construction of Dos Bocas port, only three or four supervisors from PEMEX were found, but the number of supervisors is too small for the scale of the construction. Therefore, it is recommended to utilize consultant companies to obtain the sufficient supervisors, if necessary.

(5) Working Orders of the Supervision

For example, I have heard a change in the instruction of the supervising authority at Altamira-dredging-work that the dumping area of dredged spoil has been altered to the lagoon area accompaning with a reclamation work, which was once permitted to dump into open sea. The new work is technically very difficult. The supervisor has to issue an order of work alternation upon a technical confidence backed up an adequate examination for the working procedures. It should be avoided for the authority to ask the contractor to change the works easily at times.

(6) *Construction Material*

The lack of construction material, such as the cement which is necessary for the development of the zone; has a direct influence on each work. If there is a complete supervision and inspection for the works, the responsibility should be one the superior authority. This implies to change the plan or supply the material using any other method. If this is not done, the works will be carried out with some defects.

(7) **Deviation Allowance for the Construction Supervision**

A civil engineering structure has to be completed to meet the original design in shape and also in the selection of building materials. The execution can not be carried out in a judgement of a contractor alone.

I think that a standard allowance should be prepared on an agreement between two parties of a construction work to define the allowable deviation for each structure. When I visited the working site of Dos Bocas Port, I have learned the supervisor has no solid standard for controling the accuracy of structural works or selecting of work materials yet. The supervising work should be based on some standards which are decided upon sufficient consultation with the design people.

(8) **Inspection**

In order to carry out the construction work in a favorable manner, the inspection system as well as the supervising method is required. Accordingly, in the same manner as the C.P.I. has the control of the whole processes of the development program, each works of execution should be controlled by the field office and, after the inspection is successfully completed for the assurance of work precision, the work of the next stage should be conducted.

(9) **On the Execution of Rubble Mound Breakwaters**

As the result of checking the design and observing the construction of rubble mound breakwaters at Dos Bocas Port, the following can be mentioned:

a) Design

It seems to me that the breakwater design is too complicated for a rubber mound structure, these might be mentioned after a more detailed study in reality. I asked whether the cross section could be more simple to the engineers who are now engaging with the work. The answer was they felt no difficulty at the moment and were trying to follow the given design as much as possible.

A civil engineering structure should be build with the selected materials defined in the design and shaping as close as to the design. If the execution is unsufficient and rough, the structure is not getting a designed function, even if the best planning and an excellent structural design were prepared, especially, it is said when the structures are built underwater like our port facilities.

b) Riprap Work

The bottom layer of the jetty which is indicated as thick as 50 cm, is considered to be designed to prevent scouring by waves. I have heard that they fed the rocks more than designed amount because of the sinking into the sand layer, the sinkage was confirmed at the test in-situ preceding the real execution.

This lowest layer is the most vulnerable part of this structure, therefore a confirmation of the completed shape is recommended again at the site.

c) Armour Stone Work

Armour stone is designed to use rocks of 2.6 ton in average. I have observed some smaller rocks included for this armour. A question was arisen to me for the selection of rock weight whether they have an allowance standard for the rock size to allow to lay on the armour layer.

d) Concrete block work

Looking at the concrete blocks for the armour layer and the parapet works, I have found many of them lost their corners because of a very rough transport, which might not be a defect functionally, however some of them have a crack in the body. These cracked concrete blocks should be avoided in a proper use as a matter of course. The cause of the crack is usually by the transport at an unsufficient curing period. The engineers at site explained they have kept 28 days for curing after casting concrete at site. I wonder the way of curing if they have not treated promptly as kept in wet condition during these curing period.

Curing will effect severely on the strength of the concrete structures in general. Even if a test piece in a laboratory showed a designed strength, the real structure might be less strong unless a proper curing is carried out.

I have informed that the quality control is continuously done cooperating with their laboratory, and the strength is obtained usually more than fc = 200 kg/cm^2 (designed value).

Some concrete blocks showed the segregation of material, which might be resulted from the material control process at the mixing plant. We have encountered a cement storage shed where the packed row cement were piled up as much as 20 sacks.

e) Comment

Then, I would like to comment here on several point after visiting Dos Bocas site, of course, some of them might be uncorrect because of the short visit and having not enough time to examine the basic control data for the execution works. At first, the execution work has to be controled at the most care, thus a standardized allowance for the execution deviations has to be defined between designing and executing engineers, since the deviation from the designed section could not be avoided when we execute any civil engineering structures. So, we are going to control these deviations in some predecided allowances.

In the work at Dos Bocas, I could not find this standard allowance for each work. I would like to recommend to make a standard for deviation control by the supervising engineers after consulting with the designing engineers. Supervising works could be carried out easily when the engineers have this controlling standard. In the course of discussions between design and execution people, some negotiation to determine the deviation allowances will be needed. The deviation allowances will be shown not only for the structural dimensions, but also for the size of

rocks of breakwaters.

Regarding the quality of concrete, the strength-test with the test pieces will be supplemented with the assay of fresh concrete.

Furthermore, it is recommended a high consistency concrete has to be introduced for marine structures.

4-9-3 Common Specification of Port and Harbour Construction in Japan

The port and harbour construction works in Japan have been carried out according to the common specification of port and harbour work (complied by the Ports and Harbours Bureau, Ministry of Transport). For the purpose of executing the works in a smooth manner, this common specification has been prepared and composed of the general for the port and harbour works as a whole and other chapters for specifications of the scope, materials, execution and inspection in each type of work.

In this section, as the reference for the port and harbour works in Mexico, the general of the common specification, prescribing the scheme of execution, supervision of works, safety control, etc., and other specifications of various stages, especially centering around the rubble mound breakwaters that have been taken up as a serious problem in the port and harbour work in Mexico, will be described below.

Extract from Common Specification of Port and Harbor Works in Japan

Chapter 1 General

1-0-1 Scope

1) This specification applies to the execution of contract work for ports and harbors, carried out by the Ports and Harbors Construction Bureau, Ministry of Transport.
2) The items not specified in this specification and the items not performed in accordance with this specification shall be provided in the special specification.
3) The items described in the drawing and special specification supersede those of this specification.

1-0-2 Field inspector

When necessary, a superintendant may have field inspectors (when two or more field inspectors and assigned, one of them shall be a chief field inspector) as his assistants performing his duties instead of him.

1-0-3 Definitions of terms

In this specification, the terms, Supervisor, Approval, Conference and Instruction, shall be defined as follows:

1) Supervisors mean superintendants and field inspectors.
2) Approval means the acknowledgement by the supervisor on the items reported by the contractor for the necessity of recognition regardless of the items described or not described in the specification.
3) Conference means the deliberation between the supervisor and the contractor, on a level.
4) Instruction means the indication to the contractor from the owner about the policy, standard and others on the items specified in the specification and other items among the supervisor's duties, which are thought necessary for the execution of the works.

1-0-4 Written execution scheme

1) Prior to the execution of works, the contractor must submit the following execution scheme to the supervisor.
   (1) Progress schedule
   (2) Execution method
   (3) Crafts and machines to be used
   (4) Execution control plan
   (5) Safety control plan
2) When any serious change takes place in the execution scheme, the contractor must submit a modified execution scheme to the supervisor.

1-0-5 Effecting of insurance

1) For the work crafts and their crew to be engaged in the works at the water area where the remaining explosives are often found, the contractor shall effect mine insurance and accident insurance in accordance with the provision described in the special specification.
2) When the work crafts, caissons and the like are brought to a certain area, the contractor shall effect bringing a ship insurance.

1-0-6 Survey

1) The surveys required for the execution of works must be conducted by the contractor, and their data must be submitted to the supervisor when their submission is required. However, the following surveys for the face line and base line, almost corresponding to the face line, shall be conducted by the contractor with the supervisor in attendance.
   (1) Sounding and waterway survey areas
   (2) Inquiry work area
   (3) Soil examining location
   (4) Dredging and bed removal existing foundation areas
   (5) Soil improvement area

(6) Rubble mounding and leveling areas
(7) Concrete blocks installation face line
(8) Breakwater, wharf and revetment face line
(9) Apron pavement area
(10) Reclamation area
(11) Earthwork area

2) Datum level for works
The datum level for works shall be as prescribed in the special specification.

