# S－7. 港湾の公害防止対策

## S-7 ENVIRONMENTAL PROTECTION AND ADMINISTRATION OF PORTS AND HARBOURS

### S-7-1 Introduction

In Japan, industrial pollution problems have recently (for the past 20 years) become a great issue and various laws and standards have been published and countermeasures have been established to prevent pollutions.

Especially for constructing industrial ports, sufficient study must be carried out so that changes in natural environments and industrial wastes may not cause the destruction of nature and create source of pollution.

This chapter introduce Japanese cases for environmental protection and administration which should give some references in constructing industrial ports in Mexico.

### S-7-2 Definition of Pollution

Pollution is a by-product of human activities which tends to spread over relatively broad areas, and is detrimental to human health and living environment. Pollution may be categorized into the following 7 types:

- Air Pollution
- Soil Pollution
- Offensive Odor
- Vibration
- Water Pollution
- Noise
- Ground Subsidence

### S-7-3 Pollution Prevention Program

Pollution prevention programs is prepared by governors of the related prefectures by the direction of the Prime Minister for the basic principle of the programs (pollution prevention programs) related to the prevention of pollution in areas where population is concentrated and pollution is presently eminent and where its prevention is difficult to achieve unless overall measures for pollution prevention are enforced. The programs are prepared upon approval of the Prime Minister.

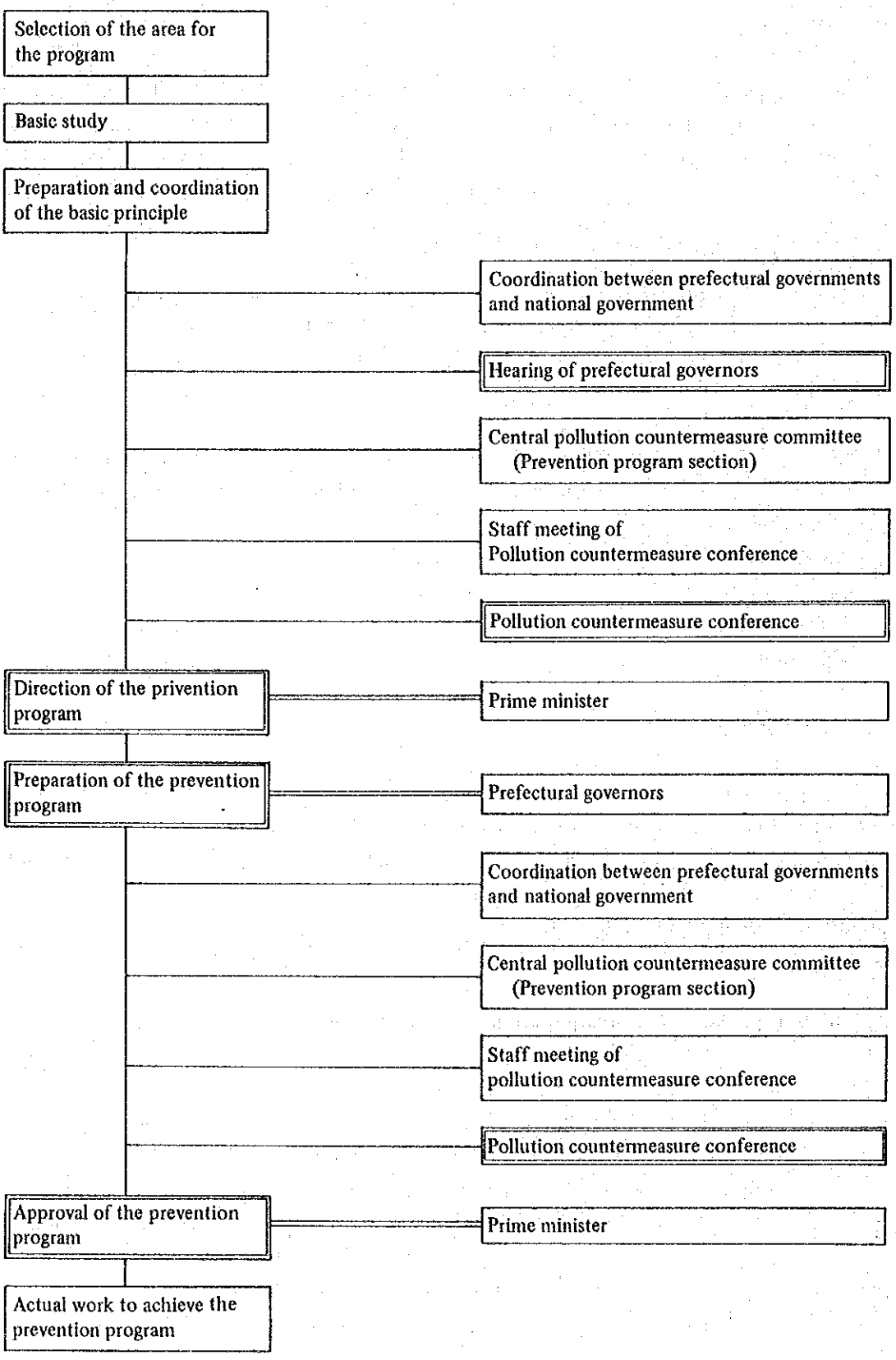
#### (1) Order of preparation of the pollution prevention program

Procedure of preparing pollution prevention program is as shown in Fig. S-7-1.

Basic study of environmental pollution in the proposed area of the pollution prevention program is carried out commissioned by the Environmental Agency first to determine areas for which the program is prepared and then to determine type of measures to be employed. Based on the result of the study, the Prime Minister will direct basic principle of the pollution prevention program to be prepared by each area after hearing of governors of the related prefectures and deliberation at the pollution countermeasure conference.

The basic principle will generally give roles, objectives, and completion date of the pollution

**Fig. S-7-1 Procedure of Preparing Pollution Prevention Program**



prevention program, enforcement of prevention measures, protection of natural environments, establishment of monitoring measuring system of pollutions, securing of cooperation system of pollution and relationships with other plans.

According to this basic principle, related prefectures prepare a pollution prevention program and the prepared program is submitted to the Prime Minister together with governor's application for approval.

Upon receipt of the application for approval, the Prime Minister will call for pollution countermeasure conference and after its deliberation will approve the pollution prevention program.

### (2) Objectives and Content of Pollution Prevention Program

#### (a) Objectives

Generally the pollution prevention program carries out overall measures related to pollution prevention systematically according to the actual condition of each area. Its objectives are to achieve drastic and immediate solution of pollution problems, thoroughly prevent occurrence of pollution, protect the health of local inhabitants and to secure living environment by carrying out these measures as well as measures related to the protection of natural environment.

#### (b) Content of the Program

The pollution prevention program embodies first the degree and period required to achieve the quality of environment, followed by the evaluation of the present condition of pollution and establishment of policies and countermeasures.

Table S-7-1 shows a typical example of the content of the program which has been already prepared.

A period of the program is generally 5 years except in large cities and surrounding areas such as Tokyo metropolitan area, and etc. The period is set for each polluting substance such as sulphuric oxides, etc.

For each area the analysis of the present condition and forecast of each polluting substance is undertaken.

Total amount of waste discharge permitted by ares is estimated and respective countermeasures are set for each polluting substance.

Table S-7-2 roughly shows countermeasures undertaken by local businesses and local public bodies, etc. to achieve/maintain respective objectives and further protect the health of the inhabitants and natural environment and secure overall living environments of the respective area.

## Table S-7-1 Content of Pollution Prevention Program

| | |
|---|---|
| Preamble | Summary of preparing pollution control program<br>Range of area<br>Objective of the program |
| Outline of area | Natural conditions (geology, weather, etc.)<br>Population, Area<br>Industries<br>Environment of cities |
| Present condition of environmental pollution | Present condition of local environmental pollution<br>Air pollution<br>Water pollution<br>Noise, Vibration<br>Ground settlement<br>Offensive odor<br>Soil pollution<br>Wastes |

## Table S-7-2 Countermeasures Undertaken by Local Business and Local Public Bodies, etc.

| | |
|---|---|
| Countermeasures to prevent pollution | Basic policy<br>Land use plans<br>Air pollution countermeasures<br>Water pollution countermeasures<br>Noise and vibration countermeasures<br>Ground settlement countermeasures<br>Offensive odor countermeasures<br>Soil pollution countermeasures<br>Waste disposal countermeasures |
| Other countermeasures | Development of pollution prevention related matters and other city facilities<br>Environmental health measures<br>Small and medium business countermeasures |
| Development of Systems of Research and Monitoring/Measuring | Development of systems monitoring pollution sources<br>Development of systems monitoring environment<br>Development of monitoring center<br>Development of research and study systems<br>Administative organization of pollution countermeasures |
| Protection of natural environment | |
| Summary of the program | Follow up to achieve objectives<br>Estimated costs<br>Securing cooperation systems<br>Coordination with the existing plans. |

(i) Businesses shall carry out various pollution prevention measures such as changing raw materials/fuel, improving method of combustion, installing desmoking/desulfurizing/denitrating facilities, dust collection system for air pollution countermeasures and installing/improving waste disposal system and changing process of production for water pollution countermeasures.

(ii) Local public bodies shall carry out various public work (A. developing sewage system, dredging rivers and harbours, installing greens as buffer, waste disposal system, countermeasures for pollution of farmland, countermeasures for noise caused by airplanes, improving school environment, developing monitor/measure systems and other pollution countermeasures. B. developing parks and green areas, countermeasures for ground settlement, countermeasures for traffic and other pollution related works) in addition to carrying out environmental assessment, control of pollution sources, site regulation and other measures.

## S-7-4 Environmental Assessment related to Development of Port and Harbours

(1) Environmental assessment related to the development of ports and harbours is carried out by making studies from the standpoint of environmental security of the ports and surrounding areas to serve as adequate development of the ports and harbours as elements for study of the development, use and security of the ports.
Basically in the course of developing ports, environmental assessment is carried out at the time of the completion of the plan in the stage of basic planning, at the time of the completion of the plan in the stage of execution planning of the project and at the time of execution of the project.

(2) The following cover the range of subjects for environmental assessment related to the development of ports and harbours.

(a) Range of space
Environmental assessment is carried out on areas affected by the development of ports and those related to the affected areas.

(b) Range of environment
Environment assessment is carried out on the living environment and natural environment but not on the economic environment.

(c) Range of influence
Basically influence is limited to direct influence caused by the development of ports and indirect influence upon plants, animals and cultural assets is included if necessary.

### (3) Environmental objectives

The following environmental objectives are set in environmental assessment related to the development of ports.

a) For all changes of environment which is subject to assessment, objectives for environmental protection are set up.
b) In case environmental standards are set up in respective area, basically the environmental standards are set up as environmental objectives.
c) In case environmental standards are not set up in respective area, adequate environmental objectives are set up in consideration of the characteristics the area.

