BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR IMPROVEMENT
OF
SECURITY FACILITIES AND EQUIPMENT
IN
MAIN INTERNATIONAL PORTS
IN
THE KINGDOM OF CAMBODIA

July 2006

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to a request from the Royal Government of Cambodia, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Security Facilities and Equipment in Major International Ports in the Kingdom of Cambodia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Cambodia a study team from January 15 to February 23, 2006.

The team held discussions with the officials concerned of the Royal Government of Cambodia, and conducted field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Cambodia in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Royal Government of Cambodia for their close cooperation extended to the teams.

July 2006

Masahumi Kuroki
Director
Japan International Cooperation Agency

July 2006

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Improvement of Security Facilities and Equipment in Major International Ports in the Kingdom of Cambodia.

This study was conducted by a joint venture consisting of International Development System Inc. and Japan Marine Science Inc., under a contract to JICA, during the period from January 2006 to July 2008. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Cambodia and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Mamoru Amemiya
Chief Consultant
Basic Design Study Team on the Project for Improvement of Security Facilities and Equipment in Major International Ports
International Development System Inc.

Location Maps

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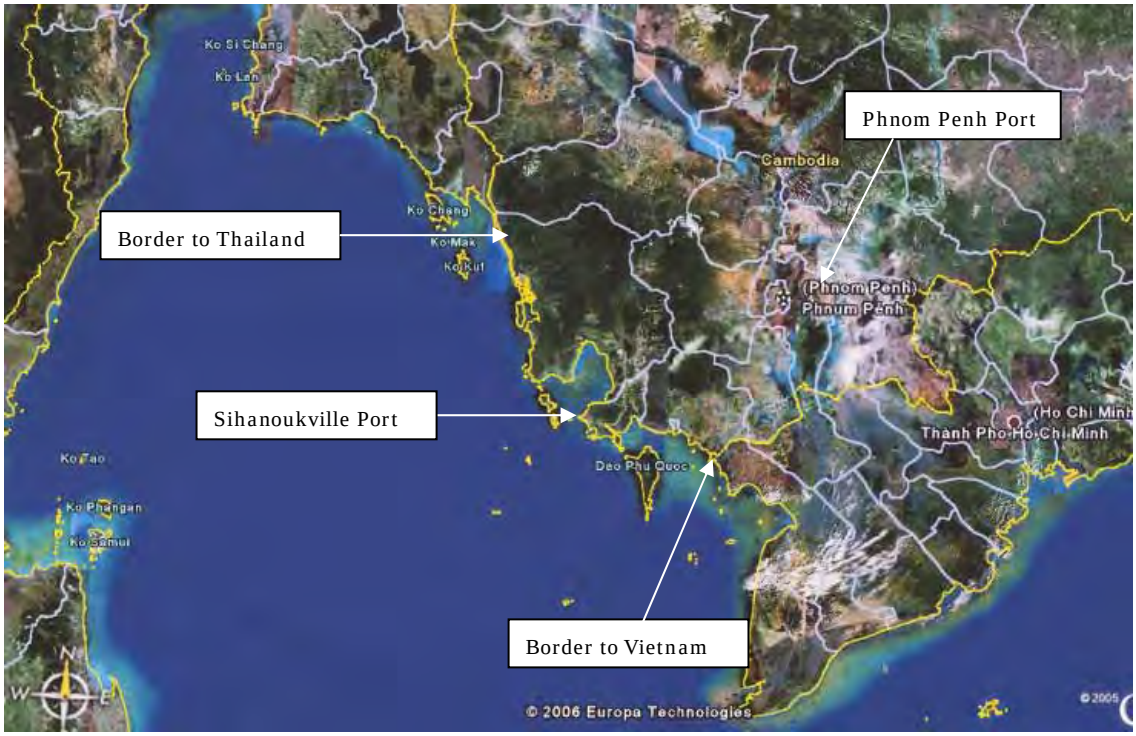

Sihanoukville port faces directly to the deep open sea, Gulf of Thailand. It locates just in front of the international channel between Leam Chabang, Singapore and beyond.

Sihanoukville port locates at the well protected area by islands. The port is connected with Phnom Penh by the National Highway4 of 250km long by 4hour drive by sedan. There is a large areas along the road with possibility to be developed to the industrial estates. This access condition is good and traffic volume is moderate and no congestion.

Sihanoukville port locates at the west-north of the down town. Surrounding area of port is rather under-developed. There is a plan to build a free trade zone to provide the private developers with industrial estates.

Phnom Penh port locates on the right bank along the Tonle Sap River. It is about 2km up-stream from the conjunction point with the Mekong River. Port area is unfortunately narrow and its access, Sisowath Quay, is so busy and congested.

Sihanoukville Port and its Surroundings

One of the Master plan of Sihanoukville Port. Area is divided into two parts namely the conventional terminal on the right hand (West) and the container terminal on the left hand (East).

This indicates Sihanoukville Port in late 1990s. It is just before the commencement of container terminal construction. Port boundary lies along the upper side road. Near the right end, there is administration office of Sihanoukville Port. On the right hand there is a jetty for small boat and cruising vessels terminal.

This is the gate No.2 for the workshop workers and passengers through the cruising boats berthing at the jetty.

This is conjunction areas between the conventional wharf and container terminal.

New container terminal is under construction to complete by 2007. After the completion, all containers will go through the Gate No.3.

Container handling by a reach-stacker in the yards is carried out .Concrete interlocking blocks are used for the yard

Container handling at the conventional wharf by the vessels own gears and reach stackers.

Concrete fence is provided along the port boundary. This area was reclaimed by excess soils from the construction site.

Structure with a red roofing on the right side is the Gate no.3.

This is the Gate No.3 of Sihanoukville Port. On the right side of it there is a container terminal administration building under construction and the X-ray container screening system will be installed on the left side.

This is the Gate No2 of Sihanoukville Port. This was the main gate before the opening of Gate No3.

Phnom Penh Port and its Surroundings

Gate of Phnom Penh Port is seen in the center of scene. Behind of the fence on the right hand, there is a container yard and stacked containers. Access road, Sisowath Quay, is always congested.

This area is an open area just after entering the main gate from the right side. Wharf area is on the left side after connecting bridges. Stacked containers are for exports.

Boundary fence at the import container areas is separating it from the Sisowath Quay roads.

This is the import container stacking area which located at the end of the upstream side. The port length is about 500m but width is just 50 to 60m. PAP work hard to repair the and install the new fence to meet ISPS.

Wharf structure are of the concrete deck supported by point baring piles. Left side is berth area and right side is port yard.

This is a view of the container stacking at the storage areas. This area is port are a, but out of security area.

List of Tables and Figures

略　　語　List of Abbreviations

略　語	日本語Japanese	英　語　English
A/P	支払授権書の発給	Authorization to Pay
B/A	銀行取極め	Banking Arrangement
CED	関税消費税局	Customs Excise Department
CDC	カンボジア開発会議	Council for the Development of Cambodia
IMO	国際海事機構	International Maritime Organization
ISPS Code	船舶及び港湾施設の保安のための国際コード	International Ships and Port Facility Security Code
JICA	独立行政法人国際協力機構	Japan International Cooperation Agency
MEF	経済財務省	Ministry of Economy and Finance
M/D	議事録	Minutes of Discussions
MOP	計画省	Ministry of Planning
MPWT	公共事業運輸省	Ministry of Public Works and Transport
NIS	統計局	National Institute of Statistics
NSDP	国家開発計画	National Strategic Development Plan
PAP	プノンペン港湾公社	Phnom Penh Autonomous Port
RGC	ガンボジア国政府	Royal Government of Cambodia
PAS	シハヌークビル港湾公社	Sihanoukville Autonomous Port
SOLAS	海上における人命の安全に関する国際条約	International Convention for Safety of Life at Sea
TEU	20 フィート型標準コンテナ	Twenty Foot Equivalent Unit
(ISPS 関連)		
PSP	港湾保安計画	Port Security Plan
PFSP	港湾施設保安計画	Port Facility Security Plan
PFSO	港湾施設保安管理者	Port facility security officer
RSO	認定保安団体	Recognized security organization
(機材及び設備名称)		
CCTV	監視カメラシステム	Closed Circuit Television Surveillance System
ICD	インランドコンテナデポ(内陸コンテナ集積基地)	Inland Container Depot
TP	ユーティリティー接続点	Terminal Points
VTMS	航行安全監視システム	Vessel Traffic Management System
XCS	X線コンテナ検査装置	X-ray Container Screening System

SUMMARY

The Kingdom of Cambodia, located on the Indochina Peninsula, has a territorial area of 81,000 km^2 and population of 13.1 million in 2002. Recorded GDP per capita of Cambodia was US$300 in 2002.

After full independence from France in 1953, Cambodia faced to hard times and exhaustion by civil war, Vietnamese invasion, and then hardship by Khmer Rouge. This changed when the 1991 Paris Peace Accords mandated democratic elections and a ceasefire. UN-sponsored elections in 1993 followed by elections in 1998 and 2003 led to the formation of coalition government and renewed political stability. On the economic development side, annual economic growth has been achieved of 6% between 2001 and 2004. This is attributed to the economic stability and increasing employment demands as planned in SEDP II (Second Five-Year Socio–Economic Development Plan).

The Royal Government of Cambodia (RGC) concluded an Agreement of SOLAS (International Convention for Safety of Life at Sea) in order to maintain maritime safety which is of deep concern after the terrorism of Sept 11, 2001. It is reported that the port security strict countries including USA may refuse vessel entering into their ports if within the last five calling ports the vessel called at a no security port in terms of ISPS.

Based upon the agreement, it is the duty for RGC's Designated Authority to comply with SOLAS and Supplemental ISPS Code (International Code for the Security of Ships and of Port Facilities). Thus it is an urgent issue to prepare a port facility security plan and implement it for strengthening the port security structure and organization.

RGC has decided to select two ports as international commercial ports: namely, Sihanoukville Port (PAS) facing the open sea, and Phnom Penh Port (PAP) in the Capital area. RGC has created the Sihanoukville Port Facility Security Plan in 2004 for accelerating exports, and securing port safety, followed by Phnom Penh Port. It is time now to implement the plans for which the project is prepared.

Hence, PAS is implementing a new container terminal for a modern commercial port under Yen Loan. This development requires introduction of modern cargo handling equipment and a wide marshalling yard for systematic cargo handling to meet the rapid increase of containers. However, it has been concluded that the present security facilities are not able to correspond to this new development. For example, existing port security facilities are not sufficient to detect and deter acts which threaten security of port representing invasion of suspicious vessels, vehicles and persons within the restricted port area, sea, and onshore. In addition, capability to prevention of the sea contamination from the oil spill due to terror incidents, etc. are not sufficient either.

Similar to PAS, PAP faces the same weaknesses.

Existing container screening system in PAS unfortunately does not work well to detect

suspicious cargo including smuggling materials and they collect a higher charge than those of neighboring countries, and it takes a lengthy time for inspection. This situation probably will affect to the bargaining power of Cambodian exports in the price war of textile, shoes and etc, against India and China.

For materializing these ports security plans for two ports, in August 2004 and January 2006, RGC has requested to Government of Japan (GOJ) to provide security facilities and equipment by Grant Aid in order to improve and upgrade security capability and marine environment maintenance.

Japan International Corporation Agency (JICA) sent a basic study team to Cambodia from January 15 to February 23, 2006 to study various aspects covering contents of the request: namely, site surveys, evaluating security vulnerability, capability of future operations and maintenance. The organization and equipment procurement plan were clarified through the discussions among the Team and parties concerned, including the Ministry of Economy Finance: MEF (Customs and Excise Department: CED), Ministry of Public Work and Transport: MPWT (PAS, PAP).

After returning to Japan, the Team carried out the basic study of the project and prepared a basic study report. JICA dispatched a mission to explain the basic study to Cambodia from June 4 to June 13, 2006.

Based on the study results and discussions with the Cambodia side, project components were selected through the following planning criteria.

The object sites should be two major international commercial ports, PAS and PAP, covering almost all the Cambodian international trade, tourism passengers, and others. In responding to ISPS Codes, the required surveillance of access to the restricted area and watching port facilities for two ports should be performed. Selected facilities and equipment should be for port security improvement and container screening system preventing the port from the smuggling.

The following table indicates project components by receiving port.

Category	Sihanoukville port (PAS)	Phnom Penh port (PAP)
Equipment	X-ray container screening system CCTV camera surveillance system ID pass card system Vessel traffic management system Patrol boats Oil spill recovery system	CCTV camera surveillance system ID pass card system
Facilities	Security station	Security station

Estimated project cost amounts to 930 million yen consisting of GOJ contributions to 925 million yen (7.98 million US$) and RGC undertaking of 5 million yen (0.04 million US$). Major obligations of Cambodian side will cover the provision of project site for installation of the

Security Station and X-ray Container Screening System and repairing and /or installation of the perimeter fence and yard lighting and others.

Implementation period is estimated to be 16.5 months from starting of the detailed design and tendering to completion of work. Within 5 months after the commencement of detailed design, a tender announcement will be carried out followed by contractor (or supplier) selection within two months. The required reconstruction period is 11 months covering the procurement of equipment, and undertaking the supplemental civil and architectural works and the initial operation training.

PAS has stabilized income and is able to cover the additional operation and maintenance costs by the project. The technical department of PAS takes care of maintenance works of existing port facilities and equipment. This department will also take care of the security facilities to be provided by project, if the required training is provided. Thus, maintenance works for the project components are intended to be carried out by PAS.

PAP also maintains steady income and is able to cover the additional costs by new project. PAP technical department will also maintain project components.

CED will operate and manage X-ray container screening system in Sihanoukville port. It is believed that CED can operate the system since it has experience in managing existing γ-ray container screening system there. It is also believed that CED can manage the operation and maintenance cost of it, since CED can collect charges from container users to meet mainly such cost.

The Project is verified and confirmed to meet the requirements in validity to receive Japan Grant Aid as follows:

1) Project will completely improve security facilities and equipment in surveillance of persons and cargoes in the port area and assist to establish a firm security structure to meet the mandatory ISPS Codes. Application of access detecting system in the restricted sea and onshore areas, deterring suspicious persons, vessels and vehicles will be performed more precisely since insufficient deterring is provided presently. These will extensively improve not only safety of passenger, cruising ships, cargo ships and cargoes but also port workers.

2) By introduction of port security systems applying ISPS Codes, Cambodian exports consisting of textiles, shoes etc, will be accepted by the security strict countries including USA. This effect will contribute to export promotion and continuing industrial development and employment opportunity. Industrial developments and employment opportunities on the national basis will be indirect beneficiary,

In order to implement and to operate the equipment efficiently and effectively, RGC and its

executing agencies are requested to undertake the following considerations into account:

1) To provide the restricted area with full fence works including repairing the damaged existing one and to improve visual condition for CCTV cameras at night in the restricted areas by means of repairing damaged existing yard lighting facilities.

2) Collaboration between the CED Sihanoukville Office and PAS for exchanging data and information on the container cargoes through the Custom Processing System which will be developed by CED.

3) CED to introduce the risk management in the container inspection system for effective application of X-ray Container Screening System.

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CHAPTER 1

BACKGROUND OF THE PROJECT

CHAPTER 1 BACKGROUND OF THE PROJECT

1-1 Background of Request

Sihanoukville port is the only deep sea port; it handles the majority of the nations cargo, (more than 90% of Cambodian trade) and also is an oil products unloading terminal. After the end of civil war and the founding of Kingdom of Cambodia in 1993, the average annual growth rate of GDP has been steadily 6%. Based on this economic progress, annual growth of container cargo is also high (16% which is about the same figure for the world average). The port plays a major role in the textile and shoes manufactory industries. They share almost 80% of national exports which simply indicates they are the leading export industries.

It is reported that all of these exports ship through Sihanoukville port to USA and Europe via feeder service at Singapore.

RGC concluded the SOLAS Agreement (International Convention for Safety of Life at Sea) which has becoming of deep concern and reflection all over the world after the terrorism of Sept. 11, 2001. It is believed that conforming to SOLAS contribute to maintain the viability of textile industries representing exports to USA. Based upon the agreement, it is the duty for RGC's Designated Authority to comply with SOLAS and Supplemented ISPS Code. Thus it is an urgent issue to prepare a port facility security plan and implement it for strengthening the port security structure and organization.

RGC has decided to select two ports as international commercial ports: namely, Sihanoukville Port (PAS) facing the open sea, and Phnom Penh Port (PAP) in the Capital area. RGC has created the Sihanoukville Port Facility Security Plan in 2004 for reducing trade barriers, accelerating exports, and securing port safety, followed by Phnom Penh Port. It is time now to implement the plans for which the project is prepared.

Hence, PAS is implementing a new container terminal for a modern commercial port under Japanese Government Loan. This development requires introduction of modern cargo handling equipment for systematic cargo handling to meet the rapid increase of containerized cargo. However, it is has been concluded that the present security facilities are not able to correspond to this new development. For example, existing port security facilities are not sufficient to detect and deter acts which threaten security of port representing invasion of suspicious vessels, vehicles and persons into the restricted port area, sea, and onshore. Similar to PAS, PAP faces to the same weaknesses.

For materializing these port security plans for two ports, RGC has requested to GOJ to provide security facilities and equipment by grant aid.

Objective of project: Scope of Beneficiary

Project will completely improve the security facilities and equipment for surveillance of vessels,

vehicles, persons and cargoes in the port area and assist to establish a firm security structure to meet the mandatory requirement of ISPS Codes.