1-0-7 Materials to be used

Construction materials, even though they have passed the inspection at delivery, shall not be used when they are regarded as degenerate or defective by the supervisor immediately before use.

1-0-8 Materials supplied and things lent

1) Material supplied and things lent shall be handed over or returned through the inspection and confirmation in the presence of both the supervisor and the contractor in accordance with the descriptions of drawing and specification.
2) When the repairs and the like of the material supplied and things lent are conducted by the contractor, the approval of the supervisor must be obtained beforehand.
3) The materials supplied and things lent must not be used for other works.

1-0-9 Work report

1) The contractor must submit the work schedule to the supervisor when it is instructed.
2) The contractor must submit the daily report for the work as instructed by the supervisor.

1-0-10 Working hours

In case the contractor must perform the work out of the duty hours of the supervisor or on a off-day due to the execution schedule of work, conference must be made with the supervisor in advance.

1-0-11 Execution control

1) Execution control test
(1) The tests and their sampling in accordance with the drawing and specification must be conducted by the contractor in the presence of the supervisor, and the methods of the tests must be based on those specified in the Japanese Industrial Standards (hereinafter referred to as "JIS") or the methods instructed by the supervisor.
(2) When unique tests, studies and the like are conducted by the contractor for the execution of works, the approval of the supervisor must be obtained on the concrete items of the test and study, and the method of expressing the results.

2) Photographs of works

(1) The contractor shall take the following pictures as the records of the works, and the requested pictures must be submitted to the supervisor.

(a) General conditions of work executed

(b) Sites where observation can not be done from the outside after the completion of work

(c) Other sites instructed by the supervisor

(2) When taking record pictures, a scale (measuring tape, pole, staff, etc.) must be photographed together with the object so that the size of the object can be clarified.

(3) The size of the picture shall be 9 cm x 5.5 cm (size of name card) or more, and the pictures taken must be pasted in an album in the order of works executed, with the descriptions of sites, date and brief explanation.

3) Report of completed amount of work

The contractor must submit the data required for the confirmation of completed amount of work which is requested by the supervisor.

1-0-12 Inspection of work

On the inspections for the completed work and partially completed work, inspections shall be conducted in the presence of field proxy and chief engineer (supervisory engineer).

1-0-13 Observance of laws and regulations

The contractor must observe the related laws and regulations on the execution of works. Further, before the execution, all legal formalities must be promptly completed at the Governmental authorities concerned. Further, when the approval, consent, etc. for the above formalities are obtained, their copies must be submitted to the supervisor.

1-0-14 Field management

1) When other works are conducted at the same worksite or in the neighbourhood, the contractor must keep contact with the other contractor to prevent troubles from taking place.
2) Prior to the execution of works, the contractor must set up a sign board showing the type of work, execution period, name of owner, name and address of contractor, at a proper place of worksite, in which passers-by can easily easily notice it.

   After the completion of work, the sign board must be promptly removed by the contractor.
3) When the work is completed, the contractor must clean the worksite and remove the remaining materials, chips and other wastes from the worksite.
4) The disposal of the materials generating during the works or the scraps due to the break-up of the existing structure must be done in accordance with the instructions by the supervisor.
5) When the crafts and machines for the work are brought in or out of the worksite, the contractor must confer with the supervisor about it.

1-0-15 Safety control

1) The contractor must take notice of the safety at the worksite and make every effort to prevent an accident and disaster from taking place.
   However, when an accident or disaster has occurred, the contractor must report to the supervisor immediately.
2) When people must be kept out of the worksite to prevent an accident from taking place, the contractor must set up the fence, gate and flaps, "Keep Out" sign board or the like in the area after the conference has been made with the supervisor.
3) When working crafts and others go through the overcrowded water area, the contractor must make every effort for the prevention of an accidents.
4) When the contractor use the public roads as the transport route for the works, care must be taken in such a manner that no damage is given to the third person through the deed of breaking the road surface by letting the loaded things fall down from the truck or through other deeds.
   Further, in case of a great deal of sand and earth or constructive materials carried by large-sized trucks such as dump-trucks, the contractor must confer with the organizations concerned and prepare the plan for traffic safety. Then, the plan must be submitted in writing to the supervisor.
5) When things have been found during the works such as excavation and dredging, the contractor must report immediately to the supervisor and the administrative authorities concerned, and follow the instructions from them.
6) When the workers have dropped, into the sea, the things hindering ships from sailing, they must be immediately removed or beacons must be fixed to them to display the dangerous sites. At the same time, report must be made to the supervisor and the administrative authorities concerned.
7) When the working crafts have run into trouble or become out of order, a proper measure must be promptly taken in accordance with 6) above.
8) In the dredging works and the like in the water area where the remaining explosives are often found, a proper measure must be taken in accordance with the provision described in the special specification.

1-0-16 Preservation of environment

When executing the works, the contractor must take a special care for the preservation of surroundings. However, if there is a fear of polluting the surroundings seriously, the countermeasure against the pollution must be prepared in advance and submitted to the supervisor in writing.

Chapter 8 Rubble Stone and Leveling

Section 1 Foundation

8-1-1 Scope

In this section, general matters shall be treated on the rubble base work for structures, such as wharves and breakwaters.

8-1-2 Materials

1) The rubbles to be used shall not be flat or long, and shall be free of efflorescence and break due to freezing.
2) The kind, specific gravity and weight of the rubbles shall be as prescribed in the special specification.
3) Prior to the execution of work, the test results on the kind and specific gravity of rubbles and a sample of rubble having a prescribed weight must be shown to the supervisor for his approval.

8-1-3 Execution

1) Leading frame of leveling
   For the setting, method and structure of the leading frame, conference must be made with the supervisor.
2) Transport and dumping
   For the time and method of transport and mounding, conference must be made with the supervisor.
3) Leveling
   (1) Leveling must be finished up in such a manner that the firmness without looseness can be obtained.
   (2) For the stage of leveling work, conference must ba made with the supervisor.

8-1-4 Inspection

1) Confirmation must be made on the prescribed section prepared through the execution of work.
   The method of inspection shall be as prescribed in the special specification.
2) Allowable range

(1) Height of final leveled surface	±5 cm
(2) Roughly leveled surface (slope measured at right angle)	±30 cm
(3) Height of roughly leveled surface in front of seawall	+0, −20 cm
(4) Crown width	+ not specified −10 cm
(5) Length	ditto

Section 2 Armoring and foot protection of foundation

8-2-1 Scope

In this section, general matters shall be treated on the armoring and foot protection of foundation for structures, such as wharves and breakwaters.

8-2-2 Materials

8-1-2 is applicable.

8-2-3 Execution

8-1-3 is applicable.

8-2-4 Inspection

1) Confirmation shall be made on the prescribed section prepared through the execution of work. The method of inspection shall be as described in the special specification.
2) Allowable range

(1) Crown and slope leveling	+30 cm
(2) Height of crown leveled surface in front of seawall	+0, −2 cm
(3) Crown width	+ not specified, −20 cm
(4) Length	ditto

Section 3 Backfilling

8-3-1 Scope

In this section, general matters shall be treated on the backfilling work for structures, such as wharves.

8-3-2 Materials

1) The kind, specific gravity and weight of backfilling materials shall be as described in the special specification.
2) When mat is used to prevent from sucking out, 7-0-2 is applicable to this case.

8-3-3 Execution

1) Leading frame of leveling
   8-1-3, 1) Is applicable.

2) Transportion and dumping of stones
For the transportion and dumping, the work must be executed not to give any damage to the existing structures.

3) Leveling
8-1-3, 3) is applicable.

4) Mat
7-0-3 is applicable.

8-3-4 Inspection

1) Confirmation shall be made on the prescribed section prepared through the backfilling. Further, the method of inspection shall be as described in the special specification.

2) Allowable range

(1) Crown height	+ not specified,	−10 cm
(2) Crown width	ditto ,	−10 cm
(3) Slope (slope measured vertically)	ditto ,	−20 cm
(4) Length	ditto ,	−10 cm

Chapter 13 Concrete Blocks

13-0-1 Scope

In this chapter, general matters shall be treated on the production, transporttion, temporary placing and installation work of various blocks, such as L-type blocks, Cellular blocks, blocks (rectanglar), precast concrete armor units and ware absoring blocks. Further, Chapter 11 applies to the items not specified in this chapter.