### (4) Matters to be considered in the execution and general procedure

In the environmental assessment related to the development of ports, following matters must be taken into consideration.

a) Situation in the course of port development
b) Local characteristics of the area subject to port development and surrounding areas
c) Laws and regulations covering the area subject to port development and surrounding areas.

Environmental problems subject to environmental assessment occur in areas surrounding where the project is carried out and those areas considered a part thereof. Therefore it is necessary to understand the natural, social and environmental characteristics of the areas. Natural characteristics include geographic location of the areas where port development takes place (areas facing outer ocean, inland sea or rivers, hinterlands are hills or plains), while social characteristics include the hinterland of the port being cities?, already developed?, etc. and environmental characteristics include the areas already polluted or not. These must be known beforehand and environmental assessment must be made according to the characteristics of the areas concerned.

Environmental assessment related to port development is basically carried out in the following procedure as shown in Fig. S-7-2.

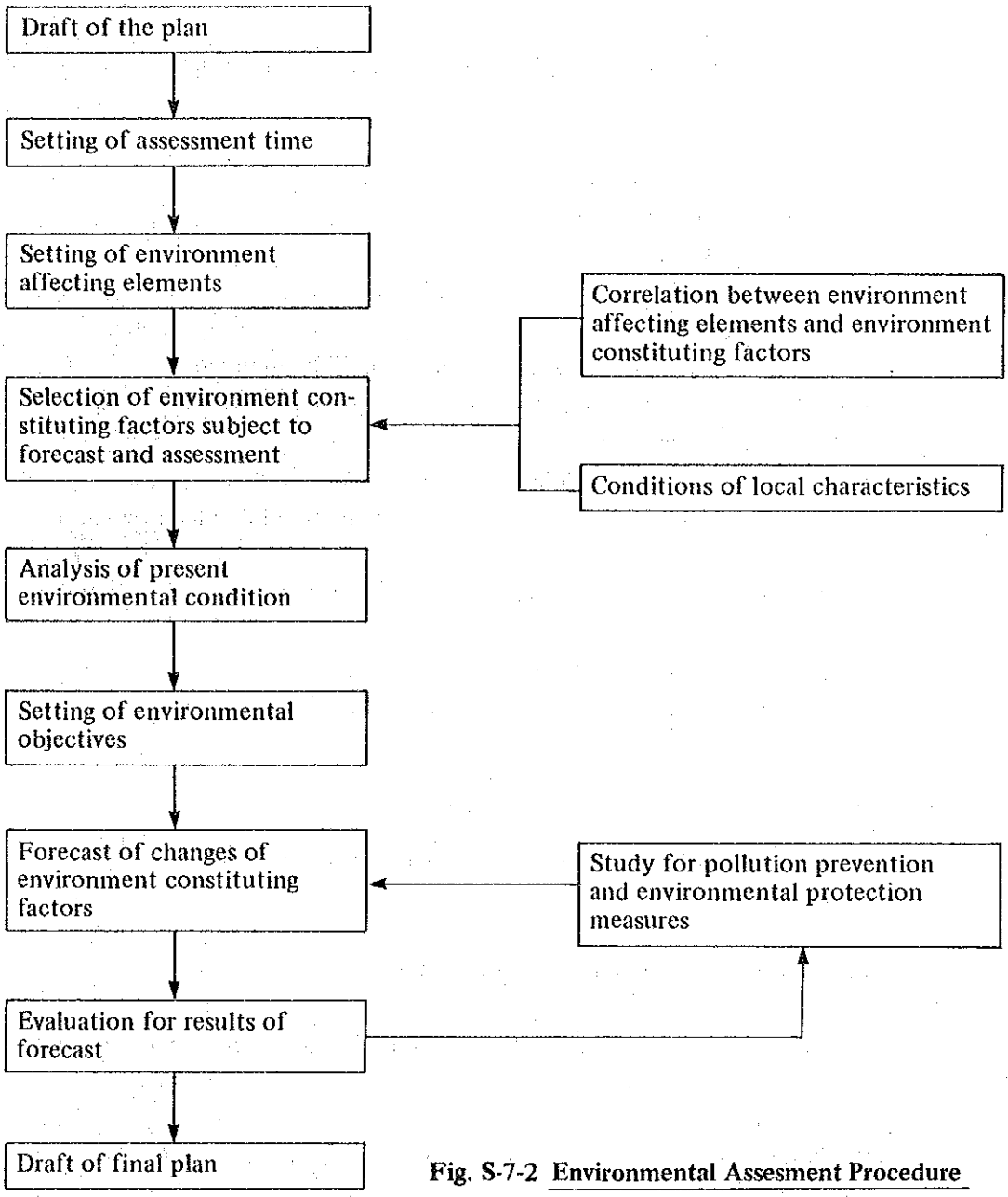



**Fig. S-7-2 Environmental Assesment Procedure**

After appropriately selecting environment constituting factors, subject of forecast and assessment, using the draft plan and in consideration of the scale of the port development and area characteristics, environmental assessment is carried out for each individual environment constituting factors for analyzing the present environment and carrying our subsequent measures.

### (5) Composition of Environment Affecting Elements

In environmental assessment related to port development, environment affecting elements to be considered are as follows.

a) Environment affecting elements related to use
- Use of channels and basins (ships)
- Use of mooring facilities (ships)
- Use of sorting areas, storage area and mobile bases (general cargo and bulk cargo)
- Use of industrial area (various manufacturing, electrical supply businesses)
- Use of land for traffic functions (land for railway and road)
- Use of land for handling dangerous cargo (land for handling dangerous cargo, oil distribution base)
- Use of land for recreation facilities (land for apron, boat yead, hotels)
- Use of land related to industrial wastes (waste disposable facilities site)
- Use of other site

  Other site includes port related site, city function site, greens, sand disposal site and public site.

b) Environment affecting elements related to existence.
   Port facilities
   Site

c) Environment affecting elements related to construction work
   Type of work

### (6) Composition of Environment Constituting Factors

In environmental assessment related to port development, environment constituting factors to be considered are as follows.

a) Environment constituting factors related to air quality
   ① Sulpharic oxide (SOx)
   ② Nitrogen oxide (NOx)
   ③ Soot and dust
   ④ Fine dust
   ⑤ Fluorine, fluoride
   ⑥ Carbon monoxide (CO)

b) Environment constituting factors related to water quality and bottom quality
   ① Chemical oxygen demand (COD)
   dissolved oxygen (DO), nitrogen (N), phosphorous (P) if necessary.
   ② Warm waste water.

③ Suspended substances (SS)
④ Oil
⑤ Harmful substances

c) Environment constituting factors related to noise and vibration.
① noise level
② vibration level

d) Environment constituting factors related to offensive odor.
① Hydrogen sulfide
② Methylmelkaptan
③ Methylsulfide
④ Trimethylamine
⑤ Ammonium
⑥ Methyldisulfide
⑦ Acetaldehyde
⑧ Styrene

e) Environment constituting factors
① Drift sand
② Ground settlement
③ Underground water system

f) Environment constituting factors related to marine conditions.
① Waves, wave current
② Tide current (including constant current)

g) Environment constituting factors related to animals and plants
① Bacteria
② Plant plankton
③ Animal plankton
④ Sea weeds
⑤ Parasites
⑥ Bottom lives
⑦ Animals and plants for fishery
⑧ Birds at tidal flat
⑨ Land plants

h) Environment constituting factors related to views
① Position of view point
② Relationship between view point and structures
③ Components of views
natural views, field views, city views, port views, greens

j) Environment constituting factors related to cultural asset

① Tangible cultural asset

② Folk cultural asset

③ Historical buildings

④ Memorials (burried memorials, etc.)

**(7) Correlation between Environment Affecting Elements and Environment constituting factors.**

Correlation between environment affecting elements and environment constituting factors is shown in the following Table S-7-3.

Table S-7-3 Correlation between environment affecting elements and environment constituting factors

| Environment affecting elements | | Atmospheric quality | Water quality and bottom materials | Noise and vibration | Offensive odor | Topography | Marine phenomena | Animals and vegetables | Scenery | Cultural assets | Wastes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Existence | Port facilities | | ○ | | | ○ | ○ | ○ | ○ | ○ | |
| | Land | | ○ | | | ○ | ○ | ○ | ○ | ○ | |
| Utilization | Channels, anchorages and basins | ○ | | | | | | ○ | | ○ | ○ |
| | Mooring facilities | ○ | | | | | | ○ | | ○ | ○ |
| | Land for cargo handling facilities land for storage facilities and movable facilities | ○ | ○ | ○ | ○ | | | ○ | | ○ | ○ |
| | Industrial land | ○ | ○ | ○ | ○ | ○ | | ○ | | ○ | |
| | Land for traffic function | ○ | | ○ | | | | ○ | | ○ | |
| | Land for dangerous material handling facilities | ○ | ○ | | | | | ○ | | | |
| | Land for recreation facilities | ○ | | | | | | ○ | | | ○ |
| | Land relating to wasted | ○ | ○ | | ○ | | | ○ | | ○ | ○ |

## S-7-5 Environmental Quality Standards of Japan

Environmental quality standards are the target of improvement toward which the administrative efforts are exerted. They should be distinguished from effluent standards, etc. which have been set for the surveillance of individual plants and businesses.

### (1) Ambient Air Quality

**Table S-7-4 Ambient Air Quality**

| Substance | Sulfur dioxide | Carbon monoxide | Suspended particulate[1] matter | Nitrogen dioxide[3] | Photochemical[2] oxidants |
|---|---|---|---|---|---|
| Environmental conditions | Daily average of hourly values shall not exceed 0.04 ppm, and hourly values shall not exceed 0.1 ppm. | Daily average of hourly values shall not exceed 10 ppm, and average of hourly values in eight consecutive hours shall not exceed 20 ppm. | Daily average of hourly values shall not exceed 0.10 mg/m$^3$, and hourly values shall not exceed 0.20 mg/m$^3$. | Daily average of hourly values shall be within the range between 0.04 ppm and 0.06 ppm or below. | Hourly values shall not exceed 0.06 ppm. |
| Measuring methods | Conductometric method | Nondispersive infrared analizer method | Weight concentration measuring methods based on filtration collection, or light scattering method yielding values having a linear relation with the values of the above method | Colorimetry employing Saltzman reagent (with Saltzman's coefficient being 0.84) | Absorptiometry using neutral potassium iodide solution, or coulometry |

Notes: 1. Suspended particulates matter shall mean airborn particles of 10 microns or less in diameter.
2. Photochemical oxidants are oxidizing substances such as ozone and paroxiacetyl nitrate produced by photochemical reactions (only those capable of isolating iodine from neutral potassium iodide, excluding nitrogen dioxide).
3. a) In an area where the daily average of hourly values exceeds 0.06 ppm, efforts should be made to achieve the level of 0.06 ppm by 1985.
b) In an area where the daily average of hourly values is within the range between 0.04 ppm and 0.06 ppm, efforts should be made so that the ambient concentration be maintained around the present level within the range or not significantly exceed the present level.
c) Not only emission control measures against individual sources but also other various countermeasures should be implemented in an integrated, effecuve and appropriate manner in order to maintain or achieve the ambient air quality standard.