Access detecting system in the restricted sea and onshore area, deterring suspicions persons, vessels and vehicles will be performed more precisely because suspicious things cannot be detected at present. These will extensively improve not only safety of passenger cruise ships, cargo ships and cargoes, but also port workers. Direct benefits should be provision of safety to the port offices and workers which will annually amount to 880,000 man-days (daily intensity in PAS: 1,600 / PAP; 800).

1-2 Effect of the Project

Project will cover optimum port security facilities and equipment; the major activities and effects of project are summarized below.

1) Security conditions in Sihanoukville port will be improved by introduction of security facility and equipment.
2) Security conditions in Phnom Penh port will be also improved by provision of security facilities and equipment.
3) Security management system and organization for both ports will be established accordingly.
4) Equipment maintenance system and organization for both ports will be set up accordingly.

1-3 Outline of Request

(1) Time of request

・August 2004: First request.

・January 2006: Second request.

(2) Total amount of requests

・1.6 billion yen / 13.8 million US$.

(3) Contents of request

1) Security facilities and equipment for PAS:
   Security station (1 unit), tug boat with firefighting system (1 x unit).Patrol boat (1 unit), oil skimmer (2 sets), oil fence (2 units), oil barge (2 units), oil tank truck (2 units), CCTV camera surveillance equipment (1 system). ID pass card equipment (1 x system), X-ray container screening equipment (1 x unit).
2) Security facilities and equipment for PAP:
   Security station (1 unit), CCTV camera surveillance equipment (1 system), ID pass card equipment (1 system), Inland container depot: Security station (1 unit).

CHAPTER 2

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2-1 Basic Concept of the Project

2-1-1 Nation's Policy and Objective of the Project

Based on the conclusion of SOLAS, it is an urgent issue for RGC to adhere to ISPS and to improve and strengthen the present port security facilities and organization. Cargoes shipped through the security port will be accepted by the importing countries in terms of safety proved cargoes. If it is shipped through a non security port, the importing country may refuse import. Thus introduction of security measures is one of the qualifications for exports to the security strict countries. For achieving this target, RGC has prepared not only Sihanoukville Port Security Facility Plan but also Phnom Penh Port Security Facility Plan and has been going to strengthen the port security based on the security plan.

However it is concluded that the present security facilities and equipment do not meet the requirements as shown in ISPS. For example existing port security facilities are insufficient to detect and deter acts which threaten port security against invasion of suspicious vessels, vehicles and persons coming into the restricted port area, at both sea and shore. And those facilities do not satisfy the response to the oil spill of vessel caused by terrorist attack etc.

Similar to PAS security, PAP faces to same weaknesses.

Considering the project background shown above, "Port Security Facility Plan" should act like a master plan for the project. Project will provide safety conditions that are crime prevention of terrorism and drug smuggling and so on.

Thus the implementation of security plan will not only accelerate exports and the manufacturing industries but also ensure safety of the port workers and employees.

2-1-2 Basic Concept of the Project

In order to conform to the objectives stated above, the project is prepared to undertake countermeasures to the port facility security specified in the port facility security plans for PAS and PAP based on the ISPS.

To fulfill the objectives for two major ports, the project will provide necessary security facility and equipment assisted by supporting services, including reviewing the security plan and assisting in technical training of the security officers. It is believed that this performance will improve the Cambodian port security and strengthen their preventive capability against terrorism and the like. The project covers both facility construction and procurement of the equipment for the two object ports, PAS and PAP, as follows:

Sihanoukville Port

- X-ray container screening system (Inspection of contents of container by x-ray)
- CCTV camera surveillance system (watching the gates and access to the restricted area)

・Public Address system as apart of CCTV camera surveillance system. (Providing warning notice of suspicious things and public notice of emergency situation happening)
・ID Pass card system (Checking ID of port works and offices at the gates)
・Security station (An office where a security officer with his staff stay to watch the data and information through the surveillance systems.)
・ Vessel Traffic management system : VTMS (Watching Suspicions vessel for discerning their behavior and providing tracking orders)
・ Patrol boat (surveillance of open water and tracing of the suspicious vessel)
・Oil spill recovery system (Recovery of spilled oil and transport to receiving facilities)

Phnom Penh Port

・CCTV (watching the gates and access to the restricted area)
・Public Address system as apart of CCTV camera surveillance system. (Providing warning notice of suspicious things and public notice of emergency situation happening)
・ID pass card system (Checking ID of port workers and offices at the gates)
・Security station (An office where a security officer with his staff stay to watch the data and information through the surveillance systems.)

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

Considering that project objective is not only to prepare countermeasures against terrorism but also to improve the exporting conditions by introduction of surveillance capability, the following planning policy was taken into account based on the Port Facility Security Plan and ISPS Codes. The security system will prevent trade barriers that would be introduced by the importing countries if the exporting ports are not prepared to meet the security requirements. Basic design of the plan for PAS and PAP was carried out considering the requests, priority in the requests, and existing situation of the port security.

・Controlling access to the port facilities (Land area and water area)
・Monitoring of the port facilities (Land area and water area)
・Resignation as Surveillance of the restricted area
・Supervising handling of cargo
・Monitoring cargoes
・Ensuring the communication network for security
・Protecting the sea from oil spill

(2) Basic Policy for Natural Conditions

Among the equipment to be installed in the project, X-ray container screening equipment, monitor and recorder for the CCTV camera monitoring system, a radar screen for the VTMS system, etc. are to be installed in the office. Hence, no influence to such equipment is expected from natural phenomena such as rain and wind.

On the other hand, CCTV cameras, ID pass card readers, out-door speakers of communication system, wind gauge and radar of VTMS system will be installed either on outdoor towers or in open air. When making their technical specifications, special attention is required to specify characteristics of these equipment so that they cannot be damaged from salt sea water and wind.

(3) Basic Policy for Socio-Economic Conditions

By conforming to ISPS code, RGC is going to prevent the port from terrorism and smuggling by means of improvement and up-grading the present port security facilities and organization. And RGC gives priority to the policy of promoting export-oriented industries such as textile and footwear industries to maintain and stimulate economic growth. Hence, it is urgently required to ensure port facility security to be able to announce about ensured security to Cambodia's trading partners in compliance the ISPS Code related to the SOLAS Convention. Equipment for port facility security to be granted through the project is expected to contribute to economic development and increase employment opportunity as well as assuring safety for the workers in port industries.

(4) Basic Policy for Circumstances of Procurement

All equipment to be granted by the project needs to be procured in Japan or third countries since it is not manufactured in Cambodia. However, construction materials such as cement and aggregate for the civil works and architectural works covering the pavement and the office in which the security equipment will be installed are obtainable in the local market in Cambodia.

Since specialized engineers and technicians are necessary for the installation and adjustment of X-ray container screening equipment, CCTV camera surveillance system, VTMS system, etc., the contract covering manufacturers or their agents needs to dispatch such experts when installing the equipment at the site. They should give initial guidance and training for operating the newly introduced equipment.

Local skilled technicians and electricians will be employed as assistants for installation and adjustment of the equipment. General workers will also be locally hired to assist carrying equipment and perform miscellaneous works at sites. Workers for constructing the civil works and buildings will be also hired from the local labor market.

Tender documents should include a clause that the contractor or supplier (including his manufacturer and makers) should support the client (or buyer) even after the delivery. The contractor (or supplier) should submit the client (or buyer) of a supply and take-care certificate

when he submits his tender. The contractor (or supplier) shall provide the client (or buyer) with direct support by him or support by agents for;

- Failure of equipment or its parts
- Break down of equipment or its parts
- To store and to supply spare parts

(5) Basic Policy for Utilization of Local Contractors

The capability and manpower of the local contractors will be utilized for the installation of supplemental works covering civil works, architectural works and underground wiring works, excluding procurement of the materials to be imported.

(6) Basic Policy for Ability of Operation/Maintenance of Implementing Agency

The ports of Sihanoukville and Phnom Penh are representative international commercial ports in Cambodia, and they have been earning a certain level of profit every year. It is therefore assumed that there will be no difficulties in operations and management of the facilities and equipment to be granted by the project. The security equipment is to be newly introduced to both ports in Cambodia, and hence it is desirable that technical cooperation be provided for training operational staff and improving operation system in terms of port facility security as so required.

(7) Basic Policy for Selection of Grade of Equipment

The security level regulated by ISPS code requires a total ability including the installation of facilities and equipment and the provision of skilled human resource. The grade of the facilities and equipment are determined to assure meeting any stipulated security level it may require. Both ports should consider that the security staffs are able to respond to the emergency situation by strengthen the human resource development. The equipment should meet the safety requirements in total and provide ease of maintenance.

X-ray container screening system could inspect suspicious materials in the container. The system should inspect 20 containers or more per hour.

X-ray container screening system will be covered by specially designed shed structure of concrete and its safety will conform to the requirements specified in ICRP-60. It is proposed that hourly radiation to the operator should be 9.1 μSV or less by shift system working. (three shift by four members)

Proposed CCTV camera surveillance system, ID pass card system and communication system for the project will be the same quality that is applied widely in the city markets.

Vessel traffic management system (VTMS) will have not only the surveillance function as specified in ISPS, but also capability for assisting vessel traffic and maneuvering in normal conditions. This system will be of easy operation and easy maintenance. Patrol boat will have surveillance capability during the rough sea and night. Oil spill recovery system will be the common type with easy maintenance works.

(8) Basic Policy for Procurement and Implementation Schedule

1) Procedure of Tendering

Competitive bidding will be adopted for construction work, and procurement and installation of the equipment.

2) Prime Contactor by Trading Company or Maker

Most of equipment in the project is manufactured by each specialized company and maker. Some equipment may be introduced through a maker or a third country including shipbuilding companies nearby. This project covers also civil and architectural construction. Thus it is recommended to adopt tendering in which the prime tender should be a trading company with his sub-contractors consisting of makers and construction contractors for the civil and architectural works. This will provide the project with the best conditions for efficient works in the proper time schedule, under a centralized and experienced management. Project cost estimation is based on this assumption.

3) Number of Tenders

As shown in the Minutes of Discussion (M/D), the project will be managed by two ministries and three implementation agencies consisting of MPWT (PAS and PAP) and MEF (CED). MEF will take care of X-ray container screening system with supplemental works and MPWT will undertake the remaining port security facilities and equipment.

There are two systems for tender package: the plural contract package and single contract package. After evaluating these for the project, it is concluded that single contract package is best for integration of various works and simplified site management. However, content of contract could be subdivided into two ports namely ①components related to MEF(CED) and ②components related to MPWT (PAS and PAP) for considering participation of two ministries. As mentioned before, the project cost estimation was carried out based on the single contract package taking economic advantages into account.

According to the M/D dated in June 12, the following actions are recommended accordingly;

- B/A (Banking Arrangement) will be carried out by MEF.
- A/P (Authorization to Pay) for X-ray container screening system with its supplemental works should be issued by CED.
- A/P (Authorization to Pay) for the rest of works should be issued by PAS representing group of PAS and PAP.

4) Implementation Period

It is estimated that the project will require a period of 11.0 months from the date of contract to the issuance of the final completion certificate.

2-2-2 Basic Plan (Equipment Plan)

2-2-2-1 Overall Project Plan

(1) Selection of Project Components

There are few port security facilities and equipment in PAS and PAP at present. It is key action to conduct precise surveillance of port facility within the restricted area for maintaining the security plan. To fulfill these requirements, the required equipment will be installed in proper arrangement at site in optimum quantity. In order to centralize application of various data and information, an office named "Security Station" will be provided for each port. These functions could be accelerated by introduction of the public address system and wire-less LAN system.

Project components are selected accordingly as follows based on the design policy and compulsory requirement of ISPS as described in Section 2-2-1.

Compulsory requirements	Corresponding port facility security equipment
①Controlling access to the port facility (Land area)	CCTV camera surveillance system, ID-pass-card system
②Controlling access to the port facility (Water area)	VTMS (Vessel Traffic management System)
③Monitoring of the port facility (Land area)	CCTV camera surveillance system
④Monitoring of the port facility (Water area)	VTMS, Patrol boat
⑤Monitoring restricted areas for suspicious persons	CCTV camera surveillance system
⑥Monitoring cargo the handling of cargo	X-ray container screening system
⑦Ensuring availability of security communication	Public address system as port of CCTV camera surveillance system
⑧Removing oil spill	Oil fence, oil skimmer and oil barge

As show above, project covers mainly the facilities and equipment required to detect and deter terrorism together with the provision for maintaining Cambodian exports to the security strict countries. Equipment for removing oil spill in the port area is also included, in consideration of environmental measure. Result of component selection based in the design policy is presented in Table 2-2-1 with the priority by requested item by RGC.

Table 2-2-1 Equipment Items Requested by the GOC with Ranked Priorities Given by the RGC and the Study Team

	Items of Equipment and Facilities	Rank priority by RGC		
		A	B	C
	Sihanoukville Port			
	X-ray container screening system:	●○		
	CCTV camera surveillance system	●○		
	ID-pass-card system	●○		
	Security station (architectural work and classified for facility)	●○		
	Vessel Traffic management System: VTMS	●○		
	Patrol boat	●○		
	Tug boat with fire-fighting device		○	
	Mooring facility for boats		○	
	CCTV camera system for ICD		○	
	Oil skimmer	●		○
	Oil fence	●		○
	Oil collecting barge	●		○
	Tank lorry			○
	Storage for oil fence			○
	Garage for tank lorry			○
	Phnom Penh Port			
	CCTV camera surveillance system	●○		
	ID-pass-card system	●○		
	Security station (architectural work and classified for facility)	●○		
	CCTV camera surveillance system for ICD		○	

Notes： ○ Rank priority given by the RGC
● Rank priority given by the Study Team
CCTV camera surveillance system includes the public address system.
ICD: Inland container depot, (container storing yard in the city.)
ID-pass-card system includes the wire-less LAN system.

(2) Application to ISPS and Security Level

ISPS requires for the security officer to prepare security countermeasures based on the evaluation of vulnerability of the existing security system. High vulnerability indicates that high possibility of suspicious individual to the important commercial points. Suspicious individual will not invade the port if he knows such port has enough surveillance capability and /or deterrent power. Based on the observation on the surveillance system and its quality, he will judge vulnerability of the security system.

This mean if the port facility security system is organized by an integrated system working well to detect and deter acts which threaten the port security, suspicious individual will be reluctant to carry out attack plans.

General speaking, the suspicious individual countermeasures in the port security will function only when sea surveillance system available in the night is employed.

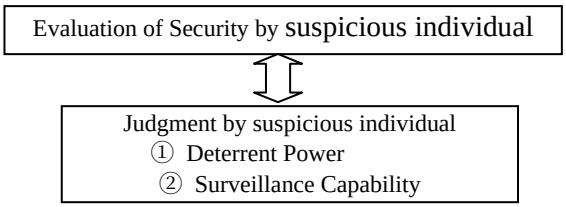


Fig. 2-2-1 Detect and Deter

Fig. 2-2-2 indicates role of security facility by ISPS, classifying from detect suspicious to the treatment after the incident happening in six steps.

Among these, “Step 6 Treatment after the invasion” is however out of ISPS requirements.

Step1	Surveillance
Step2	Detect
Step3	Confirmation
Step4	Deterrence
Step5	Emergency Notice and Warning
step6	Treatment after the Invasion

Fig. 2-2-2 Role of Port Facility Security

ISPS stresses importance of so called “Interface Area” which covers security conditions of areas consists of the berthed vessels and berths. Generally security level of the berth side will reflect to those of vessel. In the most case, the berth side security level is maintained as one, and will be up to 2 or 3 based on the judgment of the security officer and the level of emergency such as terrorist attack. Whenever situation returns to normal, the security level could be calm down to one from 2 or 3. For two years, to January 12, 2006, only one case to the level 2 is recorded in the world for the port facility security. While the level up to 2 by the ship security is reported for 42 cases. This shows the ship security is rather more sensitive than the port facility. There is no case that the level 3 was announced.

(3) Planning of Efficient Port Security System

This paragraph deals with the basic procedure of effective port security system planning.

Planning Policies

- Selection of components to meet the project requirement
- Setting up the characteristics of each component
- Harmonization between components
- Considering future security plan

Effective port facility security plan will be performed only when deterrence power is working under integration of each security component. To achieve this, data and information produced by each component should be jointly analyzed at one place, the security center.

Fig.2-2-3 indicates the situation that the security officer can see the data and judge for next

actions at the security station. Such data will contain surveillance conditions near the port fence, surveillance at gates, surveillance of vessels, and surveillance by patrol boat. Thus, important component is not only provision of each surveillance equipment, but also maintaining a data communication system, which should cover not only ordinary telephone and VHF, but also contain the media for recording and retrieval of basic data sources. It is preferable to include the following in the project.

- Storage of records of CCTV camera for 30 days at least
- Record of ID pass card information and interchange of digital data between the gates
- Supplying public address system

Proposed communication method between gates is the wireless LAN system taking cost into account. In addition to the above, public address system will be introduced not only ordinary public communication in the security level 1, but also for sheltering of the vessel and evacuation of port workers during the security level 2 and 3.