13-0-2 Production

1) General matters
(1) For the yard facilities and the method of producing blocks, conference must be made with the supervisor.
(2) The size and shape of concret blocks shall be as described in the special specification.

2) Precast concrete armor units
(1) For the form to be used, the approval of the supervisor must be obtained.
(2) The form must be firmly assembled and the countermeasure against the leakage of mortar from the joints must be taken.

3) Inspection
(1) It must be confirmed that blocks have been produced as per the prescribed size and shape.
(2) Allowable range

(Production)

Type \ Item	Width	Height	Length	Wall thickness
L type block	+2 cm -1 cm	+2 cm -1 cm	+2 cm -1 cm	±1 cm
Cellular block	+2 cm -1 cm	+2 cm -1 cm	+2 cm -1 cm	±1 cm
Block (rectangular)	+2 cm -1 cm	+2 cm -1 cm	+2 cm -1 cm	—

13-0-3 Transportion and temporary placing (including transfer)

1) Lifting
   For the time of lifting concrete blocks, the approval of the supervisor must be obtained.
2) Transportion and temporary placing
   The transportion and the temporary placing (to be put in) of blocks shall be as described in the special specification.

13-0-4 Installation

1) L type blocks, cellular blocks, blocks (rectangular) and wave absorbing blocks.
   (1) For the method and the time of blocks installation, conference shall be made with the supervisor.
   (2) In case the blocks temporary placed in the sea are installed, shells, seaweeds and others must be removed.
2) Precast concrete armor units
   (1) For the time and method of installation, conference must be made with the supervisor.
   (2) In the natural void of block layer, there shall be no interstitial stones nor fallen stones.
   (3) There shall be no stones between the foundation and the block or between the two blocks.
3) Inspection
   (1) Confirmation shall be made on the installation done as prescribed.
   (2) Allowable range
   (a) The allowable range of the void between the face line of the wharf and the neighbouring joint shall be as shown in the table below.

(Installation)

Type	In and out against face line	Space interval with neighbouring joint
L type block	±5 cm	5 cm or less
Cellular block	±5 cm	5 cm or less
Block (rectangular)	±5 cm	3 cm or less

(b) The allowable range of the void with the face line of the breakwater and the neibouring joint shall be as described in the special specification.

Chapter 15 Coping Concrete

15-0-1 Scope

In this chapter, general matters shall be treated on the coping concrete work for structures such as breakwaters and warves. Further, Chapter 11 is applicable to the items not specified in this chapter.

15-0-2 Execution

1) For the method, the order and others of works, conference must be made with the supervisor.
2) The treating method of the bonding surface in the horizontally placed joint that is prescribed in the design drawing and specification shall be as described in the special specification, and no horizontally placed joints shall be prepared except for those specified by the design drawing and specification.
3) When new concrete is placed on the old concrete, proper measures, such as removing shells, seaweeds and others sticking to the surface of the old concrete, shall be taken before placing concrete.
4) When the mooring rings and others are installed on the top concrete, conference must be made with the supervisor in advance.
5) When the spaces for various facilities are taken inside the coping concrete, work must be executed in such a manner that those facilities are located as scheduled.

15-0-3 Inspection

1) It shall be confirmed that the works has been executed as prescribed.
2) Allowable range
   (1) Breakwaters

Item \ Width	Crown width	
	10 m or less	exceeding 10 m
Length	+ not specified, - 0	
Crown width	±3 cm	+5 cm -3 cm
In and out against face line	± 5 cm	
Height and thickness of crown	± 2 cm	+5 cm -2 cm

(2) Wharves

(a) Length	+ not specified, –0
(b) Going in and out against face line	±3 cm
(c) Height and thickness of crown	±2 cm
(d) Crown width	±2 cm

Other Works

The only allowable range of inspection in other stages of works will be shown below.

Chapter 5 Removal existing foundation

(1) Slope (measured at a right angle)	Outside 2 m, inside 30 cm
(2) Bottom	±30 cm

Chapter 6 Soil Improvement

o Replacement

(1) Length	+ not specified, –0
(2) Crown leveling	±30 cm

(3) The crown width and the slope grade shall be as described in the special specification.

o Sand Drain, Sand Compaction and Paper Drain

(1) Sand mat

(a) Length	+ not specified, –0
(b) Crown height	±30 cm

(c) The crown width and the slope grade shall be as described in the special specification.

(2) Sand Pile

The allowable range of the sand pile shall be as described in the special specification.

Chapter 9 Piles and Sheet Pile Driving

○ Steel pile and concrete pile

(1) Pile head center position	10 cm or less
(2) Crown height of pile	±5 cm
(3) Pile inclination	3° or less

○ Steel sheet pile and concrete sheet pile

	Steel sheet pile	Concrete sheet pile
(1) Length of sheet pill wall	+ 1 sheet pile width, - 0	+1 sheet pile width, - 0
(2) In and out against face line of sheet pile	+ 10 cm	as specified in the special specification
(3) Inclination against face line	$\frac{1}{100}$	ditto
(4) Inclination in direction of sheet pile	$\frac{1}{100}$	$\frac{2}{100}$
(5) Crown height of sheet pile	± 10 cm	± 5 cm

Chapter 11 Concrete

○ Slump

Classification of slump	Allowable range
~ 3 cm	±1 cm
3 cm ~ 8 cm	±1.5 cm
8 cm ~ 18 cm	±2.5 cm
18 cm ~	±1.5 cm

Chapter 12 Caisson

○ *Production*

(1) *Wall thickness*	±1 cm
(2) Length, width & height	+3 cm, -1 cm

○ Installation

(1) The gap in joint interval	10 cm or less (2,000 t or less)
(2) Going in and out in alignment face line	±10 cm (2,000 t or less)

Chapter 14 Filling

○ Filling

(1) Crown height (Sand, wasted stone)	±5 cm
(2) Crown height (Concrete)	±3 cm

o Cover concrete

(1) Crown height ±3 cm

Chapter 16 Paving

Subgrade and Subbase

	Height	Width	Length
Subgrade	+3 cm -5 cm	+ not specified -10 cm	+ not specified -0
Lower subbase	±4 cm	+ not specified -5 cm	ditto
Upper subbase	±2 cm	ditto	ditto

Concrete Pavement

	Thickness	Width	Length	Flatness
Pavement	+2 cm -1 cm	+ not specified -2.5 cm	+ not specified -0	Noteworthy

Asphalt Pavement

Item	Thickness	Width	Length	Flatness
Base course	+ not specified -1 cm	+ not specified -2.5 cm	+ not specified -0	—
Surface course	+ not specified -0.9 cm	ditto	ditto	Noteworthy

4-9-4 Problems and Directions of their Settlement in the Construction of a Large-Scale Industrial Port

In the development of a large-scale waterfront industrial base, a vast area for industrial use is required and, further, the construction of great water-depth structures are needed with the commission of large-sized vessels in service, so that various types of new problems in construction works arise, quite different from the conventional condition of port construction. For example, the location of a newly developed port is not always favorable, as compared with that of the existing port, but even in such a poor natural condition, difficulties must be overcome for the construction of a new port. In addition, a rapid development is inevitablly demanded due to its large scale of construction and grading. That is, the most serious problem in the construction of a large-scale industrial port is how to establish a proper system for the rapid construction of a vast port facilities including great water-depth structures, in such an area that the working conditions are terribly poor because of the location of facing the open sea.

Therefore, in order to clarify the problems that will confront the construction of industrial

ports in Mexico and, at the same time, to furnish clues for finding out the direction in the settlement of those problems, typical examples of artifically excavated industrial ports in Japan, Kashima port and Tomakomai East port, will be described below.

(1) Kashima Port

In Kashima waterfront industrial area, an artifically excavated industrial port was constructed on the monotonous coast of the Sea of Kashima; around the port, various types of factories, such as iron and steel, electric power, oil refinery and petroleum chemical, were invited and an enormous production was secured; in addition, a modern industrial city having the population of about 300,000 was formed as originally planned.

The Kashima port forming the nucleus of the waterfront industrial area is one of the largest "artifically excavated port" in the world, constructed in the sand dune facing the rough sea of Kashima, and available for the vessel of 200,000 DWT maximum.