### (2) Noise (May 25, 1971)

(1) General area

(in dB(A))

| Category of area | Division of hours | | |
|---|---|---|---|
| | Daytime | Morning & evening | Nighttime |
| | Not more than | Not more than | Not more than |
| AA | 45 | 40 | 35 |
| A | 50 | 45 | 40 |
| B | 60 | 55 | 50 |

Note: Standard values vary depending on the area type. Therefore, classification of areas is left to the discretion of prefectural governors.
AA — Areas which require particular quite. For instance, areas where medical facilities are concentrated.
A — Primarily residential areas.
B — Areas where a substantial number of residences are located among shops and factories

**Table S-7-5 Noise**

(ii) Roadside area

(in dB(A))

| Categories of areas | Division of hours | | |
|---|---|---|---|
| | Daytime | Morning & evening | Nighttime |
| | Not more than | Not more than | Not more than |
| Type A areas bordering on a two-lane road | 55 | 50 | 45 |
| Type A areas bordering on a more than two-lane road | 60 | 55 | 50 |
| Type B areas bordering on a not more than two-lane road | 65 | 60 | 55 |
| Type B areas bordering on a more than two-lane road | 65 | 65 | 60 |

Table S-7-6 Noise

## (3) Water Quality (Dec. 28, 1971)

### ① Standards relating to human health

| Item | Standard values[1] |
|---|---|
| Cadmium | 0.01 ppm or less |
| Cyanide | Not detectable |
| Organic phsphorus[2] | Not detectable |
| Lead | 0.1 ppm or less |
| Chromium (sexivalent) | 0.05 ppm or less |
| Arsenic | 0.05 ppm or less |
| Total mercury | 0.0005 ppm or less |
| Alkyl mercury | Not detectable. |
| PCB | Not detectable |

Notes: 1. Maximum values. But with regard to total mercury, standard value is based on the yearly average value.
2. Organic phosphorus includes parathion, methyl parathion, methyl demeton and E.P.N.

Table S-7-7 Water Quality

② Standards relating to living environment

(i) Rivers

| Category | Item / Purpose of utilization | Standard values[1] pH | Biochemical oxygen demand (BOD) | Suspended solids (SS) | Dissolved oxygen (DO) | Number of coliform groups |
|---|---|---|---|---|---|---|
| AA | Water supply, class 1; conservation of natural environment and uses listed in A–E | 6.5–8.5 | 1 ppm or less | 25 ppm or less | 7.5 ppm or more | 50 MPN/100 ml or less |
| A | Water supply, class2; fishery, class 1; bathing and uses listed in B–E | 6.5–8.5 | 2 ppm or less | 25 ppm or less | 7.5 ppm or more | 1,000 MPN/100 ml or less |
| B | Water supply, class 3; fishery, class 2, and uses listed in C–E | 6.5–8.5 | 3 ppm or less | 25 ppm or less | 5 ppm or more | 5,000 MPN/100 ml or less |
| C | Fishery, class 3; industrial water, class 1, and uses listed in D–E | 6.5–8.5 | 5 ppm or less | 50 ppm or less | 5 ppm or more | |
| D | Industrial water, class 2; agricultural water[2], and uses listed in E | 6.0–8.5 | 8 ppm or less | 100 ppm or less | 2 ppm or more | |
| E | Industrial water, class 3; conservation of environment | 6.0–8.5 | 10 ppm or less | Floating matter such as garbage should not be observed | 2 ppm or more | |

Notes: 1. The standard value is based on the daily average value. (The same applies to the standard values of lakes and coastal waters.)
2. At the inlet or agricultural water, pH shall be between 6.0 and 7.5 and dissolved oxygen shall not be less than 5 ppm. (The same applies to the standard values of lakes.)

3. Conservation of natural environment: Conservation of scenic spots and other natural resources.
4. Water supply, class 1: Water treated by simple cleaning operation such as filtration.
Water supply, class 2: Water treated by normal cleaning operation such as sedimentation and filtration.
Water supply, class 3: Water treated through a highly sophisticated cleaning operation including pretreatment.
5. Fishery, class 1: For aquatic life such as trout and bull trout inhabiting oligosaprobic water, and those of fishery class 2 and class 3.
Fishery, class 2: For aquatic life, such as fish of the salmon family and sweetfish inhabiting oligosaprobic water and those of fishery class 3.
Fishery, class 3: For aquatic life such as carp and silver carp inhabiting β-mesosaprobic water.
6. Industrial water, class 1: Water given normal cleaning treatment such as sedimentation.
Industrial water, class 2: Water given sophisticated treatment by chemicals.
Industrial water, class 3: Water given special cleaning treatment.
7. Conservation of environment: Up to the limits at which no unpleasantness is caused to people in their daily life (including a walk by the riverside, etc.)

Table S-7-8 Water Quality

(ii) Lakes (natural lakes, reservoirs, marshes and artificial lakes with more than 10 million cubic meters of water)

| Category | Item / Purpose of utilization | Standard values pH | Chemical oxygen demand (COD) | Suspended solids (SS) | Dissolved oxygen (DO) | Number of coliform groups |
|---|---|---|---|---|---|---|
| AA | Water supply, class 1; fishery, class 1; conservation of natural environment and uses listed in A–C | 6.5–8.5 | 1 ppm or less | 1 ppm or less | 7.5 ppm or more | 50 MPN/100 ml or less |
| A | Water supply, classes 2 and 3; fishery, class 2; bathing and uses listed in B–C | 6.5–8.5 | 3 ppm or less | 5 ppm or less | 7.5 ppm or more | 1,000 MPN/100 ml or less |
| B | Fishery, class 3; industrial water, class 1; agricultural water, and uses listed in C | 6.5–8.5 | 5 ppm or less | 15 ppm or less | 5 ppm or more | – |
| C | Industrial water, class 2; conservation of environment | 6.0–8.5 | 8 ppm or less | Floating matter as garbage shall not be observed | 2 ppm or more | – |

Notes: 1. With regard to fishery, classes 1, 2 and 3, the standard value for suspended solids shall not be applied for the time being.
2. See notes for Rivers.

Table S-7-9 Water Quality

(iii) Costal waters

| Category | Item / Purpose of utilization | Standard values: pH | Chemical oxygen demand (COD) | Dissolved oxygen (DO) | Number of coliform groups[1] | N-hexane extracts |
|---|---|---|---|---|---|---|
| A | Fishery, class 1; bathing; conservation of natural environment and uses listed in B–C | 7.8–8.3 | 2 ppm or less | 7.5 ppm or more | 1,000 MPN/100 ml or less | Not detectable |
| B | Fishery, class 2; industrial water and uses listed in C | 7.8–8.3 | 3 ppm or less | 5 ppm or more | – | Not detectable |
| C | Conservation of environment | 7.0–8.3 | 8 ppm or less | 2 ppm or more | – | – |

Notes: 1. With regard to the water quality of fishery, class 1 for cultivation of oysters, the number of coliform groups shall be less than 70 MPN/100ml.
2. Fishery, class 1: For aquatic life such as red sea-bream, yellow tail, seaweed and those of fishery.
Fishery, class 2: For aquatic life such as gray mullet, laver, etc.
3. Conservation of environment: Up to the limits at which no unpleasantness is caused to people in their daily life (including a walk by the shore, etc.).

Table S-7-10 Water Quality

## S-7-6 Effluent Standards of Japan

The purpose of this Law is to control the emission of soot and smoke or the discharge of effluent into public water bodies, by plants and businesses.

### (1) Soot and dust (Latest amendment, June 22, 1971)

(Unit:g/Nm$^3$)

| Name of facility | Ordinary emission standard: large scale | Ordinary emission standard: small scale | | Special emission standard: large scale | Special emission standard: small scale |
|---|---|---|---|---|---|
| Boilers (using liquid fuels or gas) | 0.10 | 0.20 | 0.30 | 0.05 | 0.20 |
| Boilers (using lower-grade coal) | 0.80 | | | 0.40 | |
| Boilers (of other types using coal, etc.) | 0.40 | | | 0.20 | |
| Gas generating furnace, catalytic regeneration tower | 0.60 | | | 0.40 | |
| Roasting furnace, sintering furnace, calcining furnace converter (combustion type), openhearth furnace | 0.30 | 0.40 | | 0.20 | |
| Blast furnace | 0.10 | | | 0.05 | |
| Heating furnace, converter (excepting the combustion type), petroleum pipe stills, sulfur-collecting combustion furnace | 0.20 | | | 0.10 | |
| Lime stone calcining furnace (underground furnace), aggregate drying furnace | 0.80 | | | 0.40 | |
| Lime stone calcining furnace (others), electric furnace (for steel making) | 0.60 | | | 0.30 | |
| Electric furnace | 0.40 | | | 0.20 | |
| Blast furnace (of types not covered by any of the above items), metal melting furnace, metal-heating furnace, calcining and melting furnace (excepting lime stone calcining furnace), reactors, direct fire furnace, drying furnace (other than aggregate drying furnace), electric furnace (of types not covered by any of the above items) | 0.20 | 0.40 | | 0.10 | 0.20 |
| Glass melting furnace (crucible furnace) | 0.50 | | | 0.50 | |
| Waste incinerator (continuous furnace) | 0.20 | 0.70 | | 0.10 | 0.20 |
| Waste incinerator (others) | 0.70 | | | 0.40 | |

Notes: 1. Prefectures may, by decree, set more stringent standards.
2. The gas emission rate of 40,000 Nm$^3$/h is the criterion used for scale classification. However, heavy oil boilers alone are classified into three scales with the criteria of 200,000 Nm$^3$/h and 40,000 Nm$^3$/h for ordinary emission standards.
3. For further details, refer to Table 2 attached to the Enforcement Ordinances of the Air Pollution Control Law.