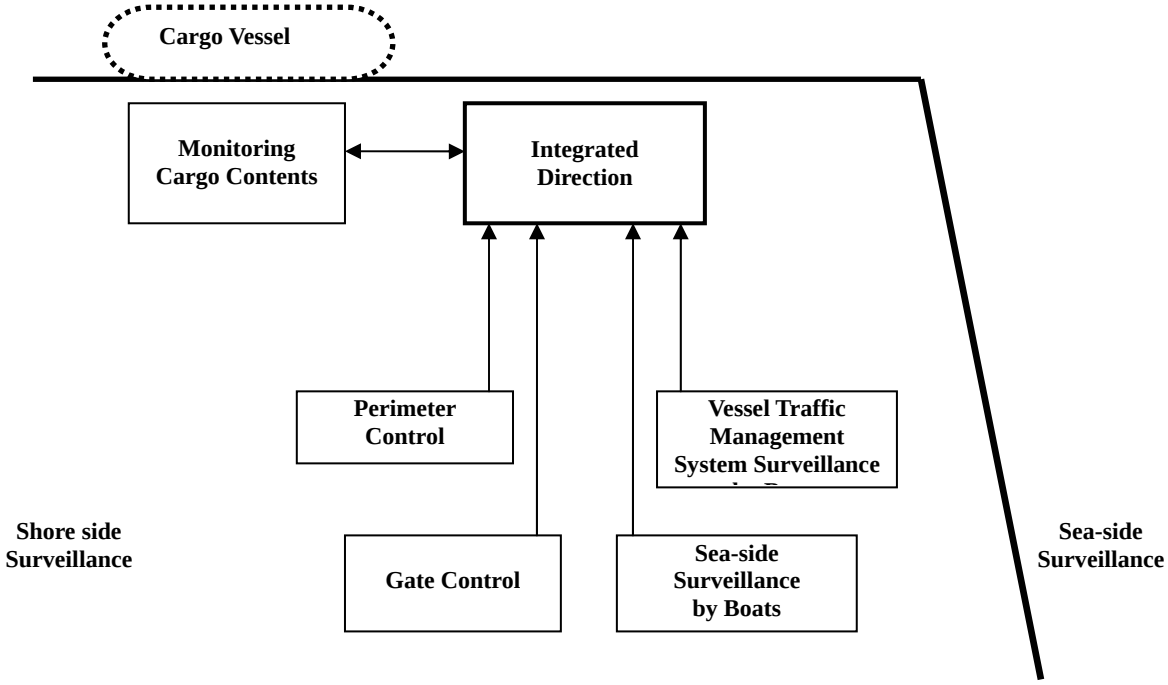


Fig. 2-2-3 Interface Relation between Port Facility and Cargo Vessels

Fig. 2-2-4 indicates that certain information collected into the security station will be redistributed to other public departments and agencies related to the security aspects accelerating effect of port security; for example:

- Direction to patrol boat to visitation of suspicious vessel
- Requesting cooperation of other project, including the police and coast guard or a like when deterrence of suspicions vessel is appeared

CED and PAS (PAP) should be coordinate in data exchange (IT), and CEO could give PAS a summary of cargo manifest and result of X-ray container inspection, and PAS can distribute to CED data collected by PAS. PAS could utilize CED information not only for the container terminal operation, but also total port security.

Thus data exchange between PAS and CED will contribute to many circumstances.

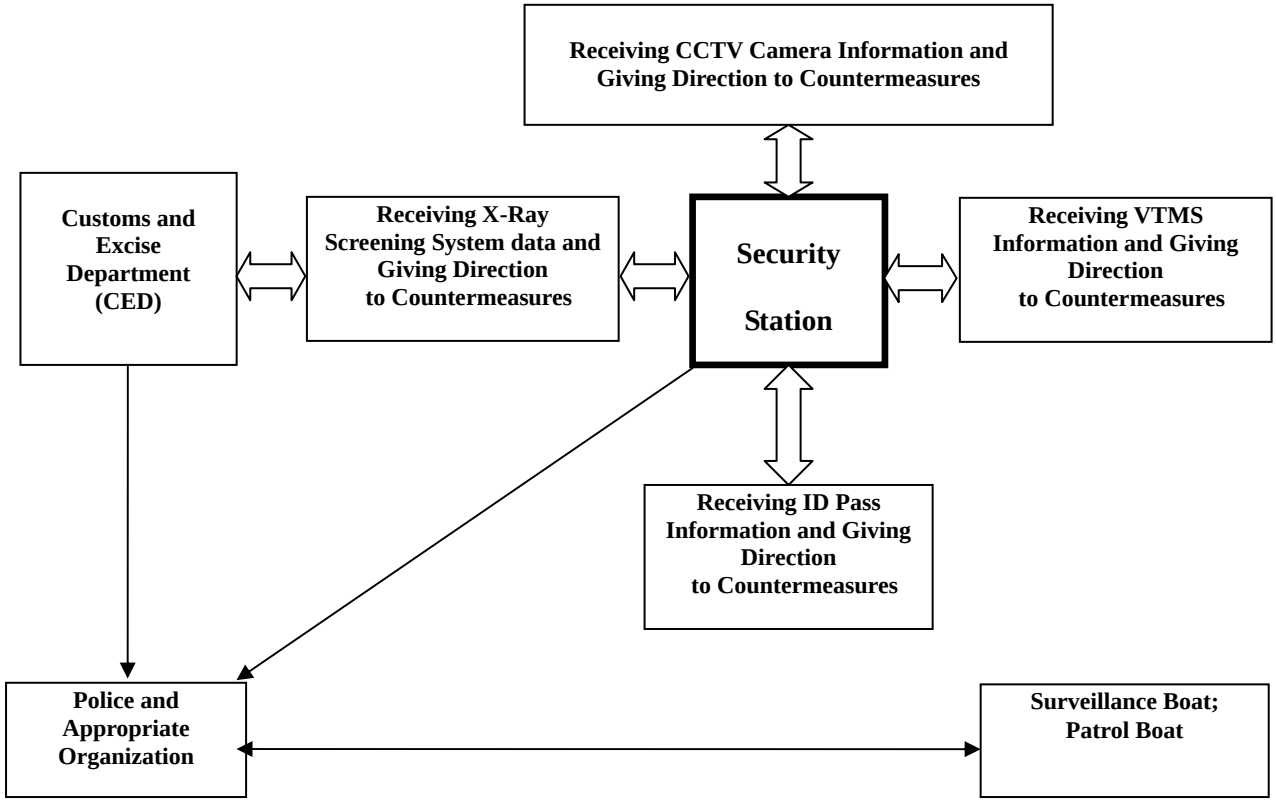


Figure 2-2-4 Integrated Security Functions at Security Station

Figure 2-2-5 indicates the relationship between each security component and the roles of security station. The security station's role is an important because all security information is gathered to decide and order the measure for suspicious individual and vessel. In addition, inspection of container scanning is implemented credibly in close touch with CED. However, it is recommended that work to be conducted in the security station should be confidential, and should not disclose the contents outside the office. Refer to Fig. 2-2-5.

Each gate will have each function, however it is recommended to simplify characteristic for ease of users understanding. Role of each gate is assumed as follows;

- Gate No.1: mainly for old jetty use including a passage for tourists and passengers and workers for workshop.
- Gate No.2: the main gate for access by the port workers, custom officers and others and the conventional cargo handling and other general use
- Gate No.3: The main gate for port workers, custom officers and others and containers from not only the new container terminal, but also the conventional terminal berths

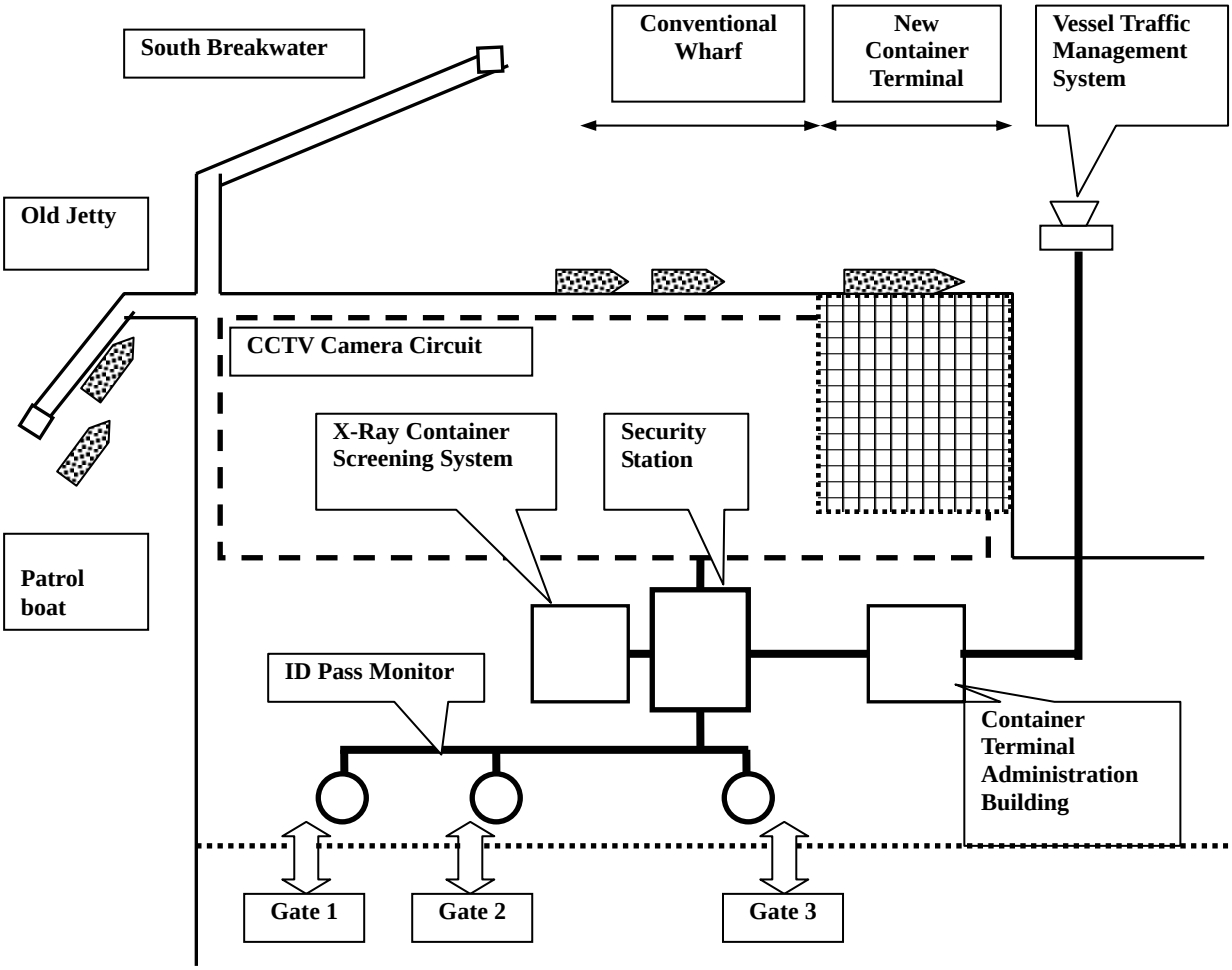


Fig. 2-2-5 General Layout of Project Component (PAS)

2-2-2-2 Facility and Equipment Plan for Sihanoukville Port

(1) Basic Plan

According to the basic policy in selecting the equipment mentioned in Section 2.2.1, the assessment of the current port facility security was carried out and the necessary countermeasures were worked out in the first step. Then, by taking account of the contents and priority of the requests by the RGC, the equipment to be provided in the Assistance Project were selected and proposed. The proposed facilities and equipment correspond to the compulsory requirements from the ISPS Code and is considered to be the minimum requirements to prevent terrorism or criminal acts within the port area.

Selection of project components was carried out based the following policies.

1) Facility or equipment working to strengthen the port facility security.

   Based on the port facility security plan and related ISPS Codes, surveillance equipment for detecting and dater invasion acts was selected. Priority order in the request of RGC was also taken into account.

2) Facility and equipment working to strengthen export power against the strict security regulations in the import countries;

   It is believed that the most important things is to test Cambodian export cargoes (containers) to certify its safety to the import countries which requires a strict verification of cargo security and safety. X-ray container screening system will be introduced mainly for this purpose.

(2) Proposed Security Facility and Equipment

Selected facilities and equipment are listed below.

- X-ray container screening system (including shelter and operation room etc.)
- CCTV camera surveillance system (with Public Address System)
- ID pass card system (with wire-less LAN system)
- Security station (Integrated office for port security)
- Vessel traffic management system: VTMS
- Patrol boat
- Oil spill Recovery system

Basic design method of each project components or presented hereinafter:

1) X-ray Container Screening System

   As mentioned in previous section 2-2-2-1(3), it is required for CED to exchange the data with PAS in order to facilitate the roles of X-ray container screening system, which CED possesses, operates and maintains. CED agrees to integrate the operation system of the container inspection system into the Customs Clearance System developed by CED and to connect to the PAS's port operation system to strengthen port security and facilitate trade.

   PAS will grant free use of land for the X-ray container inspection for CED to make the

inspection charge become reasonably low.

Basic requirement is hourly inspection speed of 20 containers or more and the annual test volumes of 70,000 containers or more, based on the following assumptions

- Annual import /export container at Sihanoukville port
- Arrival peak ratio at the weekend
- Decreasing test rate for long term based on the risk management consideration

X-ray container screening system was selected due to its high resolution and definition capability than the existing γ-ray container screening system which is planned to be relocated.

Safety standards:

Safety of this system should be based on the International Standard ICRP-60. The standard specifies acceptable annual radiation receiving intensity for human being of maximum 20 mSV or less. Based on this intensity, an acceptable hourly radiation intensity for the operation officer is estimated as 9 μSV/hour or less at the immediate outside of the concrete wall of X-ray system shelter as follows.

a. X-ray container screening system working continually for 365 days per year

b. 8760 working hours per year (365 days x 24 hours)

c. Daily working hours for an operator in four-shift system: 2,190 hours (8,760 / 4)

d. Hourly acceptable radiation receiving: 9.1 μSV/hour

20mSV / 2,190hours x 1,000 = 9.1 μSV/hour

This estimated radiation would be decreased further, if actual operating conditions are taken into account. Firstly, the annual working ratio of the system will be about 35%, thus the radiation of X-ray intensity for as operator will be down to 2.7 μSV/hour. In addition to this, the radiation intensity will be slightly decreased by the distance measuring from the shelter wall.

Basic Specifications of X-ray Container Screening System;

- Objects of Screening	Container cargo carried on a truck	
	45 feet dry container	
	13,716L x 2,438W x 2,896H (mm)	
- X-ray Energy:	6 MeV	
- Penetration:	Not less than 330 mm steel	
- Direction of irradiate:	Single irradiation by side	
- Resolution:	IQI	Less than or equal to 4%
	CI	Less than or equal to 2%
	In air	Less than or equal to 1 mm
- Screening rate:	20 or more trailers with containers per hour	

- EDI connection — This system will be able to connect with EDI (Electronic Data Interchange) through the interface devices when it is so required.

Typical System Component (depends on the maker)

X-ray Container Screening System generally consists of following components:

- X-ray Generation System

  The device generates X-ray beam corresponding to Detector.

- Detector

  The device is installed at the opposite side of X-ray Generation System and converts X-ray into electrical signal.

- Radiography system

  The device controls X-ray Generation System and Detector.

- Central Control Device

  The device, which is mainly composed of PLC, Programmable Logic Controller, is connected to System Operator Console and controls the whole system and automatic sequence.

- System Operator Console

  The device indicates all necessary conditions of the system in graphic mode and the operator can control all functions from this console.

- Data Storage Server

  The server stores pictures and has various functions as follows:

  ・Store pictures with related information: i.e. date, time, etc.

  ・Search and indicate the picture with related information indicated above

  ・Indicate monthly, weekly inspection schedule

- Inspection terminal

  Inspector reviews X-ray screening image with this terminal.

- Carrier System and shielding doors

  The system is an automatic X-ray system carrier, controlled from system operator console. Shielding door is to protect a leakage radiation during inspection and to be controlled from the System Operator Console.

2) CCTV Camera Surveillance System

The restricted area of PAS and PAP will be monitoring by CCTV camera for 24 hours a day. CCTV cameras will be installed to watch every corner and can show the yard image at night. They will be equipped with zoom-up function of 350 m range and will be also located at the gates and along the boundary fence of the restricted areas. It is assumed that the present lighting intensity at Phnom Penh port is enough for CCTV cameras. However, Sihanoukville

port has not enough lighting intensity at the night along the boundary fence; thus eight lighting poles will be included in the project by Japanese assistance. Refer to the drawings attached in Section 2-2-3.

Each lighting pole has two units of high-pressure sodium vapor lamp (HPSV 2x250w) for maintaining ten lux or more at night. It is recommended that PAS provide proper maintenance works for the existing yard lighting.

3) ID Pass Card System and Wireless LAN System

ID pass card system will be introduced for identifying port officers and workers and located at the gate. This system will provide simple and swift inspection thus the gate security officers and could concentrate to inspect on those who have no ID card. Persons who have no ID pass could be inspected more precisely. Barcode system is proposed since it is available at reasonable cost to record a minimum but enough information required, and has simple parts for easy maintenance.

Other communication system between the gates is also provided for exchanging data " In and Out". This data will also be carried out over wireless LAN system for economic and security reasons.

Thus security station would be the place where all the security information would gather.

4) Public address System

Public address system will be provided for transmitting integrated information collected at the security station to all the offices and areas. This will contribute to giving a notice and warning to the public for evacuation immediately when an incident has happened by terrorism or the like. Yard speaker will be installed by zone to meet the requirements.