The Kashima district faces the Pacific Ocean; and in those water areas, the Black Current going up north off the Kujukuri coast meets with the Kurile current coming down south along the Sanriku coast. Therefore, the marine phenomena in the Kashima district is complicated, and there are various problems such as tide, waves and littoral drift. Especially the harbor entrance facing the open sea is directly influenced by the waves generating on the Pacific Ocean and situated under a severe marine phenomena. Therefore, various problems such as the greatness in the original water depth and the planned water depth at worksite, the hard soils in dredging area and the generation of a great deal of dredged soil due to the excavated port, took place during the construction of the Kashima port.

Table 4-9-2 shows the various technical problems arising during the construction of the Kashima port and the scheme of their settlement.

(2) Tomakomai East port

Tomakomai East port district was one of the remaining areas for large-scale industrial bases in Japan. Therefore, the development of this district was planned as the base for high advancement in economy of Hokkaido, and the construction was started in 1976. The types of industry for this area were oil refinery, petroleum chemistry, automobiles, electric power, oil reservation and the like.

Tomakomai area is comparatively warm among other areas in Hokkaido, but the atmospheric and marine phenomena in this area are considerably severe. Monthly average wind velocity is 4.1 – 4.8 m through the year, but the number of stormy days reaches to 132. Further, in May to August, fog often appears and becomes the obstacle in execution of work. On the other hand, the frequency of the high waves of 1 m or more is about 30%.

Under such conditions, the construction of harbor facilities for 250,000 DWT vessels brought about various problems. Especially for the construction of breakwaters, as the number of possible work days were small, the conventional methods were largely modified so that they were effectively used under the severe conditions of this district. Table 4-9-3 shows the problems generating during the construction of the Tomakomai east port.

Table 4-9-2 Problems and Means of their Settlement in the Construction of the Kashima Port

Problem	Direction of Settlement	Means of Settlement
1) The long-term waves characteristics by the swell due to the typhoon in summer and the waves due to the low pressure in winter are unknown.	Grasping the actual state and forecaseting the future	· Waves observation · Establishment of automatic observation system · Waves estimation
2) As this coast is a straight-line, flat sand beach, it is directly affected by the waves from the open sea and the security of a calm waterway and anchorage is difficult.	Determination of an effective face line of breakwater bringing about the calm waterway and anchorage	· Shetering model test · Diffraction computation
3) The periodical deformation of the sand beach is remarkable, but littoral drift characteristics is unknown.	Grasping the actual state and forecasting the future	· Littoral drift survey. · Water depth and shore line survey.
4) The channel and anchorage are buried by littoral drift.	Determination of an effective face line of breakwater to prevent littoral drift from flowing into the channel and anchorage	· Sheltering model test · Field test using a test breakwater ..... Stickness, permeability of littoral drift and its influence on the neighboring beach.
5) As the swell-generating frequency is high through a year, the execution efficiency is lowered in breakwater work and dredging work.	The increase in the wave-resisting ability of the working craft and the improvement in work control and execution efficiency	· Development of wave-resistant dredger · Utilization of atmospheric and marine forecast. · Moderation of installation standard within the range in which the function of breakwaters is not spoiled. · Employment of the secondary dredging system
6) As the existing water depth and the planned water depth are great, the work efficiency in the breakwater work and dreding work are lowered.	The application of the working crafts to the great water depth and the improvement in work efficiency	· Utilization of high-lifting and high-efficiency large-sized dredging boats. · Moderation of rubble-mound foundation leveling standard within the range of not spoiling the function of breakwaters for the prevention of lowering in the efficiency of diving operation.
7) As the dredging of hard soils is necessary, the efficiency in dredging work is lowered.	Employment of the dredging system suitable for hard soils and the improvement in work efficiency.	· Employment of grab type dredger · Increase in the weight of grab backet · Employment of the secondary dredging system.

Problem	Direction of Settlement	Means of Settlement
8) As a great deal of soil and sand generate due to the artificially excavated port, rapid dredging and disposal are required.	Effective disposal without pollution and the improvement in the efficiency through the large-quantity, continueous work execution	• No disposal through ocean abandonment • Dumping into reclaimed land • Disposal of good-quality soil and sand (including no salt) in the neighborhood. • Large-quantity, continueous work execution principally composed of pump dredger and belt conveyors. • Survey of influence of dredging and reclamation.
9) There is a possibility of arising open-sea pollution due to the dredging and reclamation, and its influence on fishery is a serious problem.	Grasping the change of environment inthe open sea during the dredging and reclamation	• Investigation for the influence of dredging and reclamation.
10) As the countermeasure for fishermen (pollution countermeasure) must be taken, dumping the dredged and excavated soil into the ocean is difficult.	Study for the utilization of excavated soil and the security of dumping place	• Dumping to the reclaimed land in the waterfront portion (reclamation) • Dumping of the reclamation area on land – security of substituted places
11) The diffusion of pollution due to dumping must be prevented (Ocean abandonment)	Preventing pollution from diffusing, studing from the both aspects of quality and quantity when the disposal o of soil is conducted by dumping	• Qualitative aspect in the disposal of soil Preventing dredged soil from diffusing by mixing diaclear (high-molecular coagulant) with soil. Further, throwing-out the soil little by little from the land through the method prepared for such a purpose. • Quantitative aspect in disposal of soil Use of the soil as embanking material and throwing-in the sand into the temporary revetment previously prepared. Reclamation after the revetment has been completed. Prevention of flow-out sand by a submerged dike constructed off the coast.
12) The secondary transport route starting from the primary tentative yard for the dredged and excavated soil, linearly stretches over to the dump, so the influence of noise is given to the inhabitants along the route. (noise)	Limitation of soil transport method in physical treatment, in the selection of the route and in time.	• Limitation in time No transport of soil at night in housing area. • Limitation in selection of the route No selection of the route affecting the inhabitants in housing area. • Limitation in physical treatment Execution of sound-proof or sound arest countermeasure.

Problem	Direction of Settlement	Means of Settlement
13) As the dredged and excavated soil is piled up about 12 – 15 m high at the primary tentative yard, the influence of wind-blown sand brings about the housing area. (Air pollution)	Prevention of wind-blown sand through a tentative treatment and transport to the final dump, as the wind-blown sand takes place at the temporary yard.	• Sprinkling asphalt emulsion at the tentative yard.

Table 4-9-3 Problems and Direction of Their Settlement in the Tomakomai Port

	Problems	Direction of their settlement
Problems and direction of their settlement over the whole works	1) Lowering of operation efficiency due to the overcrowd of working crafts	• Technical development for large-sized working crafts and the improvement of their efficiency
	2) Lowering of operation efficiency due to the congestion of operational processes	• The improvement in work execution rate of each process and the increase in the adaptability to the variation among the processes • Setting-up of a central information control center for effective adjustment of operations in various processes
	3) Shortage of the workable days	• Development of wave-resistant working crafts • Development of a platform ships and diving operation ships. • Setting-up and development of tentative breakwaters
	4) Refuge of the working crafts in the abnormal marine phenomena	• Improvement in forecasting precision for atmospheric and marine phenomena • Security of refuge places • Refuge utilizing the marine base, diving base and LASH boats (lighter aboard ships), and the development of refuge facilities.
	5) Refuge of operational process due to back disaster	• Improvement in forecasting precision for atmospheric and marine phenomena • Countermeasure against the back disaster • Relief of operators by helicopters and others
	6) Shortage of the number of possible inspection days and the influence of inspection upon the number of operation days.	• Employment and development for precision measureing machines • Re-study of inspection methods.
Problems and direction of their settlement in each process of breakwater construction	A. Loading, carring and discharging of rubble-stones	
	1) Decrease in the workable days due to the discord of atmospheric and marine phenomena at the shipping port and the throwing-in site.	• Improvement in atmospheric and marine phenomena network and communication network • Employment of carriers having the resistance against waves
	2) As the operation area is wide and off the coast, it is difficult to find out the discharging point. Further, visibility is lost due to the congestion of the working crafts.	• Installation of an electric positioning equipment
	3) Adjustment and confirmation of throwing-in volume	• Improvement in the method of discharging • Employment of special sounding device
	4) Loss in stone materials and operations due to the waves and flow.	• Improvement in the method of discharging • Development of a machine for prevention of scattering