Table S-7-11 Soot and Dust

## (2) Harmful substances (June 22, 1971)

| Name of substance | Name of facility | Standard value |
|---|---|---|
| Cadmium and its compound | Baking furnace and smelting furnace for manufacturing glass using cadmium sulfide or cadmium carbonate as raw material | 1.0 mg/Nm$^3$ |
| | Calcination furnace, sintering furnace, smelting furnace, converter and drying furnace for refining copper, lead or cadmium | |
| | Drying facility for manufacturing cadmium pigment, or cadmium carbonate | |
| Chlorine | Chlorine quick cooling facility for manufacturing chlorinated ethylene | 30 mg/Nm$^3$ |
| | Dissolving tank for manufacturing ferric chloride | |
| | Reaction furnace for manufacturing activated carbon using zinc chloride | |
| | Reaction facility and absorbing facility for manufacturing chemical products | |
| Hydrogen chloride | Same as above | 80 mg/Nm$^3$ |
| | Waste incinerator | 700 mg/Nm$^3$ |
| Fluorine, hydrogen fluoride, and silicon fluoride | Electrolytic furnace for smelting aluminium (Harmful substances are comitted from discharge outlet) | 3.0 mg/Nm$^3$ |
| | Electrolytic furnace for smelting aluminium (Harmful substances are emitted from top) | 1.0 mg/Nm$^3$ |
| | Baking furnace and smelting furnace for manufacturing glass using fluorite or sodium silicofluorate as raw material | 1.0 mg/Nm$^3$ |
| | Reaction facility, concentrating facility and smelting furnace for manufacturing phosphoric acid | |
| | Condensing facility, absorbing facility and distilling facility for manufacturing phosphoric acid | |
| | Reaction facility, drying facility and baking furnace for manufacturing sodium tripoli-phosphate | |
| | Reaction furnace for manufacturing super-phosphate of lime | 15 mg/Nm$^3$ |
| | Baking furnace and open-hearth furnace for manufacturing phosphoric acid fertilizer | 20 mg/Nm$^3$ |
| Lead and its compound | Calcination furnace, drying furnace, smelting furnace, and drying furnace for refining copper, lead, or zinc | 10 mg/Nm$^3$ |
| | Sintering furnace and blast furnace for refining copper, lead or zinc | 30 mg/Nm$^3$ |
| | Smelting furnace etc. for secondary refining of lead, for manufacturing lead pipe, sheet, wire, lead storage battery or lead pigment | 10 mg/Nm$^3$ |
| | Baking furnace and smelting furnace for manufacturing glass using lead oxides as raw materials | 20 mg/Nm$^3$ |

Table S-7-12 Harmful Substance

## (3) Nitrogen oxides (Latest amendment June 16, 1977)

| | Existing facilities | | | | Newly built facilities | | | Residual oxygen concentration in stack gas (On) |
|---|---|---|---|---|---|---|---|---|
| | Type of facility | | New standard | Old standard | | New standard | Old standard | |
| Boiler | Gas combustion | (Unit: 1,000 Nm³/h) | | | (Unit: 1,000 Nm³/h) | | | 5% |
| | | Over 500 | 130 ppm | 130 ppm | Over 500 | 60 ppm | 100 ppm | |
| | | 100 – 500 | 130 | 130 | 100 – 500 | 100 | 100 | |
| | | 40 – 100 | 130 | 130 | 40 – 100 | 100 | 130 | |
| | | 10 – 40 | 150 | 150 | 10 – 40 | 130 | 130 | |
| | | 5 – 10 | 150 | – | 5 – 10 | 150 | – | |
| | | | | | Up to 5 | 150 | – | |
| | Solid material combustion | Over 100 | 480* | 600 (750) | Over 100 | 400 | 480 | 6% |
| | | 40 – 100 | 600 (750) | 600 (750) | 40 – 100 | 400 | 480 | |
| | | 10 – 40 | 600 (750) | 600 (750) | 10 – 40 | 400 | 480 | |
| | | 5 – 10 | 480 | – | 5 – 10 | 400 | – | |
| | | | | | Up to 5 | 400 | – | |
| | Others (Liquid combustion) | Over 1,000 | 180 | 230 (280)** | Over 500 | 130 | 150 | 4% |
| | | 500 – 1,000 | 180 (210) | 230 (280)** | 100 – 500 | 150 | 150 | |
| | | 100 – 500 | 190 (210) | 230 (280)** | 40 – 100 | 150 | 150 | |
| | | 40 – 100 | 190 (210) | 190*(280)** | 10 – 40 | 150 | 150 | |
| | | 10 – 40 | 230 (250) | – (280)** | 5 – 10 | 180* | – | |
| | | 5 – 10 | 250 (280) | – | Up to 5 | 180* | – | |
| Sintering furnace | | Over 100 | 260 | – | Over 100 | 220 | – | 15% |
| | | 10 – 100 | 270 | – | 10 – 100 | 200 | – | |
| Alumina calcination furnace | | | | | Over 10 | 200 | – | 10% |
| Metal heating furnace | | Over 100 | 160 (200) | 220 | Over 100 | 100 | 100 | 11% |
| | | 40 – 100 | 170 (200) | 220 | 40 – 100 | 130 (150) < 180 > | 150* | |
| | | 10 – 40 | 200 | 200 | 10 – 40 | 130 (150) < 180 > | 150* | |
| | | 5 – 10 | 170 (200) | | 5 – 10 | 150* | – | |
| | | | | | Up to 5 | 150* | – | |
| Petroleum heating furnace | | Over 100 | 170 | 210* | Over 100 | 100 | 100 | 6% |
| | | 40 – 100 | 170** | 210* | 40 – 100 | 130 | 100 | |
| | | 10 – 40 | 180*** | 180* | 10 – 40 | 130 | 150 | |
| | | 5 – 10 | 180 (190) | | 5 – 10 | 150 | – | |
| | | | | | Up to 5 | 180 | – | |
| Cement calcination furnace | | | 480 | – | Over 100 | 250 | 250 | 10% |
| | | | | | Up to 100 | 350 | – | |
| Coke oven | | | 350 | – | Over 100 | 170 | 200 | 7% |
| | | | | | Up to 100 | 170 | – | |
| Waste incinerator | | | | | Over 40 | 250 | – | 12% |
| Nitric acid production facility | | | 200 | 200 | – | 200 | 200 | Os |

Notes: 1. Reference to Boiler-Solid material combustion category, marked * in the "existing" column shows 650 ppm for ceiling burner and 550 ppm for divided wall type. ( ) are applied for low-grade coal combustion burners.

2. Reference to Boiler–Others (Liquid combustion), ( ) in the "existing" column are applied for the ones equipped with flue gas desulfurization facilities. Marked * indicates excluding the ones equipped with desulfurizer.
Mark ( )** are for crude oil combustion burners, and the standards marked * in the "newly built facilities" are applied from September 10, 1977.

3. Reference to Sintering furnace, "existing" does not cover pellet sintering furnaces.

4. Reference to Metal heating furnaces, "existing" does not cover the heating furnaces for welded steel pipe. ( ) are applied for heating furnaces of the radiant tube type. Marked * in the "newly built" column shows not including heating furnaces for welded steel pipe. ( ) in the "newly built" column are applied for radiant tube type heating furnaces. < > are applied for heating furnaces for welded steel pipe.

5. Marked * in the "existing" column of Petroleum heating furnace are not applied for ethylene resolving furnaces, independent superheating furnaces, methanol refining furnaces and ammonium refining furnaces. Marked ** are not applied for independent superheating furnaces and methanol refining furnaces. Marked *** are not applied for ethylene resolving furnaces. ( ) are applied for those equipped with a stack gas desulfurization facility.

6. Reference to Cement calcination furnace, standards in the "existing" column are not applied for wet type furnaces, and application from April 1, 1981.

7. Reference to Coke ovens, standards in the "existing" column are not applied for Otto type ovens.

8. The NOx emission concentration shall be converted through the following equation. (Except in the case of nitric acid production facilities.)

$$C = \frac{21 - On}{21 - Os} Cs$$

C: NOx emission concentration
On: Oxygen concentration in stack gas (set values in the above table)
Os: Actual oxygen concentration in stack gas
Cs: Actual nitrogen oxides emission concentration

Table S-7-13 Nitrogen Oxides

## (4) Effluent standards into public water bodies.

### ① Substances related to the protection of human health

| Toxic substances | Permissible limits |
|---|---|
| Cadmium and its compounds | 0.1 mg/l |
| Cyanide compounds | 1 mg/l |
| Organic phosphorus compounds (parathion, methyl parathion, methyl demeton and EPN only) | 1 mg/l |
| Lead and its compounds | 1 mg/l |
| Sexivalent chrome compounds | 0.5 mg/l |
| Arsenic and its compounds | 0.5 mg/l |
| Total mercury | 0.005 mg/l |
| Alkyl mercury compounds | Not detectable |
| PCB | 0.003 mg/l |

Note: By the term "not detectable" is meant that the substance is below the level detectable by the method designated by the Director General of the Environment Agency.

### ② Items related to the protection of the living environment

| Item | Permissible limits |
|---|---|
| pH | 5.8~8.6 for effluent discharged into public water bodies other than coastal waters<br>5.0~9.0 for effluent discharged into coastal waters |
| BOD, COD | 160 mg/l (daily average 120 mg/l) |
| SS | 200 mg/l (daily average 150 mg/l) |
| N-hexane extracts | 5 mg/l (mineral oil)<br>30 mg/l (animal and vegetable fats) |
| Phenols | 5 mg/l |
| Copper | 3 mg/l |
| Zinc | 5 mg/l |
| Dissolved iron | 10 mg/l |
| Dissolved manganese | 10 mg/l |
| Chrome | 2 mg/l |
| Fluorine | 15 mg/l |
| Number of coliform groups (per cc) | 3,000 (daily average) |

Notes: 1. The discharge standards in this table are applied to the effluents from industrial plants and other places of business whose volume of effluents per day is not less than 50 $m^3$
2. The discharge standards for BOD are applied to public waters other than coastal waters and lakes, while the discharge standards for COD are applied only to effluents discharged into coastal waters and lakes.

**Table S-7-14 Effluent Standards into Public Water Bodies**

## S-7-7 Volume of Water Utilization in Industrial Ports (for reference)

In the industrial port area, large volume of water for industries and used water by industries must be gathered or discharged.

In this section, the volume of water utilization in KASHIMA Port and TOMAKOMAI Port will be introduced for reference.