5) Vessel Traffic Management System (VTMS)

Proposed VTMS can monitor vessel traffic within the whole port area (or restricted area). Once suspicious boat invades into such surveillance area, VTMS will communicate with the patrol boat to trace such invaders. VTMS can identify 1000 AIS vessels and can trace to 200 AIS vessels taking the existence of 2,000 fishing boats nearby PAS into consideration.

6) Patrol Boat

Patrol boat is a must to trace and to carry out visitation of the suspicious vessel. However, PAS has currently no such boat with high speed of more than ten knots; thus there is no capability to trace suspicious boats. It is proposed to equip a patrol boat with communication devices for acting on the indication given by VTMS.

Basic specifications of the boat are tracing speed of 18 knots with an independent tracing capability under the radar devices and communication system. The boat will also have an echo-sounder to measure the water depth preventing it from grounding during the tracing actions.

(3) Purpose, Function and Number of Equipment

The purpose, function and number of the units of equipment to be introduced for monitoring within the water areas within Sihanoukville Port through the said Assistance Project are shown in Tables 2-2-2 and 2-2-3.

Table 2-2-2 List of Security Equipment Proposed by Study Team to Sihanoukville Port

Item No	Equipment	No.	Purpose	Function	Remarks
1	X-Ray Container Screening System	1 unit	To inspect of irregular goods in container cargo at container terminal	Scanning contents in container cargo by 6MeV X-ray energy. Inspecting irregular goods by grayscale image processing. To increase inspection efficiency by scanning whole container cargo.	CDE's ownership in Sihanouk-ville port
2	CCTV Camera Surveillance System -Outdoor pan/Tilt Camera -Outdoor Fixed Camera -Matrix Switcher -Color Monitor -Digital Recorder	 18 units 14 units 1 set 5 units 3 units	To survey for restricted port area and access gate for 24 hours and to record the CCTV footage.	-Color Camera: Night time visibility is obtained by 1.0 lx illumination. -Recorder: HDD recorder -Color Monitor: PAL system with multi screen and spot screen. -Matrix Switcher: Available for more than 48 cameras. -Joystick Controller: Camera ,focus, zoom control, selections of camera number etc	Repair of existing yard lights are required to maintain night time visibility.
	Public Address System -Amplifier-1 -Amplifier-2 -Speaker -Microphone	 1 unit 1 unit 10 nos 1 no.	To warn and/or announce for illegal access or emergency measures.	Announcements will be made from the microphone, located in security station to all or selected zones in restricted port area.	
3	ID Pass Card System -ID Card -Barcode Reader -Signal Controller -PC for Entry ID -PC for Gate Management -ID Card Printer -Wireless Network	 1800pcs 6 units 3 units 3 sets 1 set 1 set 1 set	To secure security of the restricted area by around-the-clock supervision to port staffs and vehicles at three (3) gates.	Irregular access of persons and vehicles are detected by ID information sent from main server of security station. Among gates and security station will be connect by wireless LAN for data interchange.	
4	VTMS (Vessel Traffic Management System) -Radar -AIS Receiver -International VHF Radio Telephone -CCTV Camera -Anemometer & Anemoscope -Tower for CCTV camera & Radar antenna -Radar console storage house (Shelter) -Monitor display (VTMS control room)	 1 unit 1 unit 2 units 1 unit 1 unit 1 unit	To monitor/control of the movement of vessels in the vicinity of ships using port facility and restricted water area. To identify vessels in the restricted water area. To secure distributing security information.	Radar: Monitoring the movement of vessels, navigation buoys and floating targets for 24 hours. Providing alarm when vessels enter into the restricted water areas. Setting up the restricted water areas in radar screen. Displaying identification of more than 1,000 AIS vessels on the monitor numerically. Tracking and displaying more than 200 non-AIS vessels on the monitor. Linkable with CCTV camera AIS Receiver: Receiving AIS information from AIS vessels.	

				International VHF Radio phone: 57 International channels VHF enabling receiving and transmitting security information. CCTV Camera: High sensitive color camera enabling displaying/tracking target on the radar monitor. Anemometer & Anemoscope: Enabling measurement of wind speed up to 60 m/s and wind directions.	
5	Patrol boat	1 ship	Patrolling/surveillance in the restricted water area. Detecting suspicious vessels, distributing security information to concerned security station and alarming to suspicious vessels.	High maneuverability, stability and speed of 18 knots enabling tracking suspicious vessels during night and rough sea conditions in the restricted water area. Security system of radar, AIS, GPS, PA for alarms and Echo sounder enabling surveillance for suspicious vessels in the restricted water area.	
6	Oil Fence Total length 440m	1 set	To prevent diffusion of spilled oil	Fencing round and collecting spilled oil.	
7	Oil Skimmer Capacity $30m^3$/hr	1 set	To skim, collect and transport recovered oil.	Skimming spilled oil by float type skimmer controlled from ship remotely.	
8	Oil Barge Capacity $25m^3$	1 set	To skim, collect and transport recovered oil.	Transporting recovered oil to on-shore by oil barge.	

(4) Specifications

Specifications of the equipment are shown in Table 2-2-3 (in 8 parts). Detailed specifications are shown in “Technical Specifications” for Equipment attached as an annex document.

Table 2-2-3 Specifications (Sihanoukville Port)

No	Equipment	Specification	
1	X-Ray Container Screening System		
	-X-Ray Main Body	・X-Ray Energy :	6 MeV
		・Penetration(Iron) :	330 mm or more
		・Number of Radiation Direction for Inspection :	Single radiation by side
		・Throughput :	20 trucks/hour or more
	-Building (Radiation Protection)	・Applicable Regulation :	ICRP-60 (International Commission on Radiological Protection)
		・Radiation Protection :	Concrete shelter
		・Safety Measures :	Leakage of radiation at outside of the radiation protection wall should be 9 μSV/hour or less
2	CCTV Camera Surveillance System		
	-Outdoor Pan/Tilt Camera (for yard surveillance)	・Pick-up Device:	CCD1/4 type, 430,000 pixel or more
		・Horizontal Resolution	480 lines (color) or more
		・Signal Type	PAL
		・Min. Illumination:	1.0 lux or less (Color mode) 0.05 lux or less (B/W mode)
		・Optical Zoom:	22 times or more
		・Movement :	Horizontal 360 deg, Vertical 0 – 70 deg.
		・Housing:	Water and saltwater resistance
	-Outdoor Fixed Camera (for gate surveillance)	・Pick-up Device:	CCD1/3 type, 430,000 pixel or more
		・Horizontal Resolution	480 lines (color) or more
		・Signal Type	PAL
		・Min. Illumination:	1.0 lux or less (Color mode) 0.15 lux or less (B/W mode)

	-Matrix Switcher	・Optical Zoom:	8 times or more
		・Housing:	water and saltwater resistance
		・Horizontal Resolution:	500 lines or more (PAL)
	-Color Monitor	・Video input and output:	48/ 5 or more
		・Capacity:	800 GB or more
	-Hard Disk Drive	・Camera Input:	16 or more
		・Video Output:	16 or more
		・Spot Output:	1 or more
	Public Address System		
	-Amplifier – 1	・Power Source :	AC 220 V, 50 Hz
		・Rated Output :	240 W
		・Frequency Response :	50 – 16,000 Hz (Typical)
	-Amplifier - 2	・Power Source :	AC 220 V, 50 Hz
		・Rated Output :	120 W
		・Frequency Response :	50 – 16,000 Hz (Typical)
	-Speaker	・Type :	Horn Speaker
		・Rated Input :	30 W
		・Frequency Response :	200 – 6,000 Hz (Typical)
		・Output Sound Pressure Level:	110 dB(1 W/1 m) (SPL)
	-Microphone	・Power Source :	DC 24 V
		・Frequency Response :	100 – 20,000 Hz (Typical)
		・Type :	Unidirectional electric condenser microphone
3	ID Pass Card System		
	-ID Card	・Barcode Type :	32 digit
		・Printing :	Barcode, face photo, information
	-Scan Sensor/Reader	・Scan Beam :	Semiconductor laser
		・Scan Speed:	500 Scan per second
		・Host Interface:	RS – 232C
	-Signal Controller	・Distinction:	900 (max.)
		・Sensor Interface :	RS –232C
	-PC for Entry ID	・Memory :	512 MB
		・Hard Drive :	40 GB
	-PC for Gate Management	・Memory :	512 MB
		・Hard Drive :	40 GB
	-Wireless Network Devices	・Frequency Band :	2.4 GHz
4	VTMS (Vessel Traffic Management System)		
	-Radar	・X-band Radar antenna:	10 feet or more
		・Beam width:	Horizontal 0.75° or less Vertical Approx.20°
		・Transmitting power:	25 kW or more
		・Transmitting Frequency:	9410 MHz
		・Wind velocity Operational:	51.5m/sec (100knots) or more
		・Radar Display (Shelter):	Color LCD 17”or more
		・Radar AIS Integrated Display:	Color LCD 17”or more
		・Numeric Data Integrated Display:	Color LCD 17”or more
		・Recording Monitor Display:	Color LCD 17”or more
		・CCTV Monitor Display:	Color LCD 17”or more
		・Tracked Target Indication:	Max. 200 targets
		・AIS Target:	Max.1,000 target vessel
		・Alarm function :	Entering of vessel into designated area
		・Camera movement linkage:	By the various information of tracked target and AIS data information, alarm functions, CCTV camera follows automatically to the tracked target
		・Recording function:	Recording frequency should be set from 10 sec. to 60 min. Capability of recording on built in Hard Disk Drive or DVD Approx. 14 days worth of screens in case of frequency of 10 sec.

	-AIS Receiver	・Frequency range:	156.025MHz～162.025 MHz
		・Channel spacing:	25KHz/12.5 KHz
		・Antenna:	VHF/GPS
	-International VHF Radio Telephone	・Number of channels:	INTL: 57 ch
		・Transmitting Frequency range:	155.000MHz～161.475 MHz
		・Receiving Frequency Range:	155.000MHz～159.600 MHz
		・Out put power:	25 W or less
	-CCTV Camera	Color or Color/Monochrome Automatic/ Manual Operation	
		・Imaging device:	1/2" IT-CCD, NTSC
		・Minimum illumination:	Color Integration mode 0.005 Lx/F1.4 (Monochrome mode 0.0005 Lx/F1.4)
		Zoom Lens	
		・Focal Length:	11-385 mm Without extender (22-770 mm With extender)
		・Zoom:	32X or more
	-Anemometer & Anemoscope	Wind Vane Anemometer and Indicator	
		・Transmitter:	Detection system
		・Measuring range:	Direction 0～360° Speed 1～60 m/s
	-Tower for Camera & Radar antenna	・Height:	not less than 14m
		・Design wind speed:	60 m/sec
	-Radar console storage house (Shelter)	・Material:	Aluminum
		・Wind load:	46 m/sec
		・Air conditioning:	Provided and also be monitored at VTMS Control Room
	-Power Supply	・AC220V x 1Φ	
5	Patrol boat	・Material:	Aluminum alloy
		・Classification:	NK(Nippon Kaiji Kyokai)
		・Navigation Area	Coastal
		・Length (OA):	Approx. 14.0 m
		・Breadth (Mld):	Approx. 3.6 m
		・Depth (Mld):	Approx. 1.6 m
		・Crew:	10 persons
		・Speed:	18knots
		・Main Engine:	Marine Diesel Engine x 2 sets Approx. 200PS x 2 sets
		・Fuel oil tank:	Approx. 1500L
		・Equipment:	Radar, Public addressor, Search light AIS, GPS, VHF, Echo sounder
6	Oil Skimming system		
	-Oil skimmer	Floating type	
		・Capacity:	$30m^3$/hr
		・Oil viscosity:	0-1,000,000 CST
	-Hydraulic power pack for oil skimmer	・Driving power:	Diesel engine
		・Silencer:	with spark arrester
	-Remote control device	Hunger type remote control device	
		・Pressure:	Max.210kgf/cm^2
		・Operation:	normal-stop-reverse
	-Hydraulic hose and transfer hose	For power	
		・Power package-remote control:	10m x 2
		For remote control	
		・Remote control-oil skimmer:	15m x 2
		For transfer	
		・Oil skimmer-oil barge:	30m x 1
		・Reel:	1 set each
	-Oil collecting device	Outrigger	
		・material	Aluminum
		・length	about 6m
		・Jib arm/pipe	flange connection type

		Oil fence	
		・Fixed type:	length approx. 20 m
		・Height:	approx. 200 mm above water
		・Skirt depth:	approx. 350 mm
7	Oil fence	・Type	B-type
		・Length	440 m (20m x 22 units)
		・Unit length	20m
		・Height:	above water 30 cm
		・Depth:	below water 40 cm
		・Connecting height:	80 cm
		・Connecting type:	Superposition fastener type
		・Strength:	Breaking at fence 3,000 kgf or above Breaking at skirt 30 kg/cm or above
		・Float part:	Isolite
		・Mooring rope:	200 m x 1
		・Anchor:	Danforth type（20 kg）x10
8	Oil barge	・Recovered Oil Capacity:	$25m^3$
		Material shall be longer operational, weather resist and durable	
		・Towing speed:	Light weight 10 knots Full loaded 5 knots
		・Equipment:	mooring rope Navigation light Hanging device
		・Diesel engine driven blower:	1 set

(5) Supplemental Civil Works to Support Equipment

In this project, it is the responsibility of RGC to carry out necessary preparation works for the project. It will generally cover the following:

- Preparation of area where the project will be carried out.
- Preparation access to the site
- Provision of utilities including power and water supplies to the connection point as agreed

More precise information will be given in Section 2-2-3 “Drawings”, Section 2-3, and the attached drawings (5) in the M/D, Feb. 2nd.

Civil works in the project are supplemental works for the security equipment installation including the access pavement, equipment foundations, and underground wiring.

The following civil works are included in the project for PAS.

1) Lighting facilities along the boundary fence of PAS will be included consisting of eight lighting poles with devices, taking into account to provide enough night visual intensity for the CCTV camera.
2) The pavement works for main access and waiting area for truck carrying container to the X-ray container screening system will be carried out by Japanese side since this is a significant part of project to ensure a smooth and efficient operation of scanner works. Total pavement area will amount to 9,600 m^2 near Gate no.3. Basic arrangement is shown in Fig.2-2-11; however, other alternative layout will be considered during the detailed design stage subject not to increase the pavement area and cost.

3) Underground wiring work is required for the CCTV camera surveillance system and VTMS. These laying works will be carried out between the camera position/ VTMS radar tower and the security station or the new administration building nearby the main gate. This work will be conducted with the installation of the related main equipment. Wiring route is mostly selected of the shortest distance; however, review of them will be carried out during the detailed design stage looking for better route eliminating disturbance to the present port operation. At that time, the location of existing underground works (power lines, water lines, etc,) should be reviewed by the maps and plan to be provided by PAS.

(6) Supplemental Architectural Works

This project contains various architectural works including foundation of equipment and its sheds. The following are major architectural works in the project. All of them will be included in the Japanese side works.

- A shelter of about 600 m^2 will be installed covering the main body of X-ray screening system. However, its shape and structure will be based on the design plan of each maker. The Consultant will prepare the design criteria (as shown in item (7) of this section) and will be attached in the tender documents. All applicants can design a shed applicable to his X-ray container screening system.
- At least one X-ray inspection room will be installed nearby the shelter, as a part of shelter.
- Garage like house will be provided in order to conduct visual inspection of containers under question. Design of this room is carried out by the Study Team. Thus there is no need for applicants to design it again.
- A one-story office for the integrated security station of 230 m^2 will be provided. Design of this room is also carried out by the Study Team. Thus there is no need for applicants to design it.

Among these three sheds, the visual inspection room and the security station have been designed by the Study Team and drawings were attached in Section 2-2-3, since their shape and size is independent and not related to the main body of the X-ray system. The shelter, however, should be designed by each maker to meet his design method of the X-ray screening main body.

(7) Specifications to the Shelter of X-ray Container Screening System

Basic design conditions of X-ray container screening system and its shelter is given in Section 2-2-2-2(2)(a) and (4) Table 2-2-3.

Preliminary cost estimation of X-ray container screening system with shelter was carried out delivering it to the possible applicants. In the detailed design stage to come, these design conditions will be review for improve and compiled into the tender documents. Applicant should prepare his proposal including drawings, design data and cost estimation then submit to the Client (or Buyer) during the tender.

Preliminary project design Criteria of Shelter;

- Annual Operation time; 6,760 hours (365 x 24)
- Composition of operator 5 officers x 3shifts with four team
- Annual working hours a operator 2,190hours (8,760 / 4)
- Approximate shelter area limit 50m x 30m
- Composition of rooms Monitor room, Office, Resting room, Locker room, Storage, Lavatory, etc.
- Facilities CCTV camera, Speaker devices, Air-conditioner, Lighting etc.
- Utility Water supply, drainage, are to be connected to other terminal point

As described in Paragraph (6), each maker who may offer tender can design the shelter of X-ray container screening system. Such design can be based on the maker's design method, the shape of his equipment and operation system and the provided project design criteria in the technical specifications in the tender documents. Thus maker can design the shelter and all others based on the project design criteria and his specifications. If any deviation between them, the project designs criteria in the tender documents should prevail.