	Problems	Direction of their settlement
Problems and direction of their settlement in each process of breakwater construction	B. Rubble leveling 1) Shortage of divers	· Development of mechanical execution of work · Ommission of rough leveling due to the improvement in the discharging method and in its technique. · Moderation of the precision and the standard. · Training of divers.
	C. Placing of foot protection blocks and armor blocks 1) As the overlapping waves are formed at the foot of the bank, the crane boat moves and the work efficiency is lowered.	· Setting from on the breakwaters. · Making the reach of a crane large and work executed from the opposite side. · Setting a temporary breakwaters.
	D. Production of caisson 1) In a large-sized caisson, as operation at a high place is increased, the efficiency is lowered and a labor accident is liable to occur.	· Decrease in the number of operators and the improvement in the efficiency.
	2) As a great number of operators are required on preparing and placing the reinforcement and disassembling the form, it is the bottleneck of the whole process in manufacturing caissons	· Automation of the preparation and placing of the reinforcements. · Large-sized unit type of reinforcements · Large-sized form · Simplification in the assembling and disassembling of the form. · Use of steel iron
	E. Setting of caissons 1) Setting under an unfavorable conditions due to waves, swell and flow	· Utilization of a large-sized floating crane for re-setting. · Setting-up a temporary protective facilities
	F. Filling 1) Filling each cabin uniformly is difficult.	· Improvement in filling method · Discussing on design
	2) As it takes a long time to conduct a large-quantity filling, a back accident is liable to occur.	· Employment of large-quantity rapid filling machine · Utilization of sea-bed sand
	G. Coping concret work 1) The shuttering is often broken by waves so that concrete leaks out.	· Employment of a wave-resistant shuttering.

4-10 PORT ADMINISTRATION AND OPERATION

4-10 PORT ADMINISTRATION AND OPERATION

4-10-1 Introduction

The master plan for the development of industrial ports in Mexico are now being prepared and actually construction works, have been started to aim the open port at November 1982. At this time, a subject for development of industrial ports is to establish the port administration and operation system. Namely, it was described in "Chapter 1 Recommendations" that the construction of ports and invitation of the industries under the powerfull guidance and control of Government as conducted now are proper at the early stage. However, it will be better for the local government that they are involved with the development of the local industries and their communities by themselves and the planning of ports as a part of industrial development should bring about the establishment of local culture and decentralization of population and industries.

For this purpose, the port and harbour plan should be prepared including the aims of the industrial policy and development plan of state, and local authority should take part in the administration and operation of the industrial ports.

From the above point of view, we introduce the port administration and operation system, organization setup and fund raising etc. in this section which are generally adopted.

4-10-2 Port Operation

(1) Port administration and operation system

Administration patterns of port, namely, the form of administrative system between central and local governments, vary from country to country in reflection of the port history, recognition on the port, urban development and the conditions of each country.

Principal organs in port administration are enumerated as follows;

1. Country or federation (hereinafter referred to as country) (either direct control done by a country through its department or its agency such as a public corporation)
2. Local government (direct control done by its department, committee set up by a local government such as a public corporation or a local government agency specialized in port administration)
3. Others (third sector to be set up by central and local governments, etc., an organ to be established under special enactment or private-owned)

Each of them has its own characteristics, and there is no such system that is generally desirous of.

a) Autonomy

However, it is desirous that a large-scaled industrial port should be administered by a separate, autonomous organ under the control of the country because it has the same importance to the country as major commercial ports, and the organ established under this concept is Port Authority or Port Trust.

Generally, a port authority is entrusted with its own decision power, subject to the consent by the government in making such important decisions as follows;

① Matters relating to the security and foreign policy of the country
② Annual budget
③ Matters relating to borrowing loans
④ Level of port charges
⑤ Sale of assets
⑥ Appointment of chairman and director general of the Administrative Committee

In this case, the relation between the port authority and the government could be maintained harmoniously by clearly specifying those matters that require the consent of the central government and by appointing the government representative to the member of the administrative committee.

In any case it is necessary that an appropriate relationship should be established as system between the organ of port administration and the government in view of the importance of the port to the national economy, while keeping its independence.

b) Unified Administration by One Organ

Although it is desirous that one organ that has authorities over port areas and major functions of port administration should administer the whole aspects of port operation in order to secure its efficiency, there are many cases where the functions are administered separately in reflection of historical background and institutional systems of each country. Even in this case it is necessary that the system that the port authority can administer the whole operation integratedly should be established, such as establishment of the council consisting of functional organs.

An industrial port should be administered unitarily by nature in view of security and environmental controls, and it is desirous that the port authority should be entrusted with necessary and sufficient authority. However, the greater the scale of an industrial port the bigger the amount to be invested, and it may be difficult for the existing system of the organization to cope with activities. In each local government of Japan, Land Development Bureau or Land Development Corporation is established that engages in land development under the special account, because the land development project is not suited for the Japanese governmental accounting system that coveres only one single year and the self-supporting accounting system is adopted.

The system where the land thus developed is to be sold to private enterprises is adopted, but there appears no obstacles in administration and operation, because the port authority is entrusted the power to control the port development activities in the waterfront area. Even, in case industrial land is to be leased like European industrial ports, it is desirous that the port authority should administer the port facilities undividedly as much as possible.

c) Financial Independence

As before-mentioned, financial independence is required to maintain autonomy. For this purpose port finance must be separated from national finance, the independent budget of its own must be maintained and the level of port tariff that occupies major portion of port income must be kept reasonable. The reaonable level of port tariff is sufficient enough to cover the ordinary

operating expenses including the interest of the loan and at the same time to make depreciation and renewal of the port facilities.

However, the funds required for large-scale expansion plan of channels and breakwaters are generally provided by the government in a form of grants as occasion demands, and sometimes assistance from the government budget is provided successively for 2 to 3 years after the start of operation in the case of new construction project; however, it should be born in mind that the subsidy of operating expenses must be avoided as much as possible, which should be temporary and not to be continued.

In the case of an industrial port, financial management varies in accordance with whether industrial land is to be sold out or to be leased; in principle, the section managing industrial land should be handled under the self-supporting accounting system. The characteristics of industrial land in an industrial port lie in the difference from inland industrial land; that is, it faces seashore. However, the unit price of developed land is sometimes far more expensive than that of neighbouring areas. In this case it must be reviewed whether the land in question is suitable for the development of industrial port, and if and when appeared appropriate, a financial assistance by the central or local government will be required to a degree that will not deprive the enterprises of competitiveness in commercial markets.

Financial independence will also be referred to in the section of fund raising in specific reference to the history of industrial development in Japan.

(2) Scope of Work and Organization Setup

a) Scope of work

The operation of port authority covers the following aspects;

① Construction, maintenance and operation of wharves and port functioning facilities centered around the wharves (transit sheds, warehouses, cargo handling equipment, etc.)

② Construction, maintenance and operation of port transportation facilities (toll road, tunnels, etc.) and buildings for rent

③ Development of industrial land

④ Other works and services (cargo handling, tug service, water and fuel supplies, etc.)

In the case of industrial port, environmental control may be added to the above-mentioned, among which construction, maintenance and operation of the functional facilities centered around the wharves are the basic work of port authority, which is achieved in any port.

Other work varies in accordance with country and port.

In Japan water area is owned by the government and land area is privately owned; for example, many of industrial land and quay walls in industrial ports are privately owned, while in European countries waterfront lines and its hinterland such as industrial and quay walls are basically public-owned, and usually they are leased on long term basis. The reason for this difference atributes to that of recognition on the importance of waterfront lines and its hinterland and that of land ownership, and so on.

Consequently, port authorities in European countries own publicly land for port activities including wharf (understructures), etc., administer them both nominally and virtually and impose charges on lenders as stable source of income.

b) Organization Setup

It is desirous that a port authority should be a unified entity which is given the competence of operation and implementation, however, in some countries operation is separated from implementation in reflection of the conditions and historical background of each country. This separated operation is not to be denied as long as the port is operated smoothly in a separated form.