### (1) KASHIMA Port

Following Tables and Fig. S-7-3 show the volume of water flow at the indicated intakes or outlets.

a) Volume of water discharge ($m^3$/Day)

| Outlet | Present | Future | Outlet | Present | Future |
|---|---|---|---|---|---|
| 1 | 2,951,430 | 3,186,411 | 14 | 9,807 | 20,890 |
| 2 | 11,600 | 36,000 | 15 | 9,807 | 14,862 |
| 3 | 19,000 | 259,300 | 16 | 4,183 | 9,560 |
| 4 | 8,800 | 282,500 | 17 | | 3,839,590 |
| 5 | 591 | 2,915 | 18 | | 21,730 |
| 6 | 35,804 | 332,502 | 19 | | 2,360 |
| 7 | 540,788 | 2,278,733 | 20 | | 6,866 |
| 8 | 262,550 | 402,760 | 21 | | 2,980 |
| 9 | 11,403 | 54,960 | 22 | | 2,580 |
| 10 | 500 | | 23 | | 9,200 |
| 11 | 158,400 | 855,260 | 24 | | 10,406 |
| 12 | 7,836,924 | 12,650,000 | 25 | | 571 |
| 13 | 111,190 | | Total | 11,972,777 | 24,282,736 |

**Table S-7-15 Volume of Water Discharge**

b) Volume of water to be gathered ($m^3$/Day)

| Intake | Present | Future |
|---|---|---|
| a | 2,773,610 | 7,414,400 |
| b | 8,735,478 | 17,300,000 |
| c | 360 | 14,400 |
| Total | 11,509,448 | 24,728,800 |

**Table S-7-16 Volume of Water to be gathered**

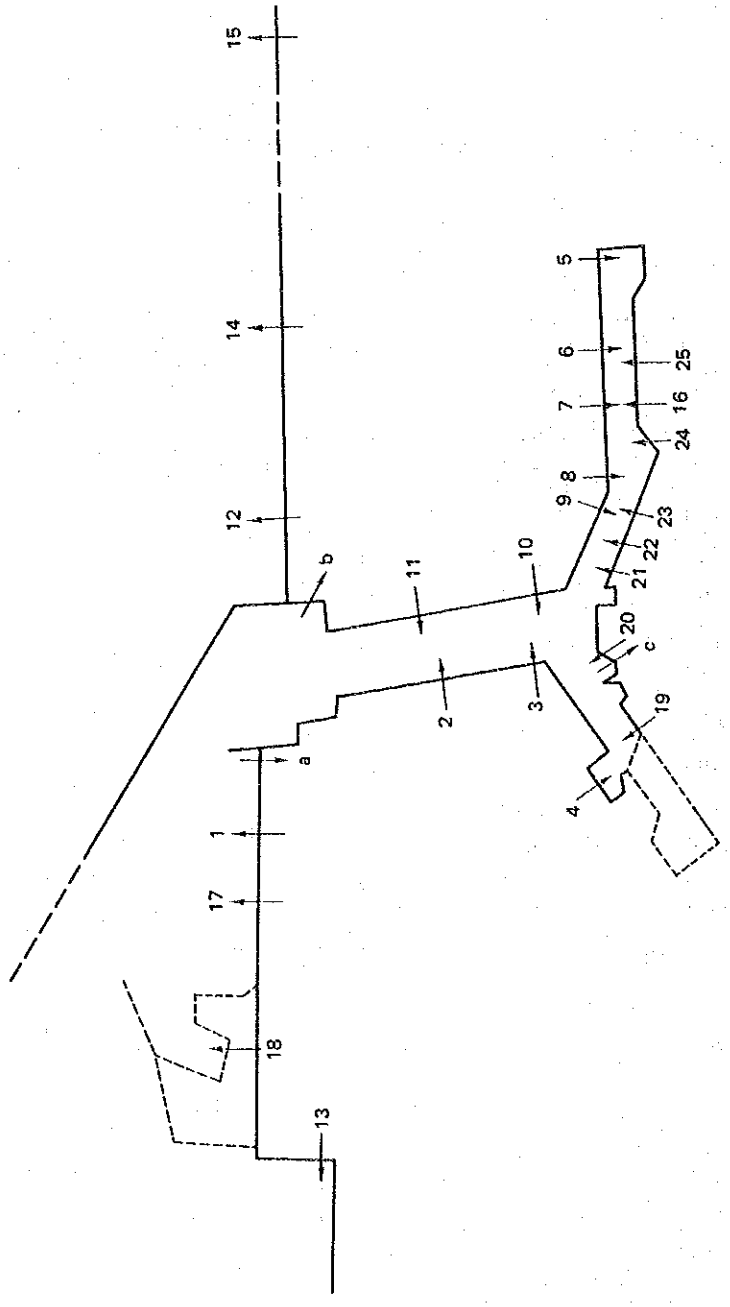



Fig. S-7-3 Location of Intake and Discharge

## (2) TOMAKOMAI Port

Following Tables and Fig. S-7-4 show the volume of water flow at the indicated intakes and outlets.

a) Volume of water discharge (m³/Day)

| Outlet | Remarks | Present | Future | Outlet | Remraks | Present | Future |
|---|---|---|---|---|---|---|---|
| 1 | River | 191,000 | 189,000 | 23 | River | 1,039,000 | 952,000 |
| 2 | River | 87,000 | 118,000 | 24 | | – | 76,000 |
| 3 | | 443,000 | 474,800 | 27 | | – | 745 |
| 4 | River | 40,100 | 43,100 | 28 | | – | 2,371,600 |
| 6 | | 39,900 | 90,900 | 29 | | – | 1,260,400 |
| 12 | | 500 | 12,000 | 30 | | – | 487,000 |
| 13 | | 5,500 | 9,100 | 31 | | – | 1,275,000 |
| 18 | | 73,400 | 322,300 | 32 | River | 359,000 | 408,000 |
| 19 | | 1,920,200 | 2,333,600 | 33 | | – | 100 |
| 20 | | 61,600 | 120,500 | 34 | | – | 1,000 |
| 21 | | 11,600 | 116,700 | 35 | | – | 6,000 |
| 22 | | 128,100 | 170,600 | Total | | 4,399,900 | 10,838,445 |

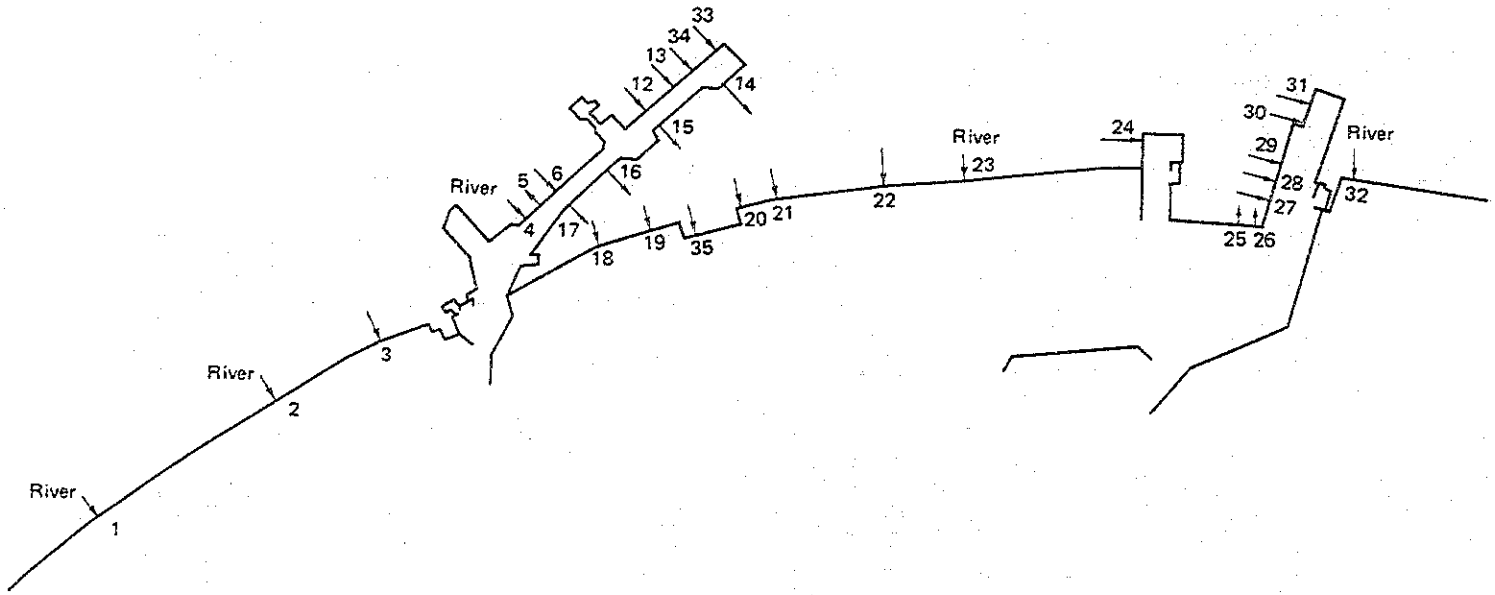
**Table S-7-17 Volume of Water Discharge**

b) Volume of water to be gathered (m³/Day)

| Intake | Present | Future |
|---|---|---|
| 5 | 29,800 | 70,000 |
| 14 | – | 3,000 |
| 15 | 61,100 | 120,000 |
| 16 | 1,920,000 | 2,333,300 |
| 17 | 63,000 | 300,000 |
| 25 | – | 1,651,000 |
| 26 | – | 3,630,000 |
| Total | 2,073,900 | 8,107,300 |