The project design criteria will cover the following:

- Design Specifications
  - Safety standards (such as ICRP-60)
  - Structural standards (such as loading condition)
  - Instrument standards
  - Maintenance standards
- Layout Specifications (such as Fig. 2-2-11)
  - Basic layout
- Utility Connection Specifications (such as Fig. 2-2-10)
  - Power supply
  - Water supply
  - Communication

(8) Security Station

Security station will be built immediately west of the gate3 where the security management work for the CCTV cameras and ID pass card will be undertaken. This office will have of area in 230 m^2 of flat with eight rooms including the monitoring room for 24 hours surveillance a day acting a central part of security view capturing and surveillance. Rooms are including resting room, power room, toilets, shower room, hot-water-supply system and storage other than monitoring room. Air conditioning facility will be provided accordingly.

Necessary utility will be supplied from the terminal point located at the administration building of new container terminal.

Due to the existing medium to hard layers of soil, the bearing capacity is assumed of 110 kN/m^2 and no pile foundation will be provided, but flat foundation for preventing uneven settlement to happen.

(9) Container Visual Inspection Room

If a suspicious container is found by X-ray inspection, it will be led to the visual inspection room for clarification under the witness of the consignees or consignor. The door of container will be opened to review the contents. The room has enough space to store the break cargo taken out from three large containers of 45 ft.

The arrangement of room is for the operation by a forklift to handle the cargo as required. The total area will be approximately 250 m^2 with platform in approximately 110 m^2. Floor level will be elevated to 1.15 m above the ground level for smooth connection to the trailer luggage face.

(10) Common Architectural Design Conditions (Sihanoukville and Phnom Penh)

1) Basic Condition in Architectural Design

   Natural conditions including the soil condition will be taken into consideration. In the architectural design, bending and vibration by the normal load condition will be considered. In the short-term load, the structure should be tough enough against wind pressure and other horizontal loadings. Structure adopted should have ease of construction with a high durability.

2) Architectural Design Standards

   Cambodian standards are being studied and are under preparation in Cambodia at present but not fixed yet. In this project, Japanese architectural design standards covering the structural analysis and design details will be applied accordingly. Material standards will be either JIS, ASTM, BS and other equivalent. Japanese standards will prevail.

3) Construction Method and Material Selection

   Construction Method

   Following to the existing architectural construction pattern, concrete column with brick wall type was basically adopted. Roof structure will be the sloped one with the steel frame on the concrete slab for water proofing.

   Reinforcement Bars, Cement and other Basic Materials

   There are three concrete plants in Phnom Penh which can provide enough concrete volume for the project demand. In Sihanoukville, introduction of a concrete plant will be necessary. Reinforcement to meet JIS, ASTM or BS could be available; however, Chinese bars have no mill sheets, thus no evidence.

Structural Steel

Structural steel will be imported from Thailand and others. Fabrication of structure in Cambodia is possible.

4) Soil Conditions

Judging from the previous soil data for the Japanese Grant Aid and the berth construction in Phnom Penh area, it is found that there is firm bearing stratum around GL –15 m which shows N-value 50 or more at Phnom Penh site. Considering the possibility of fluctuation of layer level since the area is along the river bank, it is assumed that the bearing layer should be around GL-20 m or beyond. Pre-stressed concrete pile will be driven until enough penetration into hard layers. Thus it is recommended to adapt point bearing pile foundation. While soil data near the gate3 of Sihanoukville port indicates that there are: sand layer of N20 to GL-4 m, silty sand of N2 to GL-6 m, hard silty sand of N20 to GL-8 m then rock layer in N50 below GL-18 m. Flat foundation without pile will be appropriate for the structures located near the gate3.

5) Design Loads

The following design loads will be taken into account:

- Vertical loads as per Japanese standards
- Wind pressure; Japanese design method; 30 m/sec wind
- Seismic forces; Base shear coefficient , Co = 0.05

6) Summary of Materials

Major materials for Project, available in Cambodia, are shown in Table2-2-4.

Table 2-2-4 Major Materials for the Project

Concrete	Foundation, ground floor	Cylinder Strength 21 N/mm^2
	First floor, column, wall and roof	Cylinder Strength 21 N/mm^2
Reinforcement	Round bars	ϕ6 to ϕ9
	Deformed bars SD295a	D10 to D16
	Deformed bars SD345	D19 or more
Steel Structure	Frame and structure members	SS400, SSC400

(11) Temporary Construction Site

The temporary construction site is required of an appropriate area nearby the site. This area will provide a safe zone for the preparation works, storage and the site office. PAS provides 1.0 ha area near the gate3 where various civil works and architectural works are planned. Refer to Fig. 2-2-6.

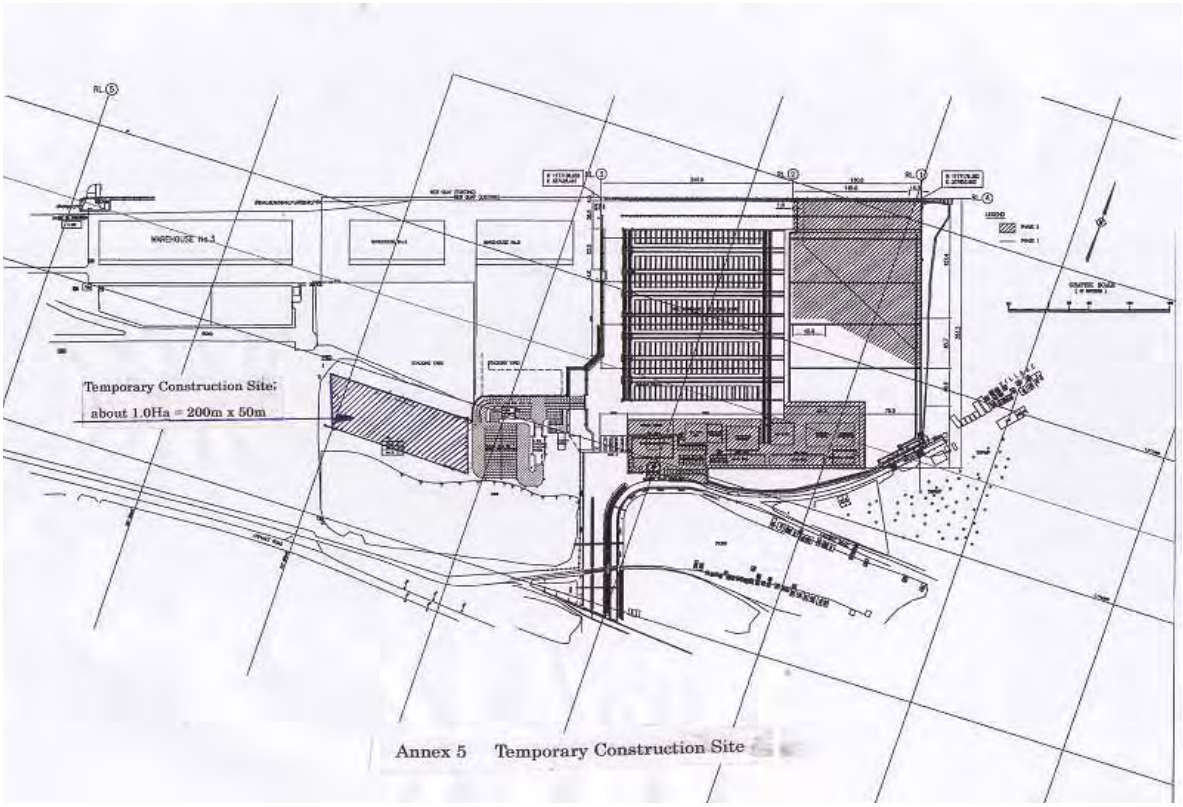


Fig. 2-2-6 Temporary Construction Site of Sihanoukville Port

2-2-2-3 Facility and Equipment Plan for Phnom Penh Port

(1) Basic Plan

According to the basic policy in selecting the equipment mentioned in Section 2-2-1, assessment of the current port security facility was carried out and the necessary countermeasures were worked out in the first step. Then, by taking account of the contents and priority of the requests by the GOC, the equipment to be provided in the Assistance Project were selected and proposed.

(2) Proposed Security Facility and Equipment

The selected facilities and equipment are as follows:

- CCTV camera surveillance system (with Public Address System)
- ID pass card system
- Security station

The design method and technical specifications of each facility and equipment are basically the same standard with those of PAS.

(3) Purpose, Function and Number of Equipment

The purpose, function and number of the units of equipment to be introduced for monitoring within Phnom Penh Port through the said Assistance Project are shown in Tables 2-2-5 and 2-2-6.

Table 2-2-5 List of Security Equipment Proposed by Study Team to Phnom Penh Port

Item No	Equipment	No.	Purpose	Function	Remarks
9	CCTV Camera surveillance System -Outdoor pan/Tilt Camera -Outdoor Fixed Camera -Matrix Switcher -Color Monitor -Digital Recorder	 14 units 2 units 1 set 3 units 2 units	To survey for restricted port area and access gate for 24 hours and to record the CCTV footage.	-Color Camera: Night time visibility is obtained by 1.0 lx illumination. -Recorder: HDD recorder -Color Monitor: PAL system with multi screen and spot screen. -Matrix Switcher: Available for more than 16 cameras. -Joystick Controller: Camera ,focus, zoom control, selections of camera number etc	Repair of existing yard lights are required to maintain night time visibility.
	Public Address System -Amplifier -Speaker -Microphone	 1 unit 5 nos. 1 no	To warn and/or announce for illegal access or emergency measures.	Announcements will be made from the microphone, located in security station to all or selected zones in restricted port area.	
10	ID Pass Card System -ID Card -Barcode Reader -PC for Entry ID -Signal Controller	 900 pcs 1 unit 1 unit 1 unit	To secure security of the restricted area by around-the-clock supervision to port staffs and vehicles at gate.	Irregular access of persons and vehicles are detected by ID information at security station.	

(4) Specifications

Specifications of the equipment are shown in Table 2-2-6 (in 2 parts). Detailed specifications are shown in “Technical Specifications” for Equipment attached as an annex document.

Table 2-2-6 Specifications (Phnom Penh Port)

No	Equipment	Specification	
9	CCTV Camera surveillance System		
	-Outdoor Pan/Tilt Camera (for yard surveillance)	・Pick-up Device:	CCD1/4 type, 430,000 pixel or more
		・Horizontal Resolution	480 lines (color) or more
		・Signal Type	PAL
		・Min. Illumination:	1.0 lux or less (Color mode) 0.05 lux or less (B/W mode)
		・Optical Zoom:	22 times or more
		・Movement:	Horizontal 360 deg. Vertical 0 – 70 deg.
		・Housing:	water and saltwater resistance
	-Outdoor Fixed Camera (for gate surveillance)	・Pick-up Device:	CCD1/3 type, 430,000 pixel or more
		・Horizontal Resolution	480 lines (color) or more
		・Signal Type	PAL
		・Min. Illumination:	1.0 lux or less (Color mode) 0.15 lux or less (B/W mode)
		・Optical Zoom:	8 times or more
		・Housing:	water and saltwater resistance
		・Video input and output:	20/ 5 or more
	-Matrix Switcher	・Horizontal Resolution:	500 lines or more (PAL)
	-Color Monitor	・Capacity:	800 GB or more
		・Camera Input:	16 or more

	-Hard Disk Drive	・Video Output:	16 or more
		・Spot Output:	1 or more
	Public Address System		
	-Amplifier	・Power Source :	AC 220 V, 50 Hz
		・Rated Output :	240 W
		・Frequency Response :	50 – 16,000 Hz(Typical)
	-Speaker	・Type :	Horn Speaker
		・Rated Input :	30 W
		・Frequency Response :	50 – 16,000 Hz (Typical)
		・Output Sound Pressure Level :	110 dB (1 W/1 m) (SPL)
	-Microphone	・Power Source :	DC 24 V
		・Frequency Response:	100 – 20,000 Hz (Typical)
		・Type :	Unidirectional electric condenser microphone
10	ID Pass Card System		
	-ID Card	・Barcode Type:	32 digit
		・Printing:	Barcode, face photo, information
	-Scan Sensor/Reader	・Scan Beam:	Semiconductor laser
		・Scan Speed:	500 Scan per second
		・Host Interface:	RS – 232C
	-Signal Controller	・Distinction:	900 (max.)
		・Sensor Interface:	RS – 232C
	-PC for Entry ID	・Memory:	512 MB
		・Hard Drive:	40 GB

(5) Supplemental Civil Works

Excluding the facility for the X-ray screening system, the same type of works as Sihanoukville should be carried out for Phnom Penh. In this project it is responsibility of the recipient country to carry out the necessary preparation works for the project. It will generally cover the following:

- Preparation of area where the project will be carried out
- Preparation of access to the site
- Provision of utilities including the power and water supplies and others to the connection points as agreed

More specific data is presented in Section 2-3.

Civil works in the project are supplemental works for the security equipment installation including the equipment foundations and underground wiring etc. The following works are included in Project to PAP.

Underground wiring work is required for the CCTV camera surveillance system. These wire laying works will be carried out between the camera position and the security station nearby the main gate. Wiring route is selected of the shortest distance; however, review on them will be carried out during the detailed design stage looking for better route eliminating disturbance to the present port operation.

(6) Supplemental Architectural Works

Similar to the civil works, the same type of works as Sihanoukville should be carried out for

Phnom Penh.

Required architectural works at Phnom Penh port is only the security station where management work for the CCTV cameras and ID pass card will be undertaken. This office will have of area in 208 m^2 with eight rooms including the monitoring room for 24 hours surveillance a day acting a central part of security view capturing and surveillance. It will be installed at the East of the main gate. Due to the limited space in the port, this office will be two stories and setting back in approximately 15 m into the port area to provide for trailer maneuvering zone at the front of the entrance. Final positioning of it will be carried out during the detailed design stage taking the traffic circulation and the existing facilities including the weighing scale.

This office consists of first floor, mid stage and second floor of 24.3 m^2, 12.96 m^2 and 167.48 m^2 respectively. Due to the soil condition data, a point bearing pile foundation (19 m long) will be provided. Pile will be pre-stressed concrete type for the high durability.

(7) Temporary Construction Site

PAP will provide the contractor (or supplier) with the temporary construction site of 0.2 ha in the port area. Refer to Fig. 2-2-7.

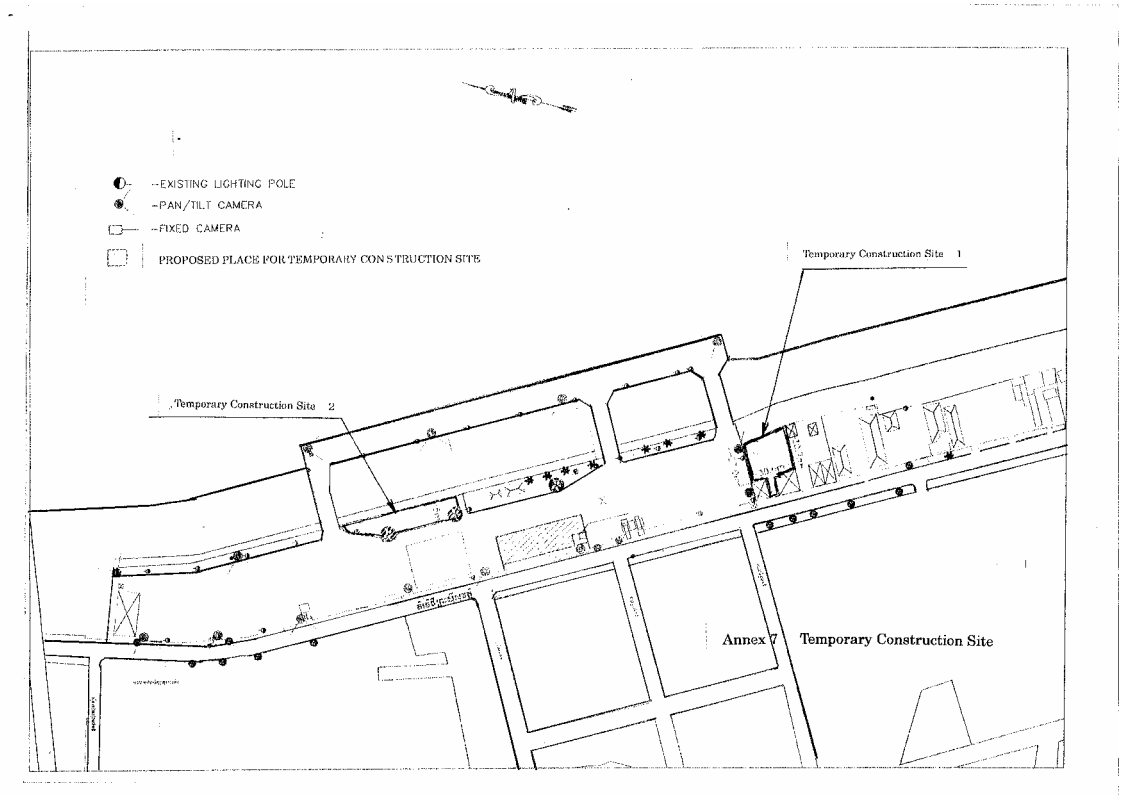


Fig. 2-2-7 Temporary Construction Site of Phnom Penh Port

2-2-2-4 General Layout of Security System

(1) Functional Allotment

In order to position of the proposed security facility, present land use condition should be reviewed. Cargo handling at PAP is undertaken mostly for the container cargo. Shape of PAP's yard is rather simple rectangular having only one gate. While PAS handles various type of cargoes in the wide space than PAP. PAS has three gates along the south boundary fence. The Study Team carried out security facility arrangement study of PAS. PAS handles not only container cargo but also conventional cargo and break bulk cargo. After start of the new container terminal operation, it is assumed to allocate the function on each gate as follows:

- Gate No.1: mainly for old jetty use including a passage for tourists and passengers and workers for workshop
- Gate No.2: the main gate for access by the port workers, custom officers and others and the conventional cargo handling and other general use
- Gate No.3: The main gate for port workers, custom officers and others and containers from not only the new container terminal, but also the conventional terminal berths

(2) Future Plan of Sihanoukville Port

The Study Team surveyed the future plan of PAS. PAS is currently under development to be a container port. In 2007, this project will be completed and provide more efficient and higher service level. It is assumed that it will be saturated with cargoes by 2015. Present plan for 2015 is summarized as follows:

- Total container traffic in 2015 : 380,000 TEU
- Quay wall length : 400 m water depth -9.5m
- Quay container gantry cranes : Two units
- Free Trade Zone : in 50 ha will be provided behind the port
- To construct a bulk terminal : in 400 m long quay
- Documentation system : IT system introducing the single window system

Security facility arrangement plan is also heavily related to the port after 2015. The alternative study of long term master plan after 2015 has been prepared in the container terminal study by PCI. According to that study, future expansion of container terminal after current 400 m long wharf construction will be made to the East within the calm area sheltered by the north breakwater.