In operating a port, there needs Executive Department that consists generally of three divisions-technical, operation and administration- and many unit organizations to engage in operation and supplementary works at site. The technical division consists of the sections of civil engineering works, machineries, electricity and maritime engineering, and engages in construction and maintenance of port facilities. The operation division engages generally in the nomination of berth, collection of charges, cargo handling and warehousing, and in the case of the industrial port monitoring will be required for environmental control and necessary instructions to the enterprises located on the industrial land should be issured. In Japan, the supervision and instructions for environmental control are made not by Port Authority but directly by the local government (prefecture or city, town and village).

The administration division is further divided into personnel, general affairs and office routine sections.

The greatest problem of developing countries in implementing the development of a large scale industrial port is short of expereince and engineering capabilities required for administration and operation. This problem cannot be solved in a short time, and weak points in organization can be covered effectively by the employment of foreign consultants and by the guidance from the experts of technically advanced countries, and through this process technical capabilities of staff members should be improved.

4-10-3 Fund Raising

For the development and improvement of a port, a port authority is generally to raise the funds by the following ways;

1 Subsidy from the central government or local government
2 General tax income of local government
3 Loan or bond issue
4 Its own capital (depreciation, income from operation)

Which funds among the above-mentioned are to be used depends upon the policy of country or the character of the port.

a) Government participation in fund raising

As mentioned hereinafter, financial management on self-supporting basis for large scale industrial ports is difficult except some exceptions, due to following reasons;

① Investment scale is considerably larger that of general ports.
② It takes a long time to induce the location of enterprises in the planned industrial areas and to increase income from port charges.
③ Large scale investment is required for non-profit facilities such as breakwaters and

channels.

However, development effect of industrial port cannot be measured only by industrial port itself, and indirect effects brought from the port cannot be ignored, i.e. development of industries in the hinterland areas increase in employment and corresponding increase in tax income for the local government. Therefore, it cannot be said that it is reasonable to recover all the construction cost of an industrial port only by the port charges from such industrial activities, but it is also difficult for the beneficiaries from indirect effects to share most of the construction cost.

In order to resolve the above mentioned problems, financial assistance from the central and local governments is necessary for the industrial Port project, and the method that Japan is employing now could be one of the ways, that is, in the case of a large scale industrial port it is extremely difficult to utilize all the amount of investment by the funds that are to be refunded, and the financial assistance from the government such as form of subsidy or investment is necessary. Only with a certain degree of financial assistance from the government, low interest rate loans from domestic and overseas sources could be better utilized.

It cannot be generally indicated to what extent the government should give financial assistance and to what part of the port investment the government subsidy should be appropriated. However, in the case of an industrial port, which is different from the project of a general port, there are many due scopes that should be developed through the introduction of private funds such as industrial land development, special and big-sized cargo handling equipment, therefore, it is recommended that private capital should be introducted as much as possible. Those portions of facilities that are sold to enterprises in future or utilized by them continuously should be constructed, in principle, only by the funds raised from the beneficiary enterprises, and of all the funds necessary are not made available at once, such funds should be loaned temporarily by other sources and refunded by the private funds on long term basis. In this case fund raising should be arranged not only through private financial institutions, but also the government playing a certain roll in arranging a long term and low interest rate loan.

On the other hand, as above-mentioned, breakwaters stretching to several kilometers long, channels and basins require huge amount of investment, and it is extremely difficult to impose the charges directly to users for covering all the investment. There is tariff system such as the port charge levied on coming vessel, however, in most cases these charges do not satisfy the level that can cover up the construction cost of breakwaters and channels, which presents a great problem in port financial management. The investment field that the governmental subsidy should be appropriated is considered to be such construction works as breakwaters, channels and basins.

It is extremely difficult to indicate how the government should participate in which construction works as mooring facilities, transit sheds, cargo handling equipment, open storage and warehouses that situate between the two categories as above-mentioned. namely, between the construction works covering industrial land and special type of big cargo handling equipment and those covering breakwaters, channels and basins. Therefore, the government participation in those construction should be reviewed in consideration of the conditions and historical background of each country and also the governmental investment policy on the social capital.

Here one of ideas as to who should bear the construction cost in view of the function of each facility for an industrial prot is indicated as below;

	Enterprise	General Port Users	Government (central/local)
Protective Facility			◎
Water Facility – Channel – Basin	○	○ ○	◎ ○
Mooring Facility	○	○	○
Cargo Handling Equipments	○	○	
Storage Facility	○	○	
Railway	○	○	
Road		○	○
Park		○	○
Green Belt	○	○	○
Industrial Estate	◎		

Note: ◎ more suitable, ○ suitable

It is shown in the Table 4-10-1 how the government participates in fund raising in the advanced countries.

Table 4-10-1 Outline of Port Situation and Government Participation

	United Kingdom (UK)		
1. Number of port and operating body	Direct administration of central government (BTDB)	National port	19 ports
	Direct administration of local government (city)	City-owned	appr. 70 ports
	By each enactment (Port Commission)	Self-governing	appr. 100 ports
	Third sector or private	Privately-owned	appr. 100 ports
	In addition, there are ports under the administration of National Railroad and Waterway Administrative Body.		
2. Basic policy of port by the government	Port is considered as the place for business management, and like the other enterprises, administration and operation of the port is treated as one of the industries, and no specific appraisal is given to the regional development effects.		
3. Degree of government participation			
(1) Supervision and guidance	Since the establishment of NPC(National Port Council) in 1963, it engages exclusively in the evaluation of new investment, reorganization plan of port and nation-wide port development projects from national standpoint in place of the central government. Among European and American countries, administrative supervision by the central government is relatively strong.		
(2) Participation in operating body	BTDB(British Transport Docks Board) is established as an independent entity from the government administration that is specialized in port administration, which administers and operates major 19 national ports.		
(3) Financial assistance	Subsidy and loan from the central government to port authority is admitted by law. Subsidy is actually not executed except in special cases. Loan is executed in full scale not only to BTDB but also to self-governing ports(municipal ports).		
4. Raising of funds for port development and improvement	Own capital of port, loan from government and private soures. However, it is not certain in the case of municipal ports whether subsidy is granted from city tax income.		

	Netherlands
1. Number of port and operating body	Direct administration by local governments ..... City owned Third sector (consisting of central government, province and city) } appr. 20 ports Third sector port is called as public statutory port body.
2. Basic policy of port by the government	Like Japan, Netherlands are processing and trading country, and appropriate development of port is considered to constitute the fundamental basis of the nation.
3. Degree of government participation (1)Supervision and guidance	Except small scale ports, no direct participation by the central government. However, there are many opinions between the government and City of Rotterdam that center around the participation of the government, one of them calls for the establishment of the body like NPC in England, which is currently under review.
(2)Participation in operating body	Participation in the port administration of small scale port.
(3)Financial assistance	No subsidy and loan to the city-owned ports. However, to the river channels maintained by port administrator, 1/3 of subsidy is granted by the central government, while to the river channels under the maintenance of the central government, the city shares 1/3 of the cost.
4. Raising of funds for port development and improvement	Own capital of the port and loan (city borrowing together with other projects). Deficit is supplemented by the city. Almost so with Third sector port, and deficit is supplemented in proportion to the ratio of investment.

	France
1. Number of port and operating body	Public operating body by the central government Autonomous ports 6 ports Government (Ministry of Public Works & Transportation) Non autonomous ports 200-300 ports
2. Basic policy of port by the government	Recognized to be very important for the economic development of the country. Namely, development of port is one of the most effective means of resional development, and indispensable for strengthening the international competitiveness in economic field.
3. Degree of government participation	
(1)Supervision and guidance	Autonomous ports are controled by the Minister of Public Works and Transportation, and given detailed control and guidance in budget, approval of project, approval of port charges, approval of bonds issue, which is the strongest form of participation among European and American countries.
(2)Participation in operating body	Autonomous ports are administered and operated by the public entity with Port Committee as its administrative organization. Non-autonomous ports are either under the control of central government (first category) or under the control of local government entrusted by the central government (second category).
(3)Financial assistance	For the development of infra-structures of autonomous ports, 60 to 80 percent of subsidy is granted. No subsidy for supper-structures. Central government does not guarantee nor undertake the issuance of bond.
4. Raising of funds for port development and improvement	Fund of central government, loan, own capital.