**Table S-7-18 Volume of Water to be gethered**

Fig. S-7-4 Location of Intake and Discharge



# S－8. 港湾の公害防止対策

## S-8 COUNTERMEASURES OF SAFETY AND PREVENTION OF DISASTER FOR PORTS AND HARBOURS

### S-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.

### S-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.

### S-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.

## S-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.

## S-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.

## S-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.

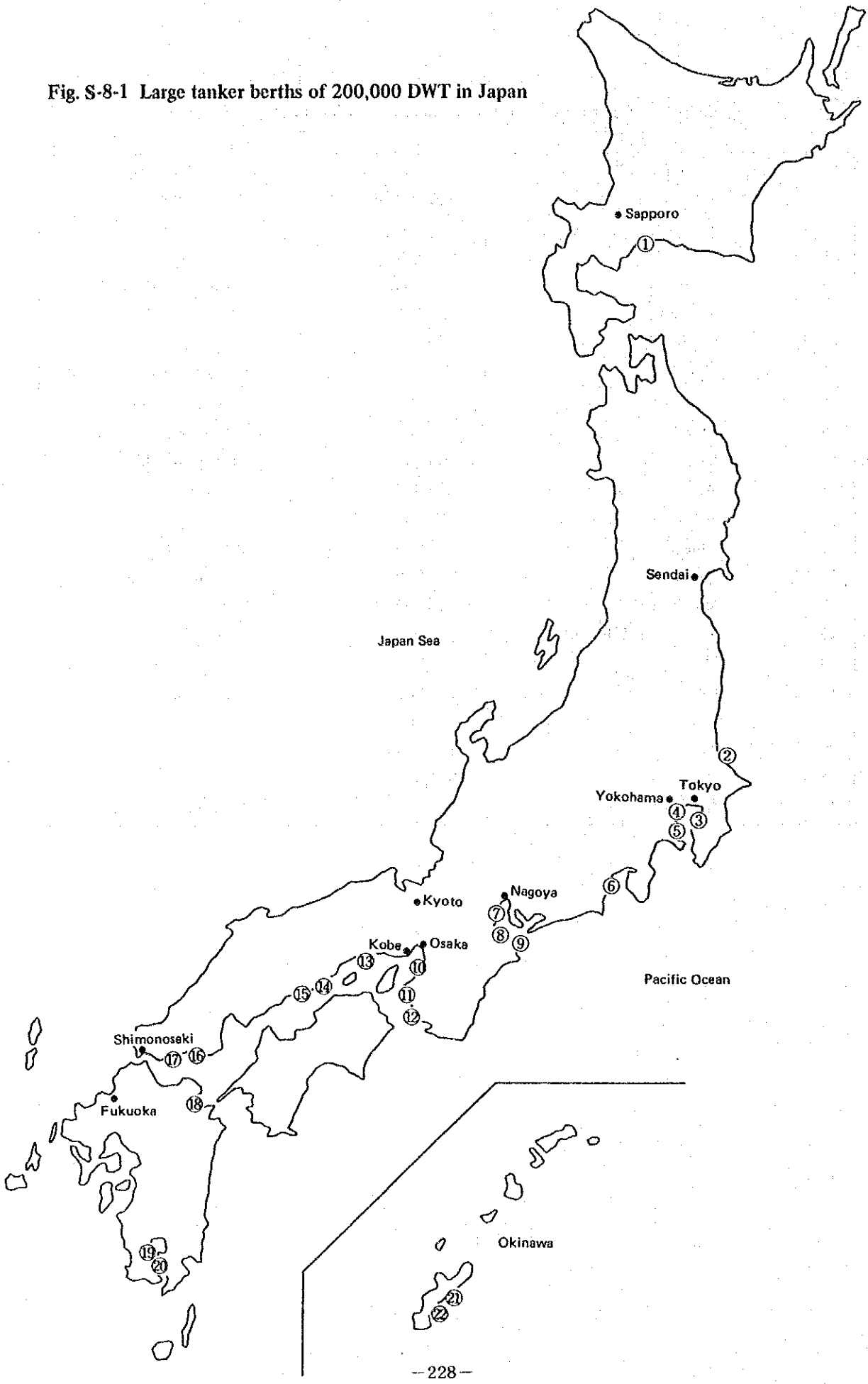
| | |
|---|---|
| Disaster prevention system: | Individual disaster prevention system and organized disaster prevention system specified at all berths. |
| Recovery system: | Oil fence, Neutralizer, Absorbent, Oil recovery boat, etc. are arranged for waste oil removing equipments and materials. |
| Maintenance: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

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

Table S-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. S-8-1 Large tanker berths of 200,000 DWT in Japan



## Table S-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<br>150,000 | 3,200 PS<br>3,200 | 6<br>4 | Tons<br>38 | 1 | 8 | (Unberthable conditions)<br>a. When strong-wind and high-wave warnings issued.<br>b. When electric storm has occurred or threatened to occur.<br>c. When port captain has issued refuge advise to ships in port.<br>d. When manager of refinery has decided that berthing is dangerous.<br>e. When the captain has decided that safe operation cannot be carried out.<br>f. When berthing is found dangerous upon consultation with persons concerned.<br>g. When port captain has so instructed.<br>h. Others. |
| 2 | Kashima | from 1 hr after sunrise to 1 hr before sunset | ditto | 5 | b, c, d, e, h<br>f,g,h | 1 sea mile | 2 | 15 | 200,000 | 2,200<br>2,880<br>1,660 | 3<br>2<br>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<br>258,000 | 8,000<br>20,000 | (4)<br>(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<br>74,000 | 3,400<br>3,600 | 5<br>3 | 12,<br>5~36,<br>96 | 2 | 15 | |
| 6 | Shimizu | ditto | mooring head out | 10 | c, d, e, f, g, night | 1 sea mile | – | 15 | max<br>250,000<br>as directed by pilot | 3,900<br>2,900<br>1,900 | 1<br>1<br>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<br>210,000<br>Secure towing P.S of 5–10% of DWT of the entering tanker | 2,400<br>3,200<br>3,200 | 1<br>3<br>4 | 4.8<br>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<br>50,000 | 3,000<br>2,000 | 4<br>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<br>150,000~200,000<br>(increase/decrease the number of tugboats according to wind velocity, tide and load) | 3,000 PS<br>3,000 | 4~5<br>5~7 | Tons<br>20 | 2 | 15 | |
| 12 | Wakayama – Shimozu | from sunrise to sunset | mooring head in or head out | 12 | a, c, d, e, f, g | 0.5 sea mile | 2 | 12 | 230,000 | 1,600~3,000 | 6 | 19.38 | 2 | 13 | |
| | | | | | swell within the range of securing safety | | | | | | | | | | |
| 13 | Himeji | ditto | mooring headin | 6~7 | a, b, c, d, e, f, g, h | 1 sea mile | 1 | 10 | | 3,000 | 2~4 | 105.94<br>10.80 | 1<br>1 | average 15 | |
| | | | | | night and when unloading cannot be started untill 1 hr before sunset | | | | | | | | | | |
| 14 | Mizushima | ditto | ditto | 5 | b, c, d, e, f, g | 1 sea mile | 1.5 | 15 | 235,000<br>100,000 | 3,000<br>2,500 | 5<br>4 | 5 | 2 | 8 | |
| 15 | Mizushima | ditto | ditto | 10 | b, c, d, e, f | 2,000 m | – | 15 | 100,000<br>200,000 | 2,500<br>3,000 | 4<br>5 | 5<br>6 | 1<br>1 | 8 | |
| 16 | Tokuyama –Kudamatsu | ditto | mooring head out | – | c, d, e, f, g | – | – | 15 | 275,000<br>200,000 | 3,200<br>3,200 | 5<br>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<br>4,200 | 2<br>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<br>4,200 | 2<br>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<br>250,000 | 13,800<br>11,200 | (5)<br>(4) | 32 | 2 | 2 | |
| 22 | Nakagusuku | ditto | mooring head in or head out | 10 | c, d, e, f, g, h | 1.5 sea mile | 1.5 | 15 | | 1,900<br>2,100 | 1<br>1 | 19.07 | 1 | 3 | |
| | | | | | standard height of swell less than 1 m | | | | | | | | | | |

## Table S-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<br>a. indicate points to be observed<br>b. patrol regularly<br>c. indicated fire prohibited area and fire restricted area<br>Note 2. Conditions of discontinuing the oil handling<br>a. earthquake sensor, when more than ____ is felt<br>b. ordered by port captain<br>c. dangerous gas leak is sensed<br>d. abnormal pressure of liquid line<br>e. fire occurs on the berth, aboard ship or in the neighbourhood<br>f. electric storm has occured or threatens to occur<br>g. ships which may endanger the ship are navigating nearby<br>h. refuge advice is issued to ships by port captain<br>i. manager of refinery finds it necessary<br>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<br>Tension of more than 90 tons works on mooring rope and motor siren buzzes | – | 15 | l. the ship is pulled off the berth<br>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<br>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<br>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<br>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 S-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<br>250,000<br>150,000 | PS<br>3,200<br>3,200 | <br>4<br>3 | m<br>2.0 | m/s<br>30 | D/W<br>250,000<br>150,000 | PS<br>3,200<br>3,200 | <br>1<br>1 | D/W<br>250,000 | hrs<br>4 | hrs<br>31 | hrs<br>1 | hrs<br>36 | |
| 2 | Kashima | 200,000 | 2,200<br>2,880 | 3<br>2 | 2 | 20 | 200,000 | 2,200<br>2,880 | 3<br>2 | 200,000 | 1.5 | 42 | 1.5 | 45 | |
| 3 | Chiba | 100,000<br>258,000 | 5,000<br>12,000 | (2)<br>(3) | – | – | 100,000<br>~258,000 | 3,900<br>1,000 | 1<br>1 | 100,000<br>~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.<br>250,000<br>as directed by pilot | 3,900<br>2,900<br>1,900 | 1<br>1<br>2 | – | 15 | – | 2,900 | 1 | – | 2 | 21 | 1 | 24 | |
| 7 | Yokkaichi | – | – | – | 1.5 | 15 | 275,000<br>100,000 | 900<br>350 | 1<br>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<br>50,000 | 3,000<br>2,000 | 3<br>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~<br>150,000<br>150,000~<br>250,000 | 3,000<br>3,000 | 3~4<br>4~5 | 2.0<br>determined upon consultation with persons concerned | 20 | 100,000<br>~<br>250,000 | 3,000 | 1 | 200,000 | 2 | 16~36 | 1.5 | 19.5~<br>39.5 | except hours from berthing to unloading and from finished unloading to unberthing |
| 12 | Wakayama –Shimozu | 230,000 | 1,600<br>~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<br>100,000 | 3,000<br>2,500 | 4<br>3 | – | 20 | more than<br>200,000 | 3,000 | 1 | – | 0.5 | 43.0 | 0.5 | 44.0 | |
| 15 | Mizushima | 100,000<br>200,000 | 2,500<br>3,000 | 4<br>4 | – | – | 200,000 | 3,000 | 1 | | 0.5 | 40 | 0.5 | 41 | |
| 16 | Tokuyama –Kudamatsu | 275,000<br>200,000 | 3,200<br>3,200 | 3<br>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 | berth-ing time | unload-ing time | unberth-ing time | total | |
| 17 | Ube | D/W<br>all ships | PS<br>3,000 | 1 | m<br>2.5<br>(light draft) | m/s<br>18 | D/W<br>all ships | PS<br>2,000 | 1 | D/W<br>all ships | hrs<br>2~2.5 | hrs<br>22~45 | hrs<br>0.5~1.0 | hrs<br>24.5~<br>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<br>450,000 | 3,200<br>4,200 | 2<br>2 | 2 | 25 | all ships | 3,200<br>4,200 | 2<br>2 | 300,000 | 3.5 | 30 | 1 | 34.5 | |
| 20 | Kiire | 150,000<br>450,000 | 3,200<br>4,200 | 2<br>2 | 2 | 25 | all ships | 3,200<br>4,200 | 2<br>2 | 400,000 | 3.5 | 38 | 1 | 42.5 | |
| 21 | Kin | 360,000<br>250,000 | 13,800<br>11,200 | (5)<br>(4) | 1.5 | 15 | 360,000<br>250,000 | 13,800<br>11,200 | (5)<br>(4) | 150,000 | 2 | 30 | 24 | 56 | |
| 22 | Nakagusuku | | | | 1.5 | 18 | | 1,900<br>2,100 | 1<br>1 | 270,000 | 1.5 | 35 | 0 | 36.5 | |