In order to find out the best location of security equipment, parameters which may influence to the long term plan of port were studied. Such elements cover further expansion of container terminal and the port zone functional allotment. Case study of the equipment positioning was carried out for PAS, since PAP is rather narrow space and simple shape.

(3) Location of X-ray Screening System

Three site candidates for the X-ray Screening System were evaluated by three criteria: namely, cost, present accessibility, and future accessibility.

- Site 1 : Just East of existing γ-ray Screening system
- Site 2 : Just West area of Gate no. 3
- Site 3 : East area of Gate no. 3

Results of study indicated that Site 2 is the best.

Table 2-2-7 Site Candidate Alternative Study

Site	Evaluation item	Site candidates		
		①	②	③
1	Cost	◎5	◎5	●1
2	Present Accessibility	○3	◎5	●1
3	Future Accessibility	●1	○3	○3
	Total	9	13	5

◎5；better, ○3；good, ●1；fair

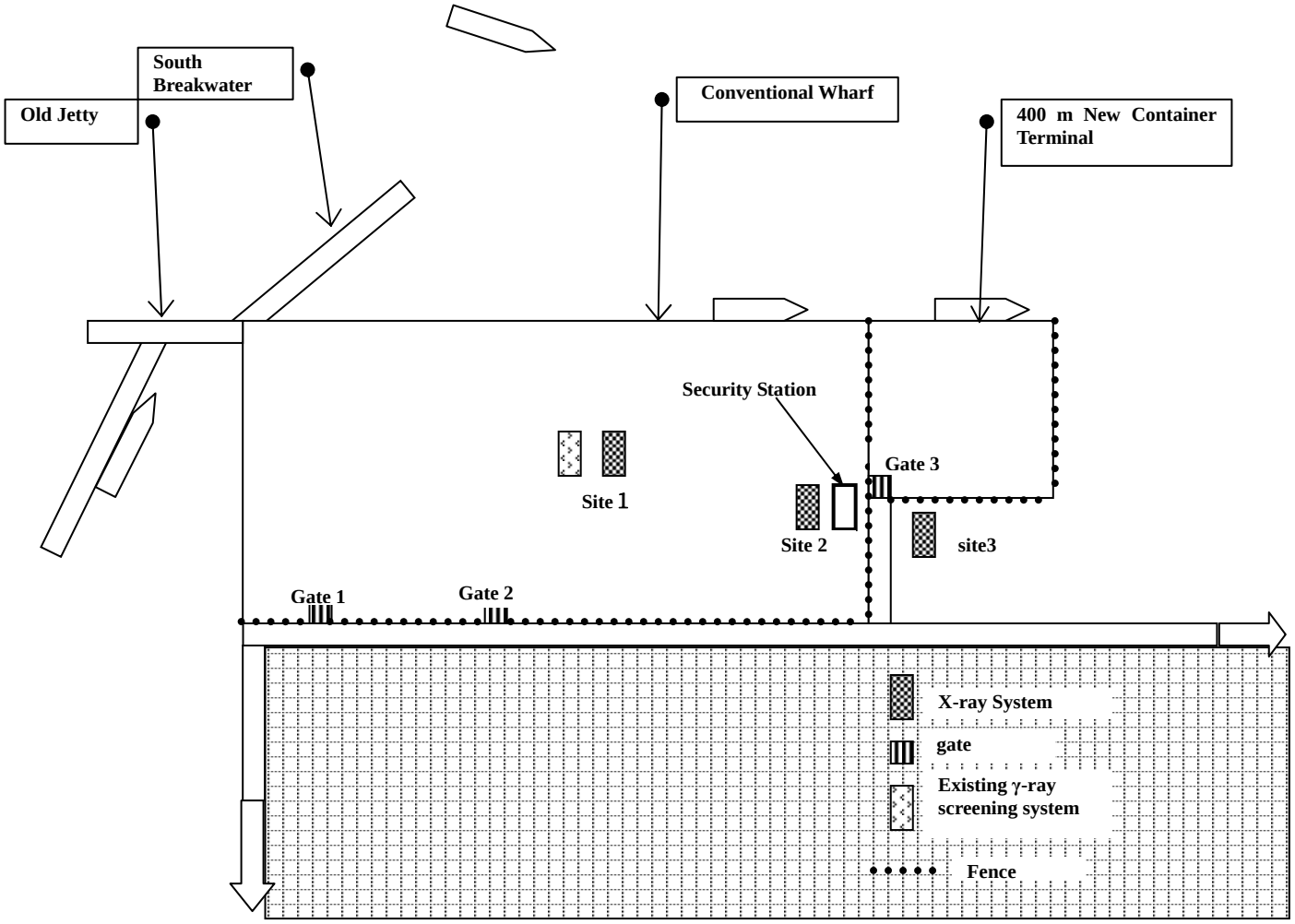


Fig.2-2-8 X-ray Screening system Site Alternatives

(4) Equipment Location at Sihanoukville Port

Each piece of security equipment consists of two parts: namely, the view capture instrument and monitoring devices. The former will be located at the place where object to be protected is. However, the latter should be located at a good connection point by means of communication tools to the security officer in order to integrate the information gathered and evaluate it quickly. In this project, the request by RGC is to have a security station at each port. It is to be so functional that smooth communication can be achieved. It is proposed to include the public address system and wireless-LAN (Local network) as the tool of integration. LAN will connect each gate with the security station, so computerized data analysis ‘ In/Out” will be available.

(5) Equipment Location at Phnom Penh Port

Due to extremely narrow space at the Phnom Penh Port, location of recording devices is easy to fix. One security station will be also provided near the main gate similar to Sihanoukville port.

(6) General Layouts

Four drawings are presented below for illustrating existing situation and location of major security equipment and supplemental civil and architectural works. Of them, three drawings of Sihanoukville Port focus on the X-ray screening system. One sheet is on Phnom Penh Port.

Fig.2-2-9 indicates the general layout of Sihanoukville port and major facilities. Most busy place is surrounding area of the Gate3 where the security station and X-ray container screening system are located. All the surveillance information will be gathered at the security station through the underground wiring. Fig.2-2-10 indicates more details than those of Fig. 2-2-9. Fig.2-2-11 shows the X-ray container screening system, access and pavement area where the parking area for waiting trailers before the inspection. Fig. 2-2-12 presents the general layout of PAP.

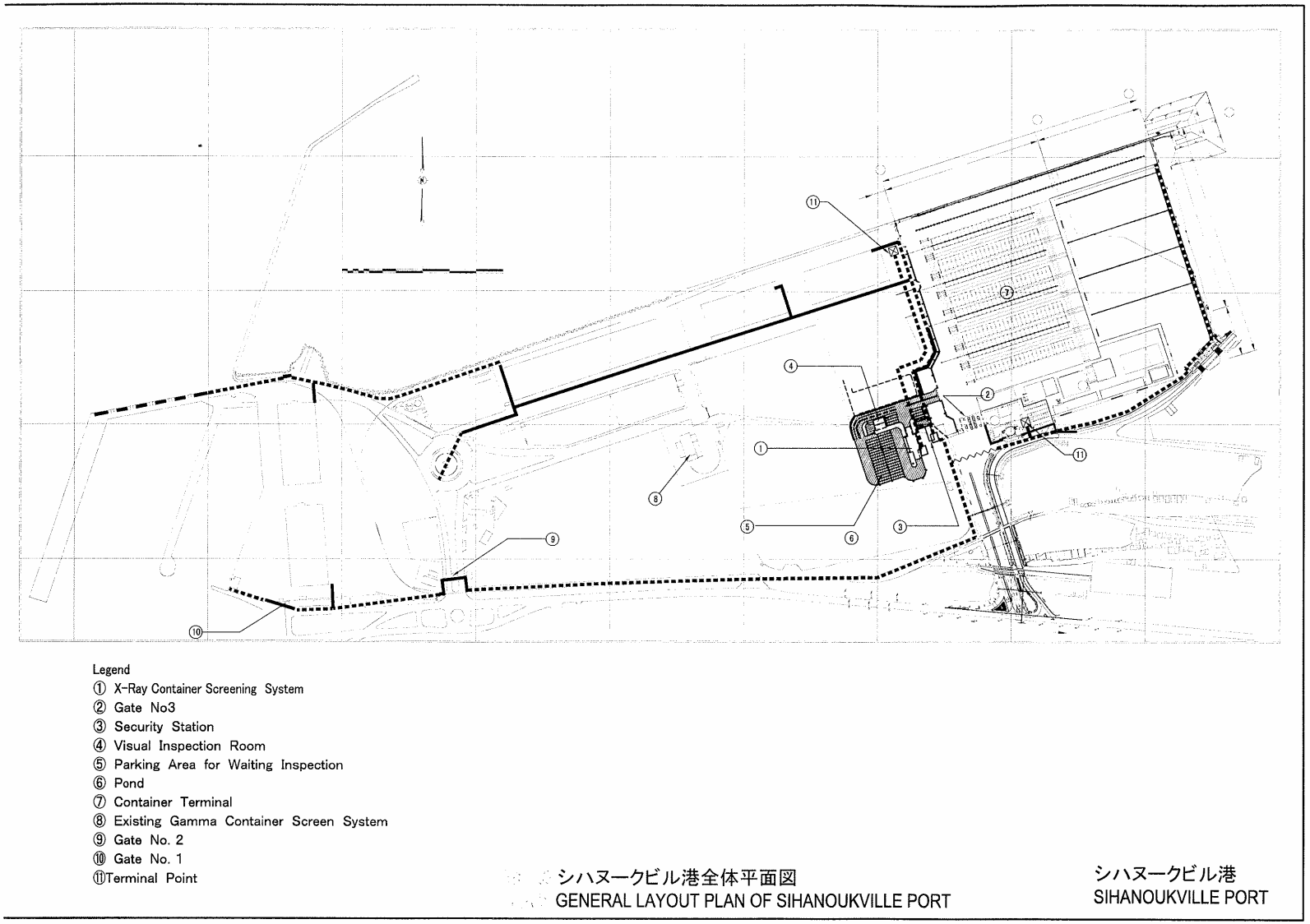
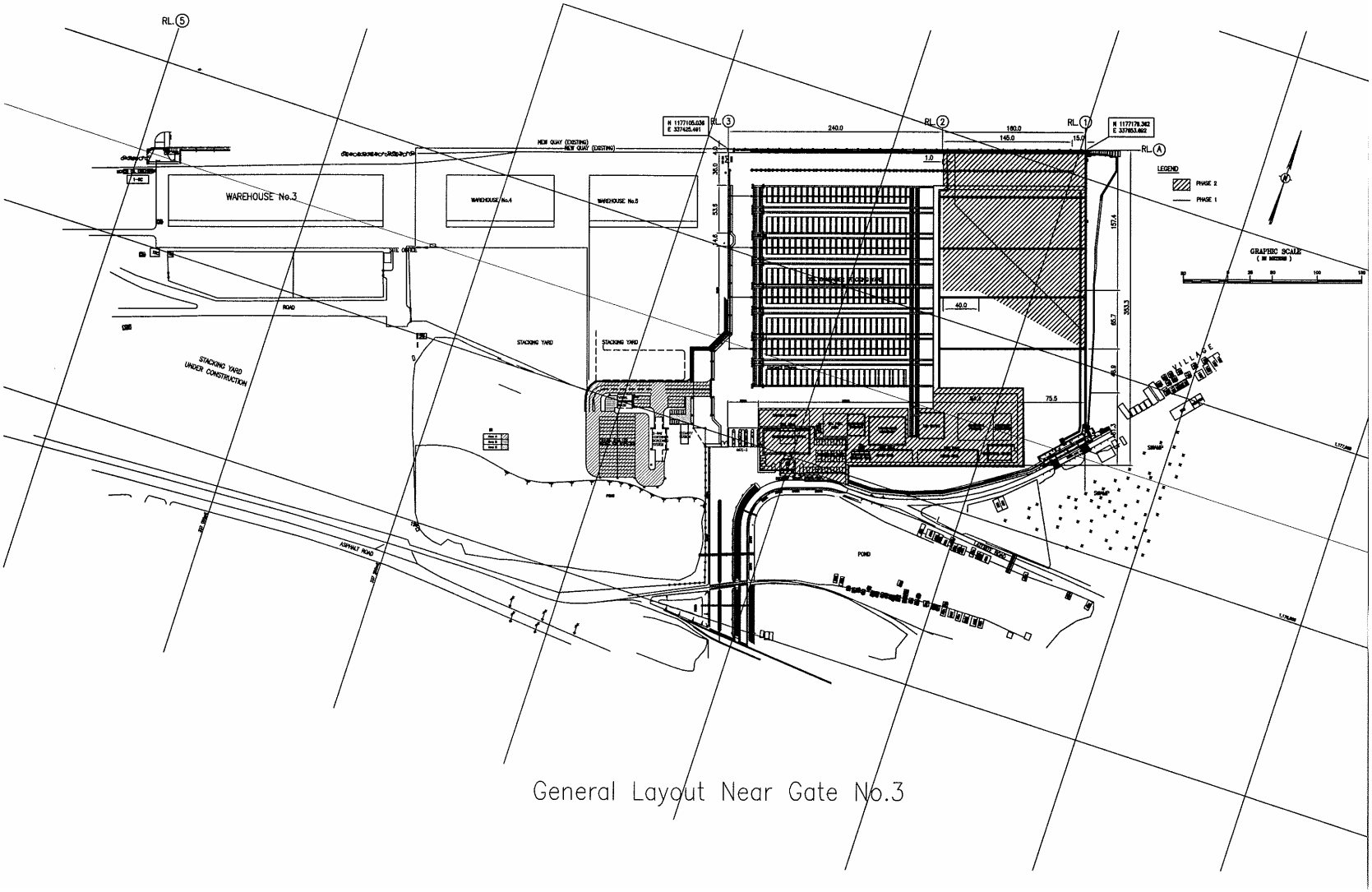


Fig.2-2-9 General Layout plan of Sihanoukville Port ； Security Facilities；PAS



General Layout Near Gate No.3

Fig.2-2-10 General Layout near Gate No.3 ； X-ray screening system and Container Terminal；PAS