	Belgium	Federal Republic of Germany
1. Number of port and operating body	Under direct control by local governments 3 ports Third sector (consisting of central government and city) 1 port In addition, there are some ports alongside with river and canal. Above are port numbers of major ports in Belgium.	Local governments (province) appr. 10 ports
2. Basic policy of port by the government	Due to economic recession caused by energy conversion from coal to oil, the development of coastal industrial area centered around oil is presently under way. A strong attention is paid to the development of trade port facing directly outer sea.	Regarded as important strategic means for regional development, and there is a port that is appraised to constitute the axis for city formation.
3. Degree of government participation		
(1)Supervision and guidance	Except the port under the control of Third sector that the central government participates in (the port of Zee Brugge), ports and operated by city, and the central government gives considerably strong guidance by granting subsidy and maintaining facilities.	No participation by the federal government
(2)Participation in operating body	Paticipation only in port authority of Zee Brugge, Brugge.	Federal government is not administrative principal of port.
(3)Financial assistance	Subsidy is granted 100 percent for lower structures and 60 percent for upper structures. Central government sometimes maintains and developes all wharves by the government fund and entrust the port authority with its administration. River channels are maintained and developed by the central government in its full expenses.	No subsidy is granted by the federal government. River channels are developed and maintained by the federal government in its full expenses.
4. Raising of funds for port development and improvement	Fund of central government, own capital, loan.	

	Canada
1. Number of port and operating body	Direct administration of federal government (Ministry of Transportation) (Public Harbour) appr. 200 ports Borad of federal government National port (National Harbour Board) appr. 15 ports Under each enactment (Harbour Commission) appr. 10 ports In addition, there are some 500 government wharves under direct administration of federal government.
2. Basic policy of port by the government	Received high appreciation as a cheap mean of water transportation, and port plays a great roll in the promotion of exporting raw materials such as mineral and agricultural products.
3. Degree of government participation	
(1)Supervision and guidance	Except Harbour Commission, all the ports are owned by the federal government in a broader sense, and its administrative guidance is prevailing Harbour Commission is inclined to be independent, and although federal government is trying to uniform them under the integration law, some ports are under each own independent administration by each enactment. Administrative guidance by the federal government is relatively stronger than that of European and American countries.
(2)Participation in operating body	Federal government controles public harbours as a part of administration and also organized NHB, which shows considerably broader participation by the federal government in port administration. 10 ports under the control of Harbour Commission can be regarded as independent from the federal government.
(3)Financial assistance	There is no legal subsidy system for NHB and Harbour Commission, however, actualy subsidy is granted to their lower structures. With regard to raising of funds, NHB receives all the necessary funds by loan, and Harbour Commission also receives wide range of loan by the federal government.
4. Raising of funds for port development and improvement	Fund of federal government, own capital and loan (government and private). Public harbour and goverment wharves are provided in its full expenses by federal government.

	United States of America
1. Number of port and operating body	Port of local government, commission established by local government, commission established by local enactment } Port with more than 7.5 meters deep wharf appr. 150 ports In addition, there are 29,000 miles of inland waterways artificially constructed, and there are many ports alongsthe waterways.
2. Basic policy of port by the government	Federal government puts importance into trade promotion and stability of employment, and has strong concern over competition with Canadian ports.
3. Degree of government participation	
(1)Supervision and guidance	Almost no participation by federal government. It is judged that its participation is necessary for the proper maintenance and development of port but impossible due to stronger presence of port authority and state government.
(2)Participation in operating body	Federal government is not the administrative principal of port.
(3)Financial assistance	No subsidy is granted by federal government. However, in case that it is judged necessary as employment promotion policy, subsidy is granted. Except pier head line, channel and inland waterways are improved and maintained in full expenses by federal government.
4. Raising of funds for port development and improvement	Own capital of local government (state and city), loan (including issuance of bond).

4-10-4 Financial System for Port Development in Japan

(1) General

In Japan, construction and improvement of port facilities are, generally speaking, carried out by the port management body having responsibilities for the management of the port.

And as for the basic port facilities such as breakwaters, channels, anchorages and berthing facilities, the port management body is provided subsidies from the central government.

The rates of the subsidies vary according to the classification of ports, i.e. specially designated major port, major port and local port, and they are fixed by law. They are currently 50%–75% for specially designated major port, 50% for major port and 40% for local port, respectively. Thus, the port development projects are favoured by the powerful support of the central government for their obtaining funds. On top of this, in the case of ports and harbours located in less developed regions, such as Hokkaido, Okinawa and other detached islands, above rate of the national subsidy is increased up to 95%–100%.

On the other hand, Japanese Government appropriates for the Port Management Body the fund to meet whole or part of expenses necessary for the works of sheds, open storage areas, timber stock yards, tug boats, cargo handling equipment other than land reclamation, or intermediate for appropriation of the fund, and/or serve recommendation, advice or aid necessary for execution of the works concerned.

(2) Subsidiary system

a) The ratios of subsides stipulated in 'Port and Harbour Law'.

Items	Water Facilities		Protective Facilities		Mooring Facilities		Port Transport Facilities	
	State	P.M.B.	State	P.M.B.	State	P.M.B.	State	P.M.B.
Special Major Ports	% 50 – 75	% 25 – 50	% 50 – 75	% 25 – 50	% 50 – 75	% 50 – 75	% 50	% 50
Major Ports	50	50	50	50	50	50	50	50
Local Ports	40	60	40	60	40	60	40	60
Refuge Ports	75	25	75	25	–	–	–	–

Remarks:

1. Water facilities: Waterways, anchorage and basins
2. Protective facilities: Breakwater, sand groins, sea walls, training walls, sluices, locks, revetment, dikes, jetties and parapets
3. Mooring facilities: Wharves, mooring bouys, dolphins, lighters' wharves, floating piers, landing stages and slip ways

4. Port transport facilities: Roads, parking lots, bridges, railways, tramways, canals and heliports within port areas

The amount of such subsidy from the Central Governemnt to the development ports is gradually decreasing.

b) The ratios of subsidies stipulated in 'the Acts for the development of Hokkaido, Outlaying Islands and Okinawa'.

	Water-Facilities	Protective Facilities	Mooring Facilities	Port Transport Facilities	Land for Cargo Storage
Hokkaido	9.5/10	9.5/10	7.5/10	7.5/10	7.5/10
Outlaying Islands	9.5/10	9.5/10	7.5/10	7.5/10	-
Okinawa	10/10	10/10	10/10	10/10	10/10

c) The ratios of subsidies stipulated in 'the Act for the Promotion of Rationalization of Enterprises'.

	Government	Port Authority	Beneficiaries
Major Ports	2.5/10	2.5/10	5/10
Local Ports	2/10	3/10	5/10

Remarks:

The facilities built in the works applied by enterprises based upon 'the Act for Promotion of Rationalization of Enterprises' are:

1. to be utilized for a public purpose and
2. for the time being, used for a specialized enterprise and
3. applied for water-facilities or protective facilities in the meantime.

In addition, the works are expected to bring a half of the construction cost as benefit to beneficiaries.

d) The ratios of subsidies stipulated in 'the Act on the Special Measures for Improvement of Specialized Port Facilities'.

Category	Government	Port Authority	Beneficiaries
Ports for handling Petroleum or iron ores	less than 2.5/10	less than 2.5/10	more than 5/10
Specialized wharf	4/10	up to 6/10	(less than 2/10)

Remarks:

Ports for handling petroleum or iron ores

The works shall be applied from enterprises based upon 'the Act for Promotion of Rationalization of Enterprises' and satisfy, moreover, the items as follows:

1. Construction works of water-facilities or protective facilities for the productive expansion of large-scaled oil refineries.
2. Construction works of water-facilities or protective facilities for the productive expansion of large-scaled steelworks.

Specialized wharf for a specific commodity of bulk cargo

The construction works of a specialized wharf based on 'the Act on the Special Measures for Improvement of Specialized Port Facilities' aim at operating the wharf efficiently by specializing to handle a specific commodity of bulk cargo for public use, when a large amount of the bulk cargo loaded/unloaded by trampers are handled at major ports.

(3) Issue of Local Government Bonds

Terms and conditions for local bonds relating to port improvement are shown in the following table.