## Table S-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<br>water hydrant<br>foam hydrant<br>air foam liquid tank | 2<br>4<br>1<br>1 | 1,900 ℓ/min<br>450 ℓ/min<br>450 ℓ/min<br>3,000 ℓ | Yes. | – | c | No. | a, b, c<br>by radio | (note 1) Remote watch on berth and aboard ship<br>a. by industrial TV.<br>b. by binoculars<br>c. No.<br>(note 2) Objects of remote watch<br>a. fire<br>b. gas leak<br>c. pressure<br>d. others<br>(note 3) Method of communication<br>a. wire telephone<br>b. microphone<br>c. alarm buzzer<br>d. buzzer<br>e. others |
| 2 | Kashima | 1 | 1 | 4,000 ℓ/min | fire pump<br>proportioner<br>fire hydrant<br>water curtain<br>air foam nozzle<br>remote monitor nozzle | 1<br>2<br>28<br>6<br>4<br>2 | 330 t/hr x 14 kg/cm²<br>500~4,000 ℓ/min<br><br>250 ℓ/min<br>1,600 ℓ/min<br>2,000 ℓ/min | Yes. | b | | Yes. | a, b, c | |
| 3 | Chiba | 2 | 1 | 12,000 ℓ/min | fire pump<br>fire extinguisher<br>fire extinguisher | 1<br>23<br>2 | 80 t/hr<br>20 LB<br>100 LB | Yes. | b | a, b, c | Yes. | a, b, c, e | |
| 4 | Kawasaki | 3 | 2 | 3.6 t/min x 2 | | | | Yes. | b and visual | a, c, d and oil leak | Yes. | e<br>radio<br>ship's telephone | |
| 5 | Kawasaki | 1 (common use) | | fire pump 2.5 m³/min, mixing sea-water with chemical 0.5 m³/min, chemical pump 0.07 m³/min | vacuum pump<br>fire fight pump<br>water gun<br>foam fire extinguisher gun<br>air foam liquid pump | 1<br>1<br>4<br>2<br>1 | 120 m³/hr, 7.5 KW<br>100 m³/hr x 75 hrs, 37 kw<br>400 ℓ/min<br><br>5.5 kℓ/hr, 3 KW | Yes. | – | a, b, c | Yes. | a, b, c<br>trans-ceivers<br>3~4 sets | |
| 6 | Shimizu | 1 | – | – | air foam extinguisher gun<br>water gun<br>fire extinguisher<br>fire hose<br>large and small type fire extinguisher | 9<br>6<br>2<br>6<br>4 | 3,400 ℓ/min<br>350 ℓ/min<br>460 ℓ/min<br>21/2B x 2 x 350 ℓ/min<br>21/2B x 2 x 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<br>powder (fixed)<br>powder (portable) | 8<br>1<br>50 | 1,380 t/hr<br>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<br>(fixed)<br>(semi-fixed)<br>water curtain<br>powder | <br>2<br>6<br>1 | <br>3,000 ℓ/min<br>800 ℓ/min<br>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<br>water curtain<br>foam and water extinguisher | 3<br>44<br>4 | 3,000 ℓ/min × 3<br>3,040 ℓ/min<br>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<br>BC fire extinguisher | 1<br>6 | 0.5 kℓ/min<br>48 kg | Yes. | c | – | Yes. | e radio | |
| 14 | Mizushima | 1 (common use) | | 2,000 ℓ/min | powder extinguisher gun<br>water gun<br>air foam and water extinguisher gun<br>powder extinguisher | 2<br>2<br>2 | 2t<br>1,600 ℓ/min<br>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<br>fire hydrant<br><br>fire fighting equipment (semi-fixed)<br>fire extinguisher (powder)<br>ditto (foam) | 2<br>2 mouth × 2<br><br>2 mouth × 2<br><br>5<br>1 | 500 ℓ/min × 7 kg/cm²<br>800 ℓ/min × 9 kg/cm²<br><br>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<br>3,000 ℓ/min × 1<br>fire extinguisher liquid 15,000ℓ | tugboat<br><br>fireboat | 1<br><br>1 | fire pump 3, 7,000 ℓ/min<br>fire pump 1, 3,300 ℓ/min | Yes. | b | a | Yes. | e transceiver | |
| 17 | Ube | 2 | 1 | | fireboat<br>patrol boat<br>assistant boat | | 1,500 t/hr<br>170 t/hr<br>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<br>fire extinguisher<br>fireboat<br>tugboat for fire fight | 4<br>4<br>1<br>1 | 280 kℓ/hr<br><br>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)<br>1,000 ℓ/min (water) | fire hose<br>fire nozzle<br>fire hydrant<br>foam extinguisher gun | 10<br>5<br>5<br><br>1 | 400 ℓ/min<br><br>–<br><br>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)<br>1,000 ℓ/min (water) | fire hose<br>fire nozzle<br>fire hydrant<br>foam extinguisher gun | 12<br>6<br>6<br><br>1 | 400 ℓ/min<br><br>–<br><br>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<br>sprinkler<br>fire hydrant | 3<br>7<br>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 S-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<br>oil fence (submerging/floating type)<br>straw mat<br>absorbent | 20,980 ℓ<br>1,548 m<br>500 sheets<br>3,760 sheets | times/year<br>15 | times/year<br>15 | times/year<br>15 | Yes. |
| 2 | Kashima | ditto | ditto | oil receiving factory | oil fence<br>emulsifier<br>absorbent | 900 m<br>100 cans<br>50 cases | 2 | before berthing | 2 | |
| 3 | Chiba | ditto | ditto | oil handling company | oil fence (submerging/floating type)<br>portable oil fence<br>neutralizer<br>oil absorbent | 1,454 m<br>400 m<br>18 ℓ x 498 cans<br>1,000 kg | 1 | 1 | 1 | Yes. |
| 4 | Kawasaki | ditto | ditto | oil receiving factory<br>oil handling company (captain) | oil fence<br>treating chemical<br>absorbent<br>oil recoverer | 6,400 m<br>27,520 ℓ<br>4,100 kg<br>4 sets | 1 | 1 | 1 | Yes. |
| 5 | Kawasaki | ditto | ditto | oil receiving factory | chemical<br>oil catcher<br>fence | 18 ℓ x 50<br>1,000 sheets x 50 cases<br>400 m | 4~5 | 6 | 4~5 | Yes. |
| 6 | Shimizu | ditto | ditto | oil receiving factory or oil handling company | oil fence<br>treating chemical<br>oil catcher | 2,500 m<br>12,600 ℓ<br>20,000 sheets | 2 | 20 | 48 | |
| 7 | Yokkaichi | ditto | ditto | oil receiving factory | emulsifier<br>oil fence<br>absorbent | 16,400 ℓ<br>2,000 m<br>3,900 kg | ¼ | | 1 | Yes. |
| 8 | Yokkaichi | ditto | ditto | oil recieving factory<br>oil handling company (captain) | oil fence<br>treating chemical<br>absorbent | 2,660 m<br>13,626 ℓ<br>3,550 kg | 1 | – | 365 | Yes. |
| 9 | Yokkaichi | ditto | ditto | oil receiving factory | | | ¼ | | 1 | |
| 10 | Sakai | ditto | ditto | oil receiving factory<br>captain | oil fence<br>absorbent<br>treating chemical | 3,220 m<br>5,000 kg<br>5,400 ℓ | | | | Yes. |
| 11 | Wakayama –Shimozu | ditto | ditto | causer | oil fence<br>treating chemical<br>absorbent<br>other workboats | 4,300 m<br>5,000 ℓ<br>4,400 kg | 95<br>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<br>absorbent<br>surfactant | 2,200 m<br>3,016 kg | times/year<br>1 | times/year<br>1 | times/year<br>1 | |
| 13 | Himeji | ditto | ditto | oil receiving factory | oil fence<br>absorbent<br>treating chemical | 2,500 m<br>6,000 kg<br>20 kℓ | 1 | 1 | 1 | |
| 14 | Mizushima | ditto | ditto | oil receiving factory | oil fence A type<br>B type<br>treating chemical<br>absorbent | 4,500 m<br>1,200 m<br>18,738 ℓ<br>4,335 kg | 2 | 1 | 365 | Yes. |
| 15 | Mizushima | ditto | ditto | oil receiving factory<br>oil handling company | oil absorbent<br>treating chemical<br>oil fence (B type) | 11,400 kg<br>22,700 ℓ<br>5,000 m | before berthing | | | Yes. |
| 16 | Tokuyama<br>–Kudamatsu | ditto | ditto | oil receiving factory<br>oil handling company | oil fence<br>others | 1,110 m | 1 | 12 | 12 | Yes. |
| 17 | Ube | ditto | ditto | oil receiving factory<br>ship's owner | oil fence<br>oil absorbent<br>treating chemical | 1,500 m<br>2,320 kg<br>2,800 ℓ | 1 | floating arm<br>30 | submarine hose<br>24 | Yes. |
| 18 | Ohita | ditto | ditto | oil receiving factory | oil fence (B type)<br>(others)<br>treating chemical<br>oil absorbent | 1,200 m<br>2,000 m<br>10.8 kℓ<br>2,175 kg | 72 | 72 | 72 | |
| 19 | Kiire | ditto | ditto | ditto | treating chemical<br>oil absorbent<br>oil fence | 720 ℓ<br>2,000 sheets<br>1,240 m | 1 | 12 | 12 | Yes. |
| 20 | Kiire | ditto | ditto | ditto | treating chemical<br>oil absorbent<br>oil fence | 900 ℓ<br>2,000 sheets<br>1,704 m | 1 | 12 | 12 | Yes. |
| 21 | Kin | ditto | ditto | oil receiving factory<br>oil handling company | | | 1 | 2 | 1 | |
| 22 | Nakagusuku | ditto | ditto | oil receiving factory | oil fence<br>absorbent<br>treating chemical | 2,200 m<br>4,039 kg<br>6,200 ℓ | 1 | | 1 | |