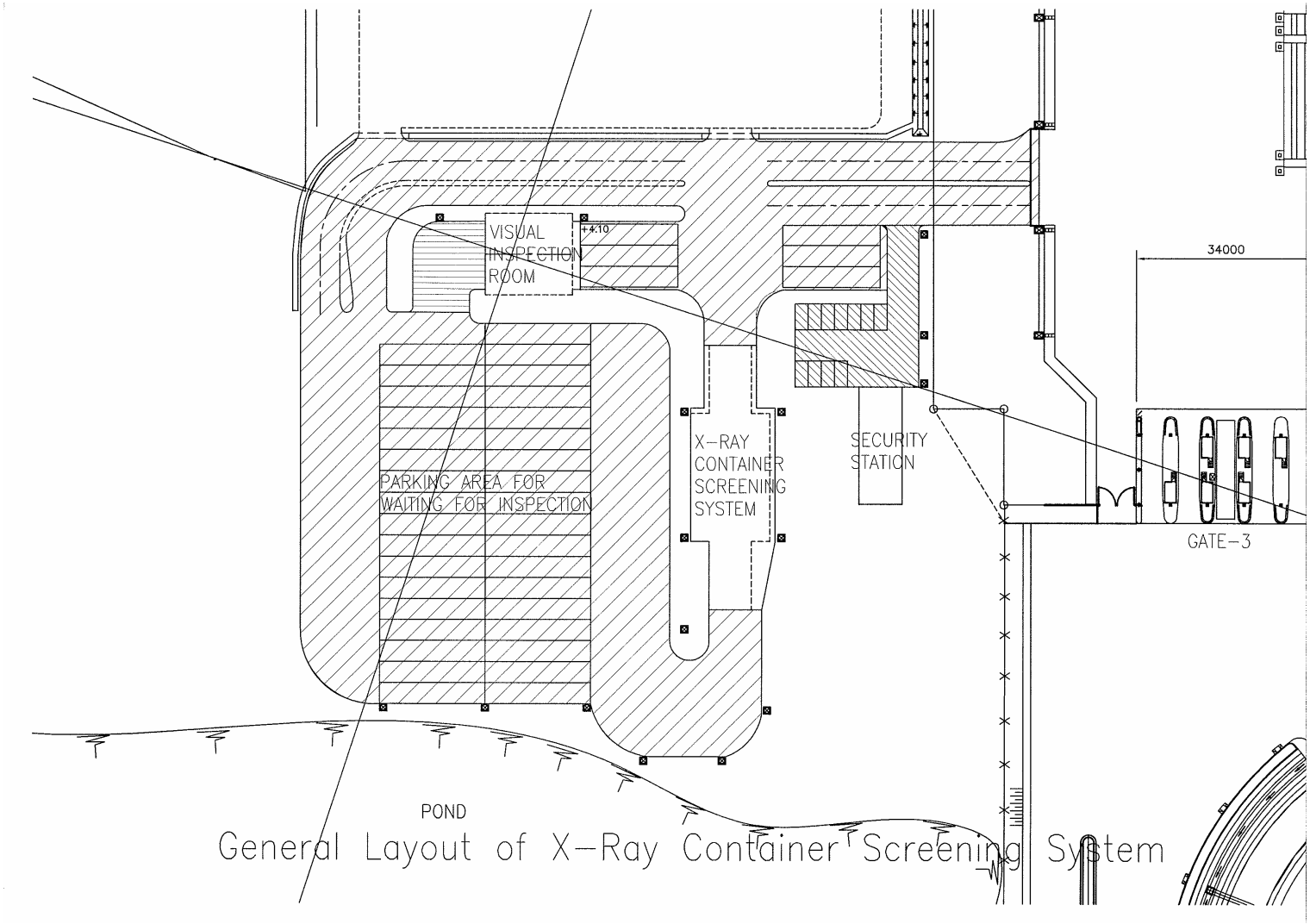
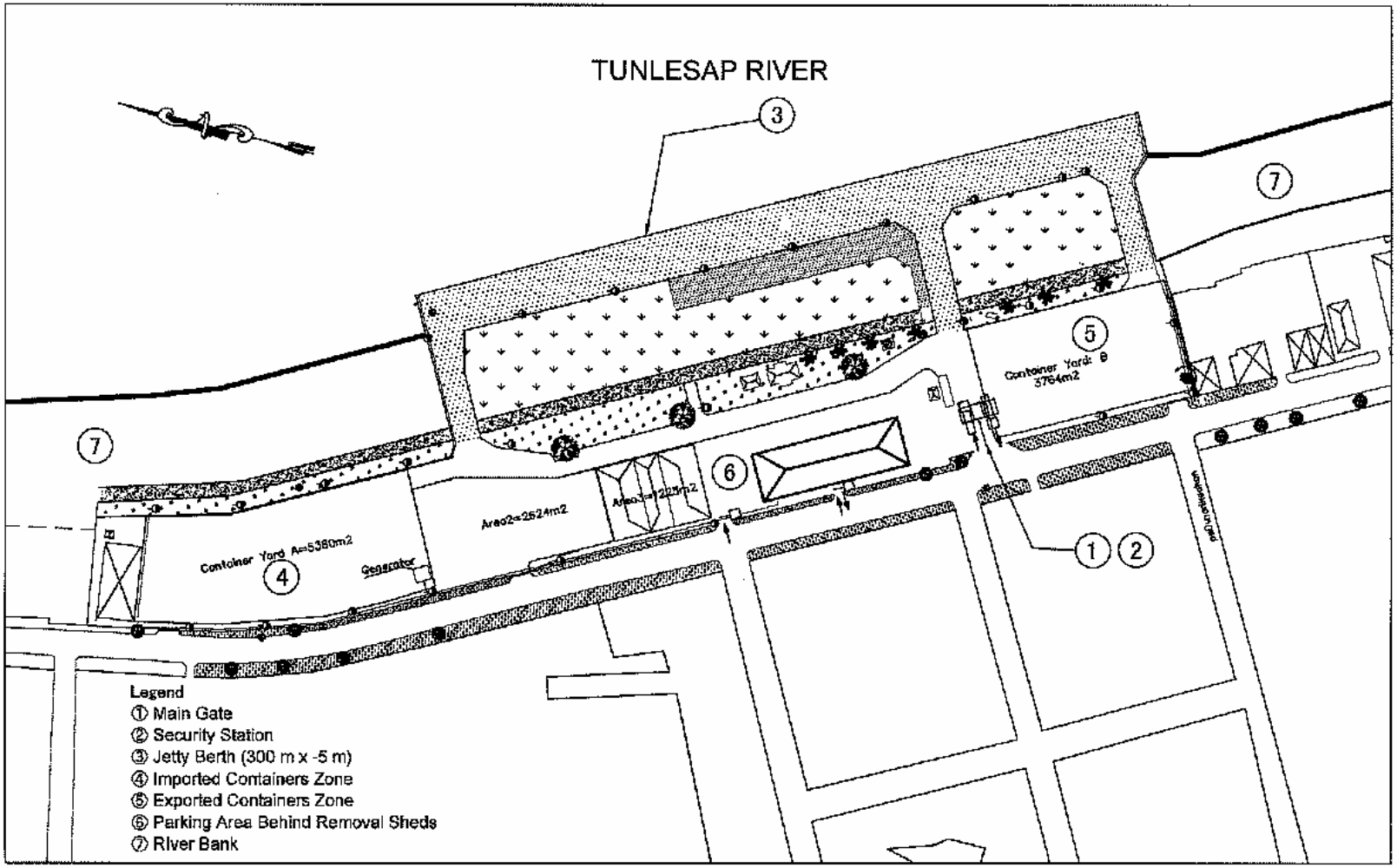


Fig. 2-2-11　General Layout of X-ray Container Screening System；PAS



プノンペン港全体計画図
GENERAL LAYOUT PLAN OF PHNOM PENH PORT

Fig.2-2-12 Phnom Penh Port General Layout; Security Equipment: PAP

2-2-2-5 Capacity of X-ray Container Screening System

(1) Basic approach

Design capacity of X-ray container screening system is estimated considering future container cargo demand and other related factors. It is assumed X-ray system should test both import and export containers subject to preparation arrangement by CED. Object container for test is all the laden containers, excluding empty containers. Container test ratio will be decreased gradually by introduction of risk management. Present test ratio is estimated as 62% for export/import total laden containers and approximately 100% for import containers. It is tentatively assumed that test ratio will be 50%, 40%, 20% and 5% in 2005, 2010, 2015, and 2025 respectively although more rapid .progress is expected.

Table2-2-8 Estimated Laden Container Test Ratio (PAS)

Year	2005	2008	2010	2015	2025
Test Ratio(Imp + Exp)	62%	50%	40%	20%	5%
Laden Containers (box)	101,953	118,654	135,478	184,745	346,000*1
Theoretical Test Boxes	63,371	59,327	54,191	36,950	17,300

*1: growth rate of container cargo from 2015 to 2025 estimates as 6.5%.

Table2-2-8 shows that the required number of annual test boxes is 70,000 or less.

(2) Teat Record as Peak Arrival (PAS, 2005)

Counting the test is based on the number of trailers carrying laden containers, irrelevant to the size of containers. According to the actual record in 2005, total laden import container was 86,034 TEU, breakdown of which is shown in Table 2-2-9 accordingly.

Table2-2-9 Import Laden Box and Trailer (PAS 2005)

Size of Container	Number in TEU and composition rate in %	Boxes (Trailers)	Conversion factor from TEU to box
20 Ft Import	41,098 TEU (47.8%)	41,098	1TEU= 1.0
40 Ft Import	41,417 TEU (48.1%)	20,709	1TEU= 2.0
45 Ft Import	3,519 TEU (4.1%)	1,564	1TEU= 2.25
Total Import Laden	86,034 TEU (100%)	63,371	1TEU= 1.36
Total Export Laden	52,472 TEU	38,582	1TEU= 1.36
Total Laden	138,506 TEU	101,953	1TEU= 1.36

(3) Estimation of Laden Test Box in Peak Arrival (PAS, 2015)

Laden container by size and number of trailers at 2015 is obtained from the design report of the new container terminal (JBIC Project).

Laden Import	147,615 TEU
Laden Export	103, 218 TEU
Total Laden Containers	250,833 TEU

Assuming composition of size of container is maintained as it is in 2005 to 2015, laden containers and required number of trailers is estimated as shown in Table2-2-10.

Table2-2-10 Estimated laden Boxes and Trailers (PAS 2015)

Size of Container	Containers in TEU	Containers in Boxes (Trailer)
20 Ft	119,798 TEU (47.8%)	119,798
40 Ft	120,751 TEU (48.1%)	60,376
45 Ft	10,284 TEU (4.1%)	4,571
Total Laden	250,833 TEU (100%)	184,745 Boxes (Trailers)

(4) Estimation of Box for Test by Test Ratio, 2008/2015, PAS

Monthly amount of test boxes is estimate from 2008 to 2015. It is assumed that test ratio will be gradually decreased to 2015 introducing a risk management system.

Table 2-2-11 Estimated Laden Boxes; Annual and Monthly Figure (2008/2015, PAS)

Year	Laden Containers TEU	Number of Trailers	Test Ratio	Annual Test Boxes	Monthly Test Boxes (note 1)
2005	86,034 Import		100% Import	63,371	6,281
2008	167,278 Im/Ex	118,654 Im/Ex	50% Im/Ex	59,327	4,944
2010	191,151 Im/Ex	135,478 Im/Ex	40% Im/Ex	54,191	4,516
2015	250,833 Im/Ex	184,745 Im/Ex	20% Im/Ex	36,950	3,079

Note 1; Monthly figure is calculated annual figure divided by 12.

(5) Relation between Peak Ratio and Testing Capacity

X-ray container screening system will test 20 containers (trailer) or more a hour. This capacity will be effectively utilized when the peak ratio is equal to one, that means there is only an even arrival. This means lower fluctuation of trailer arrivals to terminal, the test equipment can work under the most efficient condition. Contrary to above high peak or high fluctuation of containers arrivals to the terminal will make the test equipment with lower efficiency and productivity.

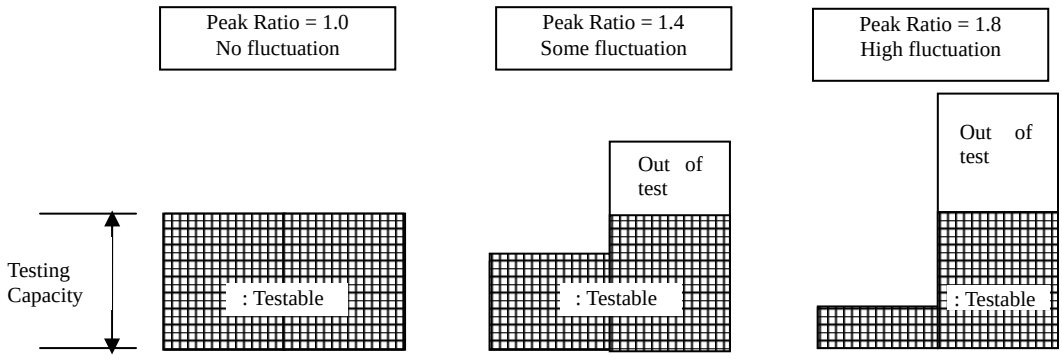


Fig. 2-2-13 Relation between Peak Ratio and Test Boxes

(6) Estimated Test Boxes at Peak, 2015 PAS

Estimation of testing trailers on Sunday peak in 2015 was carried out based on then actual hourly arrivals pattern in PAS, 2005. Estimation was made for the trailer arrivals from7AM to12AM.

Table 2-2-12 Estimated Hourly Test Boxes on Sunday (7AM to 12AM, PAS)

Year	Monthly test box (daily average)	Test box on Sunday (1.8 x average)	Estimated Hourly Test Boxes					
			7AM	8AM	9AM	10M	11AM	12AM
2005	6,281 (210)	310	3.8%	8.4%	12.6%	21.05%	15.8%	9.5%
2008	4,944 (165)	297	11	25	37	61	46	28
2010	4,516 (150)	270	10	24	34	56	42	25
2015	3,079 (103)	185	7	16	23	39	29	18

Table 2-2-13 shows the possible waiting (hour) of trailer for the X-ray test. It is assumed the average testing speed in 20 trailers per hour or one trailer every three minutes.

Table 2-2-13 Estimation of Waiting Time of Trailer at Peak on Sunday (PAS)

Year	Test Ratio	Number of Trailer and Waiting Time in Hour					
		7AM	8AM	9AM	10AM	11AM	12AM
2008	50%	11	25	37	61	46	28
Waiting hours		0.55	1.25	1.85	3.05	2.3	1.4
2010	40%	10	24	34	56	42	25
Waiting hours		0.5	1.2	1.7	2.8	2.1	1.25
2015	20%	7	16	23	39	29	18
Waiting hours		0.35	0,80	1.15	1.95	1.45	0.90

Table 2-2-13 shows that:

- In 2008, Maximum waiting time is 3.05 hours at 10AM
- In 2010, Maximum waiting time is 2.80 hours at 10AM
- In 2015, Maximum waiting time is 1.95 hours at 10AM

It is assumed that the maximum waiting time will be decreased further due to the lower test ratio in the future.

(7) Required Scale of Supporting Facilities for X-ray Container Screen System

Required Parking Area for Trailers

Since the waiting time of trailer will decrease by time, optimum investment should be pursued accordingly. It is proposed to maintain waiting time in 2015 from one to two hours (average 1.5 hour). Area of parking apace is arranged to meet waiting of 30 trailers.

Required Parking Space for the Waiting Test Results

It is assumed that container should stay in the X-ray inspection area for thirteen minutes in total, namely three minutes for the screening and ten minutes for the evaluation of screening. It is proposed to provide after-screening space of three trailers. The container and trailer driver need remain at the X-ray inspection area till the evaluation is over.

Required Space for Visual Inspection Room

Visual inspection ratio is about 10% at present. It is assumed that new X-ray container screening system will provide better resolution thus requiring visual inspection will decrease accordingly. It is assumed that average visual testing ratio of 3%. It is assumed that visual inspection will take a day long. Estimated visual inspection number is as follows.

- 2010 54,191 x 3% / 360 = 4.5 containers
- 2015 36,950 x 3% / 360 = 3.1 containers

Based on this analysis, space of visual inspection room should be enough space of three containers. It is also proposed to provide space of six containers for waiting visual inspection.

2-2-2-6 Collaboration between CED and PAS for X-ray Container Screening System

This section deals with the basic container traffic circulation on the new container terminal.

X-ray Container Screening System should be located at the best location considering the present and future container traffic in the port.

Basic planning conditions are as follows:

- The system will test containers both from the new container terminal and existing conventional berths.
- All the containers should go through the Gate3.
- CED will select containers for testing based on its ideal.
- Data exchange between CED and PAS should be done for smooth coordination

(1) Export Containers

Container appointed for test by CED should basically go the X-ray inspection after gate3 but before arriving at the container marshalling yard.

1) Ordinary Route of Trailer without X-ray Test, Refer to Fig. 2-2-14

① Trailer with export container arriving at Gate3 and making registration by driver.

② Terminal Giving a card indicating address at the yard to carry and report it to the yard crane operator.

③ After arriving that address, the driver displaying the card to the crane operator.

④ The yard crane operator confirming the trailer in the screen of computer in the crane booth.

⑤ The crane operator sling the container from the trailer then storing at the specified address.

⑥ The trailer going back to Gate3 and report delivery of container and asking go through.

⑦ The trailer gets permission of going out of port

2) Route of Trailer with X-ray Test, Refer to Fig. 2-2-15

① Trailer with export container arriving at Gate3 and making registration by driver.

①-1 CED judging arrived container for test or not; if yes, CED informing it to the trailer driver and hand over the test card. CED informing this to the terminal side

①-2 The driver going to the testing area and designating the testing card to the checking post at the entrance.

①-3 The trailer getting the test accordingly.

①-4 CED informing the driver of the test result and the yard crane operator through PAS

①-5 If the test result is acceptable, the driver hands over the acceptance card to the guard post of the entrance. If not, the trailer should go to the visual inspection room.

①-6 The trailer going to the yard

② Terminal Giving a card indicating address at the yard to carry and report it to the yard crane operator.

③ After arriving that address, the driver displaying the card to the crane operator.

④ The yard crane operator confirming the trailer in the screen of computer in the crane booth.

⑤ The crane operator slings the container from the trailer then storing it at the specified address.

⑥ The trailer going back to Gate3 and report delivery of container and asking to go through.