Name of funds	Items to be invested	Amotization period	Grace period	Interest rate
Government Funds (from Trust Fund Bureau, MOF)	General port facilities	20	3	8%
	Marshalling yards	20	3	
	Transit sheds	20	3	
	Timber stock yards	20	3	
	Cargo handling equipment	15	3	
	Tug boats	15	3	
Finance Cooperation for Local Public Enterprises (from Postal Life Insurance and Postal Annuity or Public Corporations)	Timber stock yard	15	3	8%
	Marshalling yars	15	3	
	Cargo handling equipment	15	3	
	Transit sheds	15	3	
	Tug boats	15	3	
	Land reclamation for industries	10	3	8.4%

4-10-5 Development System of Industrial Ports in Japan

(1) Outline of Industrial Ports Development after World War II

World War II stroke destructive blows to major industrial ports in Japan, but they gradually developed to the period of maturity since they had begun to recover with the special procurement derived from the Korean War. Petroleum energy transfered from coal and water energy changed the type of industries located at industrial ports into heavy industries such as petrochemicals or iron and steel and machineries. Thus, industrial ports had been considered one of indispensable production measures for industries developing their markets supported by booming demands. The fact that existing industrial ports could not accept the development of Japanese economy necessitated the promotion of new industrial ports development. The development of new industrial ports was due to the economical policies performed and the national comprehensive development policies in a series, considering the balance between economical growth and national land utilization. This tendency introduced the establishment of the Acts for the New Industrial Cities and the Special Areas for Industrial Consolidation, bringing the best period of industrial ports development in 1960s.

It must be noted that the technology for the implementation of large-scaled civil engineering works represented by the construction of deep water port facilities seen at the Port of Kashima, during this period, developed and that industries equipped with large-scaled plants were combined each other through the supply of materials and energy. The import of industrial materials and the size expansion of enterprises could not be realized any longer without considering the industrial location at industrial ports.

The new age of development of industrial ports, however, has been coming recently and the re-examination on the development and operation of industrial ports has been made. A few examples are shown in the problems of environmental destruction accompanied by the development of industrial ports and of financial situation making the super large-scaled development feasible. Some trials has already made to solve the issues. They are the obligation performed within industries to solve their brought external diseconomies or the promotion of developmental and operational organizations established on semi-governmental basis.

In the Third National Compulsory Development Plan established in 1977, a concept for large-scale development of industrial ports as remote areas was proposed. The purpose of this concept, one of major large-scale development projects in the Third National Compulsory Development Plan, is to promote the decentralization of industries for restraining the outflow of local population and softening the exceeded centralization to unbanized areas and to build up huge productive functions to overcome international competitieness.

Some starts have been already made with the construction works for the large-scale development of industrial ports at East Tomakomai in Hokkaido and Mutsu-ogawara in Tohoku District.

(2) Development Acts relating to Industrial Ports

Two Acts for 'the Promotion of the New Industrial Cities (hereinafter referred to as "NI

Cities")' and the Development of Special Areas for Industrial Consolidation (hereinafter referred to as "Special AIC") playing important roles on the development of industrial ports in 1960s are introduced in this report for the reference in developing countries.

a) The Act for NI Cities (1962)

Purpose: To promote the development of new industrial cities to serve as economic development nuclei. In selecting the location of the new industrial cities and in planning them two important considerations are borne in mind. First, care is taken to prevent excessive concentrations of population and industry in large urban centres. Second, the need to rectify imbalances in economic activity and employment between the different regions and thus to contribute to national economic growth.

Highlights: Appropriate areas are designated by the Prime Minister for the construction of new industrial cities (15 have been designated so far). In accordance with this policy, the Prefectural Governors concerned draw up the basic construction plans. All necessary measures are taken by the central and local governments to implement the basic plans. These measures include financial and other assistance to private industry for the acquisition of land for factories and for housing estates, for ensuring adequate supplies of industrial water, for transportation facilities and other financial assistance.

b) The Act for Special AIC (1964)

Purpose: To promote industrial development in selected areas that are especially suitable for industrial development, but where industrialization is already at an advanced stage and there is promise of a high return on investment through improvement and consolidation of infrastructure.

Highlight: Six special industrial areas have been designated by the Prime Minister. The Prefectural Governors concerned set out in their basic programme goals for industrial consolidation, the labour market situation, land utilisation plans and plans for the construction and improvement of industrial faciltieis. On the basis of these plans, action is taken by the central and local governments to implement the basic programms through the construction and improvement of the necessary infrastructure.

c) Measures for the Promotion of Industrial Ports

The Acts for "NI Cities" and "Special AIC" provide some special favors for local governments to execute the projects and enterprises located there. Such priviledges are shown in Table 4-10-2.

It should be noted that, unlike the position in some other countries, there is no system of outright grants or subsidies to attract industry to development areas. On the other hand, governmental institutions (the Japan Development Bank and the Financial Institutions for Development in Hokkaido and Tohoku) provide loans for investment in installations and equipment at a rate of 7-8.3%.

The Treasury defrays the loss on local tax revenues of the local authorities which allow enterprises reductions or exemptions on local taxes.

Table 4-10-2 Measures for the Promotion

Category of Measure	Contents
Central Government Assistance	The State's share in the cost of road, port, housing and sewage system construction by municipalities is increased to a maximum of additional 25 per cent. Remarks: This priviledge is applied only for facilities managed by cities or towns.
Increasing Amount on Local Bonds	The local bond for the additional amount of public works implemented is automatically allowed to be increased equivallent to 50% of the amount.
Interest Payments on Local Bonds	Grants-in-aid are provided towards the interest on local bonds (a maximum of 4.5 per cent of the interest, the rate of which exceeds 3.5 per cent)
Tax Relief for Industry	- on replaced bussiness assets - for enterprises with an equipment investment of more than 100 million yen and employing more than 101 persons, tax reduction and compensation is given on the immovable acquisition and fixed assets taxes

CHAPTER 5

RECORD OF DISCUSSIONS

CHAPTER 5 RECORD OF DISCUSSIONS

– Working Schedule, both Mexico and Japan for the Industrial Port Development –

5-1 The First Mission

Record of discussion

1. Mr. TAKEUCHI will visit Mexico in January, '82. Upon his next visit, he will also discuss the development of new industrial ports at Topolobampo, Tuxpan, Ensenada and Cobah beside the existing five ports. C.P.D. will prepare materials for the discussion of new ports.

2. The Mexican government will ask for the cooperation of the Japanese government with regard to the development of hydraulic experiment facilities at S. C. T. and dispatch of experts concerned. Mr. TAKEUCHI will adivse the Japanese government on the matter.

3. The Mexican government will ask for the cooperation of the Japanese government on the execution of F/S of Tuxpan port project among the above 4 ports.

4. With regard to the feasibility of the technical cooperation of the Japanese government on the improvement work of the Balsas River, the undersigned persons respectively will consult with their government and exchange the conclusions of the consultation between them.

– signed –
Dr. Fernando Rosenzweig H.
Director of C.P.D.

– signed –
Ing. Yoshio Takeuchi
Head of JICA Survey Mission

5-2 The Second Mission

Record of discussion

1. In case the Japanese Government carries out the investivation for Tuxpan port development project in the 1982 fiscal year, the Mexican Authorities desires the investigation to be performed with the understanding of the general situation in the development of industrial ports in Mexico, in order to clarify the background of the Tuxpan port investigation. Mr. Takeuchi will report it to the Japanese Government.
2. As for the river Balsas, in addition to the section survey on flooding, which was taken up in the last visit, the water-utilization program including dam in order to stabilize the supply of agricultural water and industrial water has come to the question of the day. Mr. Takeuchi will report it to the Japanese Government and the Mexican Authorities will submit the written request to the Japanese Government in Form A-1 for the technical cooperation about the above problem.
3. The CPI has a plan for dispatching about four members of the staff for two weeks or so at the expense of the Mexican side in order to get the informations about industrial ports in Japan. Mr. Takeuchi recommended the CPI to make a request to the Japanese Government for the above inspection trip to Japan through the Japanese Embassy at Mexico for convenience of the trip.
4. Mr. M.E. Villanueva, Director General of Ports and Harbors Bureau in SCT, has earnestly requested the continuation of the technical cooperation with the Japanese Government about the research on hydraulic experiment.

– signed –
Dr. Fernando Rosenzweig H.
Director of C.P.I.

– signed –
Ing. Yoshio Takeuchi
Head of JICA Survey Mission

12th February, 1982 in Mexico.