## S-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

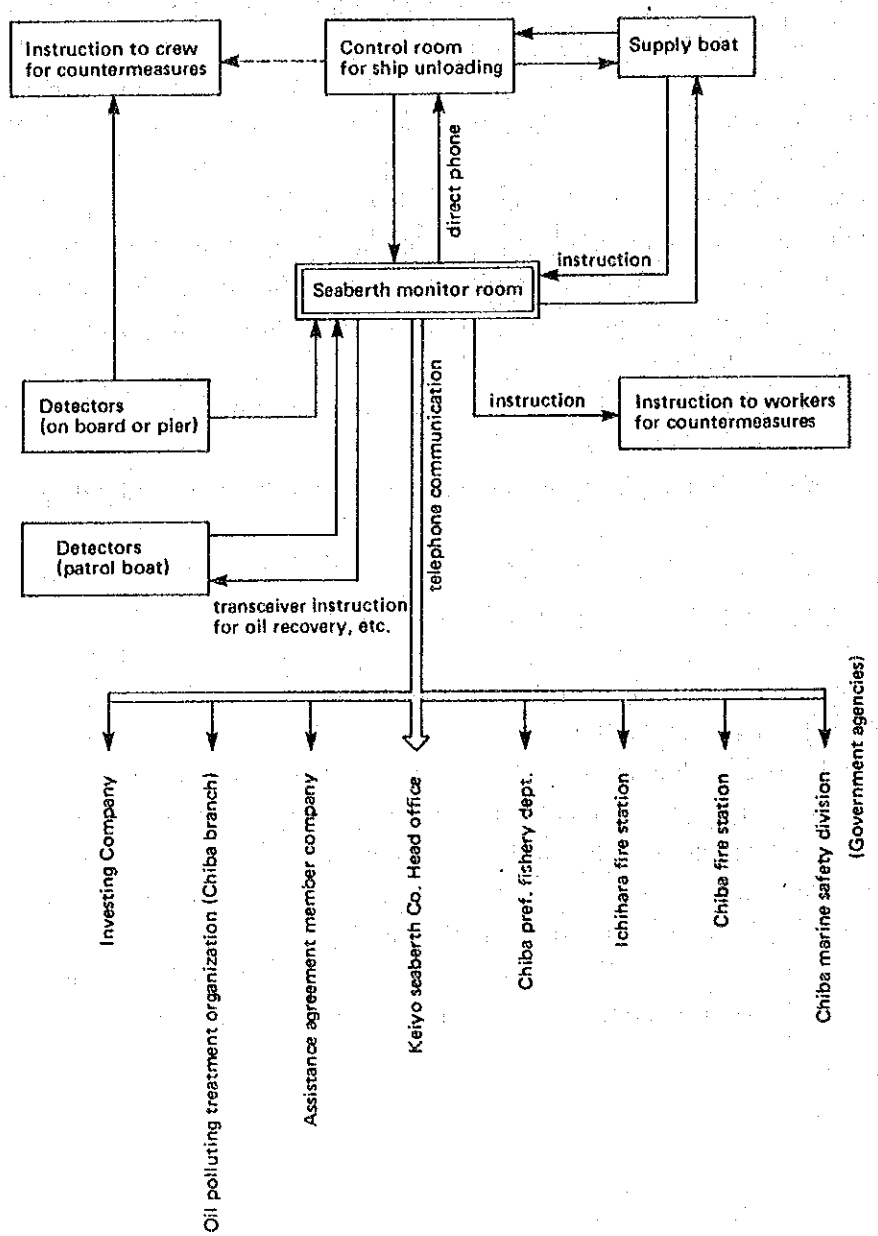
Safety problems of ports cannot be solved by development of port facilities alone, but proper management and operation are necessary to accomplish their effects. Many agencies are involved in ports such as administrator, users, etc.. For securing safety of ports, it will be necessary for related agencies 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.

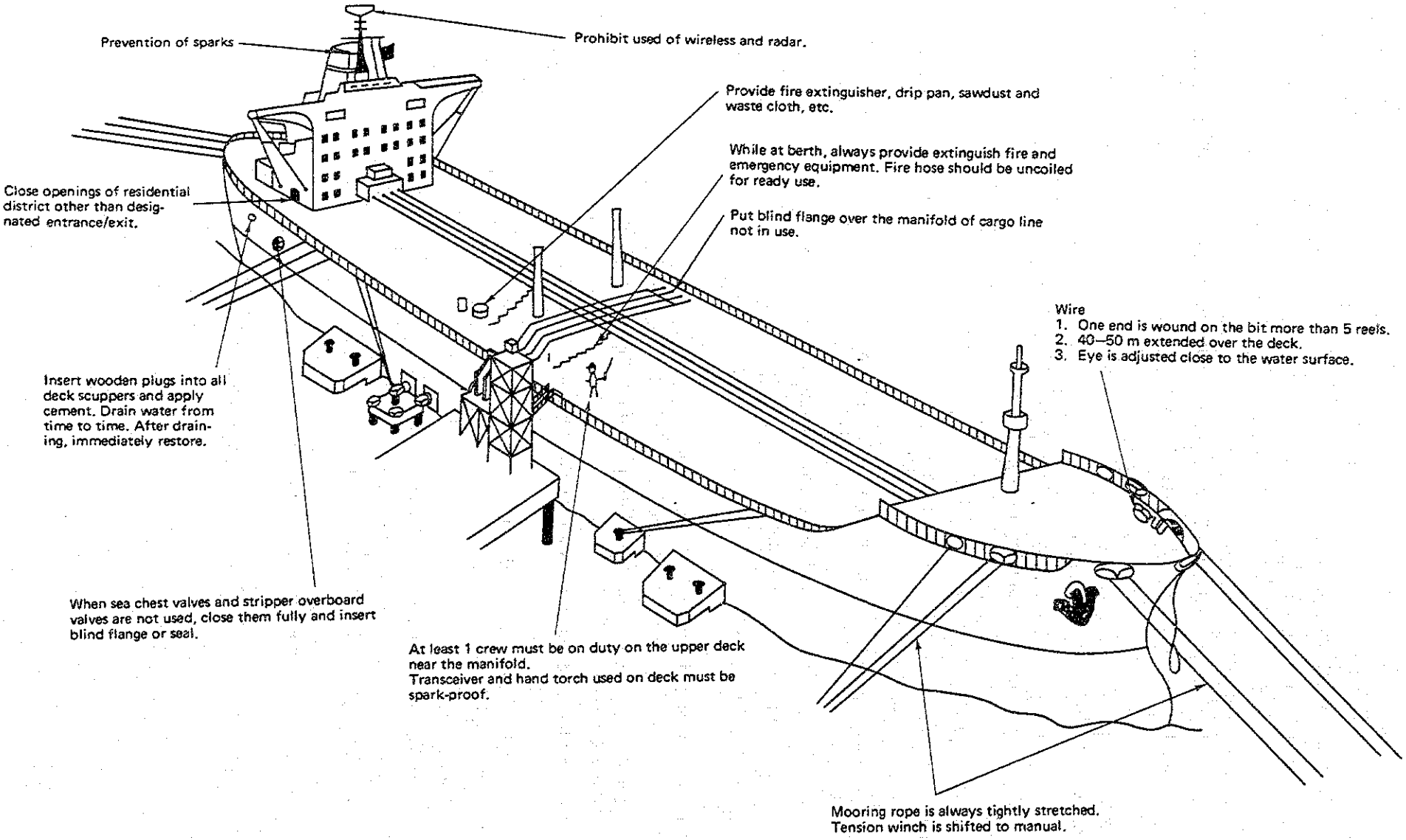
Actions to be taken by the shore side

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



# S－9. 施 工 及 び 施 工 管 理

## S-9 EXECUTION AND SUPERVISION OF PORT CONSTRUCTION

### S-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 S-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 S-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.

## S-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.

## S-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<br>-1 cm | +2 cm<br>-1 cm | +2 cm<br>-1 cm | ±1 cm |
| Cellular block | +2 cm<br>-1 cm | +2 cm<br>-1 cm | +2 cm<br>-1 cm | ±1 cm |
| Block (rectangular) | +2 cm<br>-1 cm | +2 cm<br>-1 cm | +2 cm<br>-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<br>-3 cm |
| In and out against face line | ± 5 cm | |
| Height and thickness of crown | ± 2 cm | +5 cm<br>-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

○ Cover concrete

(1) Crown height ±3 cm

## Chapter 16 Paving

Subgrade and Subbase

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

Concrete Pavement

| | Thickness | Width | Length | Flatness |
|---|---|---|---|---|
| Pavement | +2 cm<br>-1 cm | + not specified<br>-2.5 cm | + not specified<br>-0 | Noteworthy |

Asphalt Pavement

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

## S-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 S-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<br>• Establishment of automatic observation system<br>• 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<br>• 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.<br>• 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<br>• 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<br>• Utilization of atmospheric and marine forecast.<br>• Moderation of installation standard within the range in which the function of breakwaters is not spoiled.<br>• 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.<br>• 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<br>• Increase in the weight of grab backet<br>• 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<br>• Dumping into reclaimed land<br>• Disposal of good-quality soil and sand (including no salt) in the neighborhood.<br>• Large-quantity, continueous work execution principally composed of pump dredger and belt conveyors.<br>• 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)<br>• 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.<br>• 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<br>No transport of soil at night in housing area.<br>• Limitation in selection of the route<br>No selection of the route affecting the inhabitants in housing area.<br>• Limitation in physical treatment<br>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 S-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<br>• 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<br>• Development of a platform ships and diving operation ships.<br>• 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<br>• Security of refuge places<br>• 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<br>• Countermeasure against the back disaster<br>• 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<br>• 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<br>• 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<br>• Employment of special sounding device |
| | 4) Loss in stone materials and operations due to the waves and flow. | • Improvement in the method of discharging<br>• 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<br>1) Shortage of divers | • Development of mechanical execution of work<br>• Ommission of rough leveling due to the improvement in the discharging method and in its technique.<br>• Moderation of the precision and the standard.<br>• Training of divers. |
| | C. Placing of foot protection blocks and armor blocks<br>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.<br>• Making the reach of a crane large and work executed from the opposite side.<br>• Setting a temporary breakwaters. |
| | D. Production of caisson<br>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.<br>• Large-sized unit type of reinforcements<br>• Large-sized form<br>• Simplification in the assembling and disassembling of the form.<br>• Use of steel iron |
| | E. Setting of caissons<br>1) Setting under an unfavorable conditions due to waves, swell and flow | • Utilization of a large-sized floating crane for re-setting.<br>• Setting-up a temporary protective facilities |
| | F. Filling<br>1) Filling each cabin uniformly is difficult. | • Improvement in filling method<br>• 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<br>• Utilization of sea-bed sand |
| | G. Coping concret work<br>1) The shuttering is often broken by waves so that concrete leaks out. | • Employment of a wave-resistant shuttering. |

# S－10. 港湾管理運営

## S-10 PORT ADMINISTRATION AND OPERATION

### S-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.

### S-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.

## S-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 S-10-1 how the government participates in fund raising in the advanced countries.

## Table S-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<br>Third sector (consisting of central government, province and city)<br>} appr. 20 ports<br>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<br>Autonomous ports 6 ports<br>Government (Ministry of Public Works & Transportation)<br>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<br>3 ports<br>Third sector (consisting of central government and city)<br>1 port<br>In addition, there are some ports alongside with river and canal. Above are port numbers of major ports in Belgium. | Local governments (province)<br>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<br>(Ministry of Transportation)<br>(Public Harbour) appr. 200 ports<br>Borad of federal government<br>National port<br>(National Harbour Board) appr. 15 ports<br>Under each enactment<br>(Harbour Commission) appr. 10 ports<br>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<br>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.<br>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<br>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). |

## S-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% |

## S-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 S-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 S-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.<br>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<br>- 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 |