⑦ The trailer gets permission for going out of port

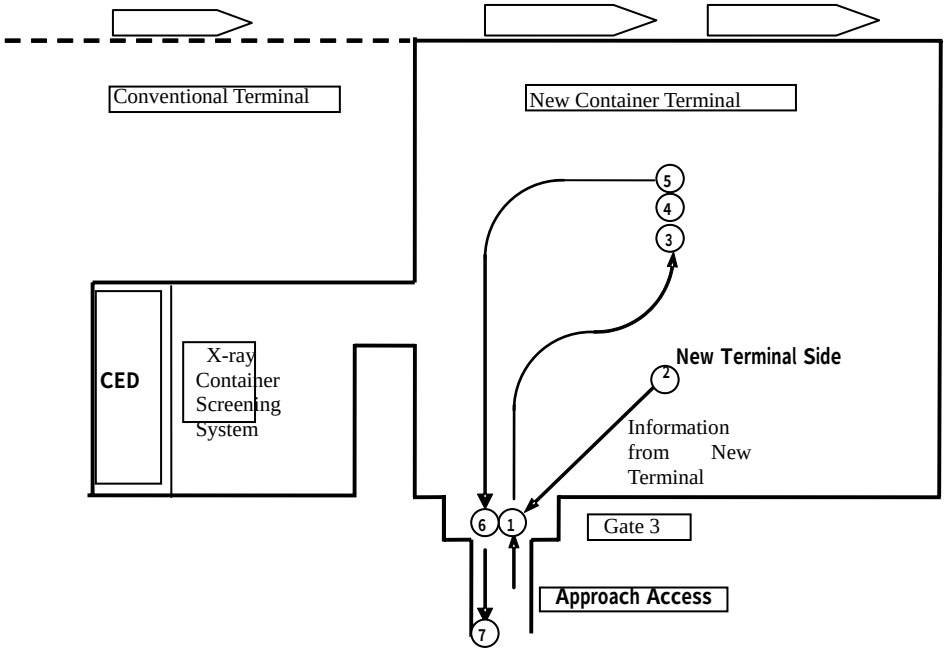


Fig. 2-2-14 Export Container Trailer Flow when no Test Indication by CED

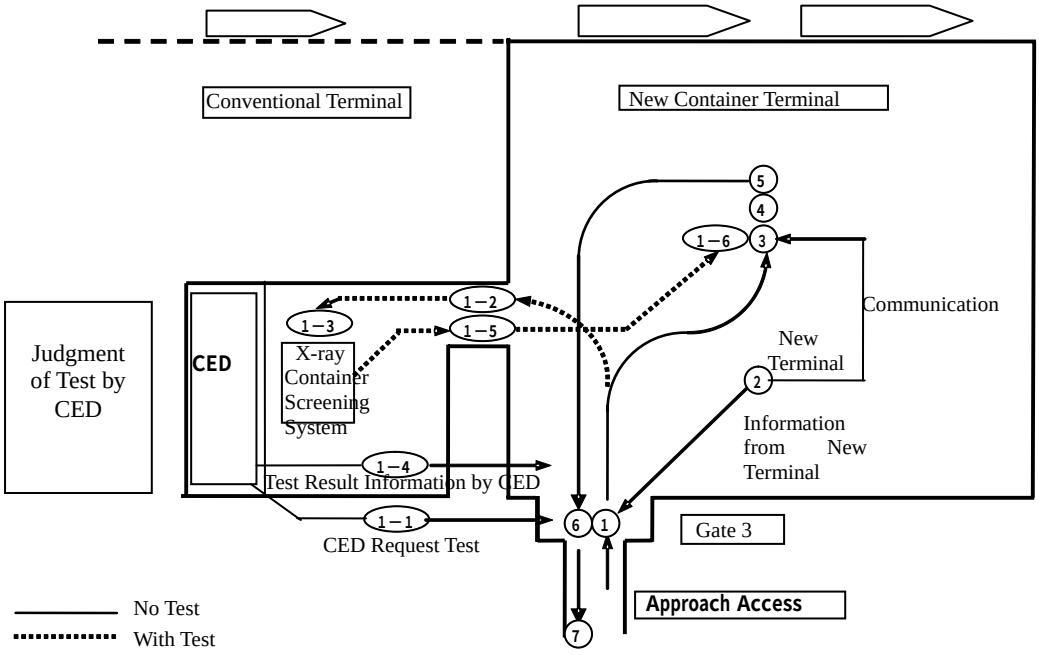


Fig. 2-2-15 Export Container Trailer Flow when Test Indication by CED

(2) Import Containers

CED will appoint container for test when it is stored in the marshalling yard after unloading from vessel. Container for the test will go to the X-ray inspection area before arriving at the gate3.

1) Ordinary Route of Trailer without X-ray Test, Refer to Fig. 2-2-16

① Empty trailer arriving at Gate3 and making registration to terminal

② Terminal giving a card indicating address at the yard to receive imported container and report it to the yard crane operator at that address.

③ After arriving that address, the driver displaying the card to the crane operator.

④ The yard crane operator verifying the trailer in the screen of computer in his booth.

⑤ The crane operator slinging the requested container on the ground and loading on the trailer.

⑥ The trailer with imported container going back to Gate3 and report it to terminal then request to go out.

⑦ The trailer gets permission for going out of gate

2) Route of Trailer with X-ray Test, Refer to Fig. 2-2-17

① Empty trailer arriving at Gate3 and making registration to terminal

② Terminal giving a card indicating address at the yard to receive imported container and report it to the yard crane operator at that address.

③ After arriving that address, the driver displaying the card to the crane operator.

④ The yard crane operator verifying the trailer in the screen of computer in his booth.

④-1 CED judging the delivered container to test or not; if yes CED inform the yard crane operator through PAS. The yard operator checking it by his computer and indicating it to the driver by card. CED informing to the gate 3 and X-ray test room of the trailer N0. and container number.

⑤ The crane operator slinging the requested container on the ground and loading on the trailer.

⑤-1 At the exit of marshalling yard or before, the driver receiving a test request card from CED inspector.

⑤-2 The driver going to the X-ray testing area and designating the test card to the guard post at the entrance

⑤-3 The trailer getting the test accordingly.

⑤-4 CED informing the test results to the driver and the gate3 through PAS. If the test result is acceptable, the driver hand over the acceptance card to the guard post of the entrance. If not, the trailer should go to the visual inspection room.

⑥ The trailer with the tested imported container going back to Gate3 and report it to terminal then request to go out.

⑦ The trailer gets a permission for going out of gate

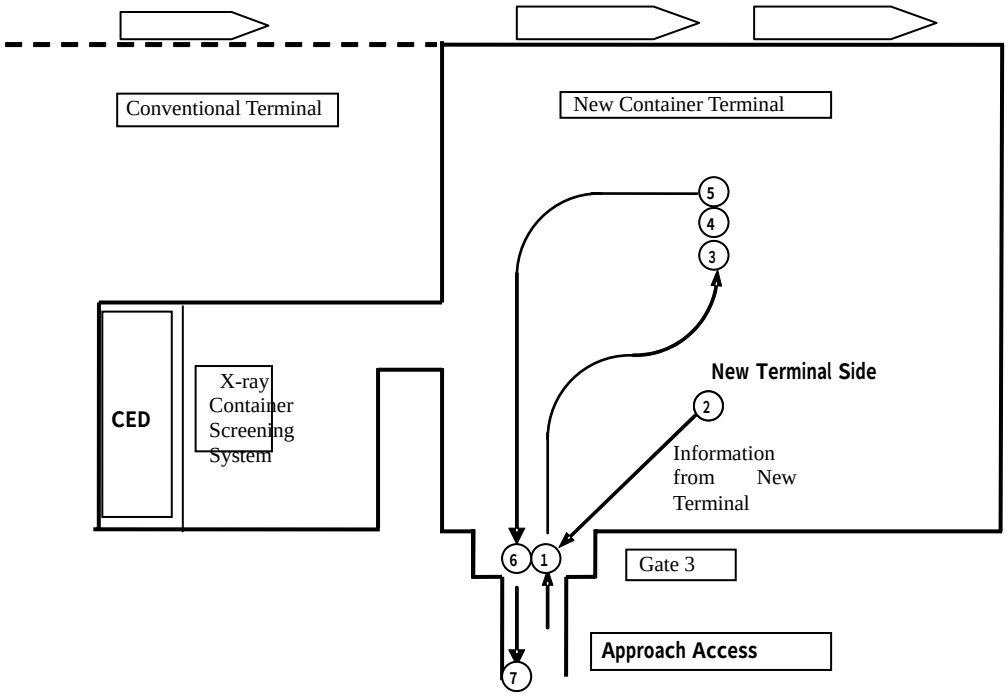


Fig. 2-2-16 Import Container Trailer Flow when no Test Indication by CED

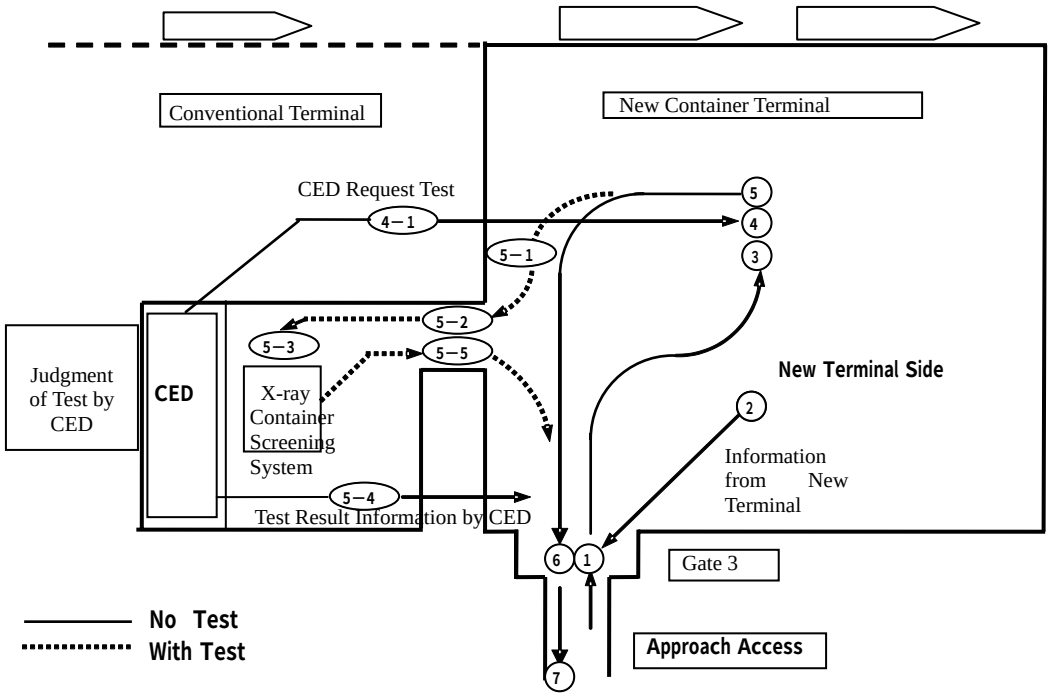


Fig. 2-2-17 Import Container Trailer Flow when Test Indication by CED

(3) Test Procedure in Container handling at the Existing Conventional Terminal

In the Sihanoukville port, there are two types of terminals: namely, the conventional terminal and new container terminal under construction in July 2006. Container handling at the former is carried out by the vessel's gears since no quay crane is provided. However, the latter will have modern quay cranes and a wide container marshalling yard. X-ray container screening system to be introduced by the project should handle and provide inspection to the all containers of both terminals. Thus new X-ray system should receive the containers from two directions.

Basically the traffic pattern of trailer for new terminal will be applied to the conventional terminal with minor modification of route. It is proposed that all containers go in and out through the Gate3.

Fig. 2-2-18 and Fig. 2-2-19 indicate the typical container traffic circulation from and to the conventional terminal.

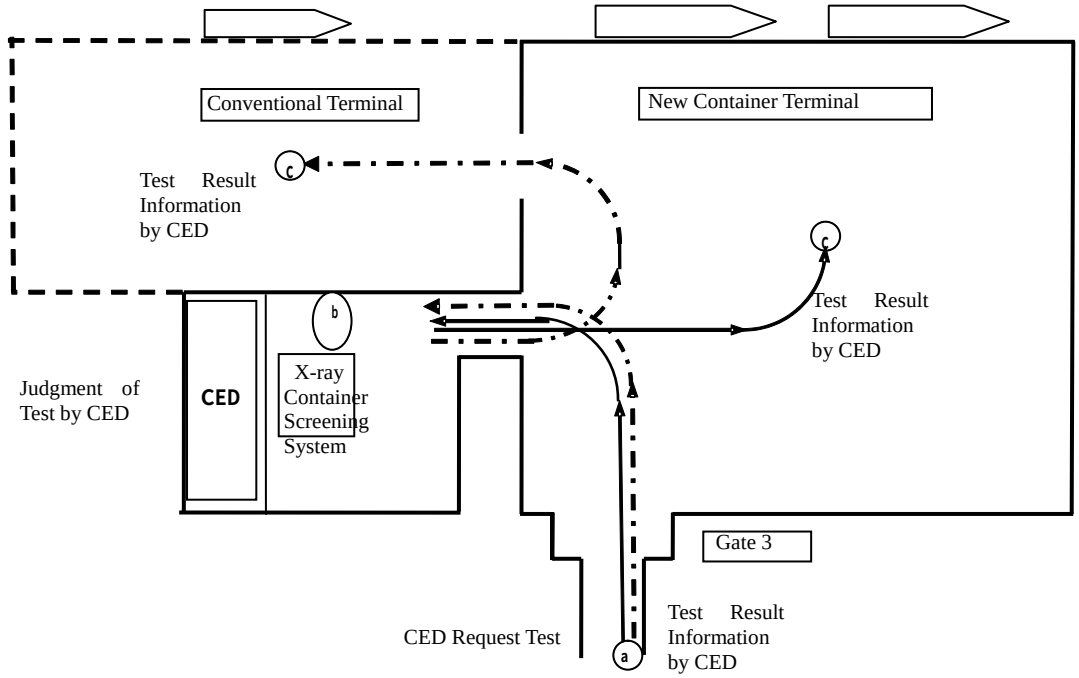


Fig. 2-2-18 Export Container Traffic of Conventional Terminal

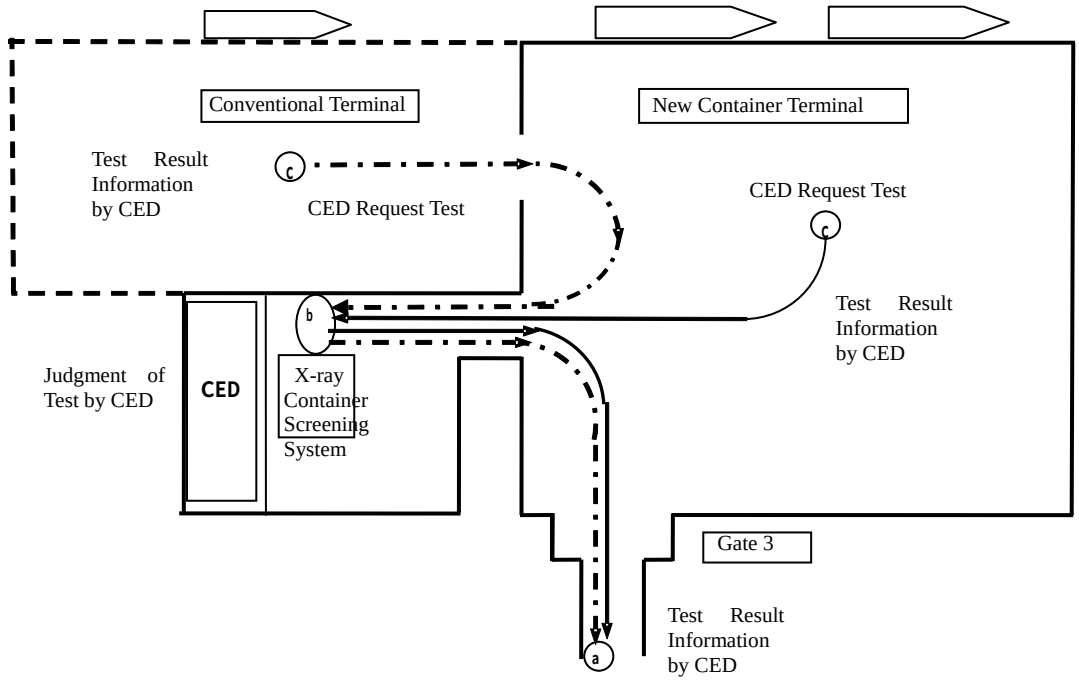


Fig. 2-2-19 Import Container Traffic of Conventional Terminal

2-2-3 Basic Design Drawing

Basic design Drawings are prepared for presenting major conclusion of study. Drawings consist of the following six groups of items:

- General Layout
  - A. Security Equipment (I) Land Side
  - B. Security Equipment (I) Sea Side
  - C. Supplemental Architectural and Structural works
  - D. Fittings and Utilities of Architectural Works
  - E. Supplemental Civil Works

Drawings contain following detailed drawings.

・General Layout

Fig.-1 General Layout Plan of Sihanoukville Port

Fig.-2 General Layout Plan of Phnom Penh Port

A. Security Equipment (Ⅰ) Land Side.

(Sihanoukville Port)

Fig.-1 Arrangement of VTMS

Fig.-2 Configration Diagram (Plan)

Fig.-3 General Arrangement of Patrol Boat

Fig.-4 Outline of Oil Skimming System

B. Security Equipment (Ⅰ) Sea Side.

(Sihanoukville Port)

Fig.-1 CCTV Camera Installation Plan for Gate and Yard Surveillance

Fig.-2 Cable Installation Route

Fig.-3 CCTV Camera System Diagram

Fig.-4 CCTV Monitor, Control Desk

Fig.-5 CCTV Equipment Rack

Fig.-6 Concept of ID Pass Card Gate Control System

Fig.-7 Public Address System

(Phnom Penh Port)

Fig.-8 CCTV Camera Installation Plan for Gate and Yard Surveillance

Fig.-9 Cable Installation Route

Fig-10 CCTV System Diagram

Fig.-11 CCTV Monitor, Control Desk

Fig.-12 CCTV Equipment Rack

Fig.-13 Concept of ID Pass Card Gate Control System

Fig.-14 Public Address System

C. Supplemental Architectural and Structural works

(Sihanoukville Port)

Fig.C-1 Location Map

Fig.C-2 Security Station: Elevation (PAS)

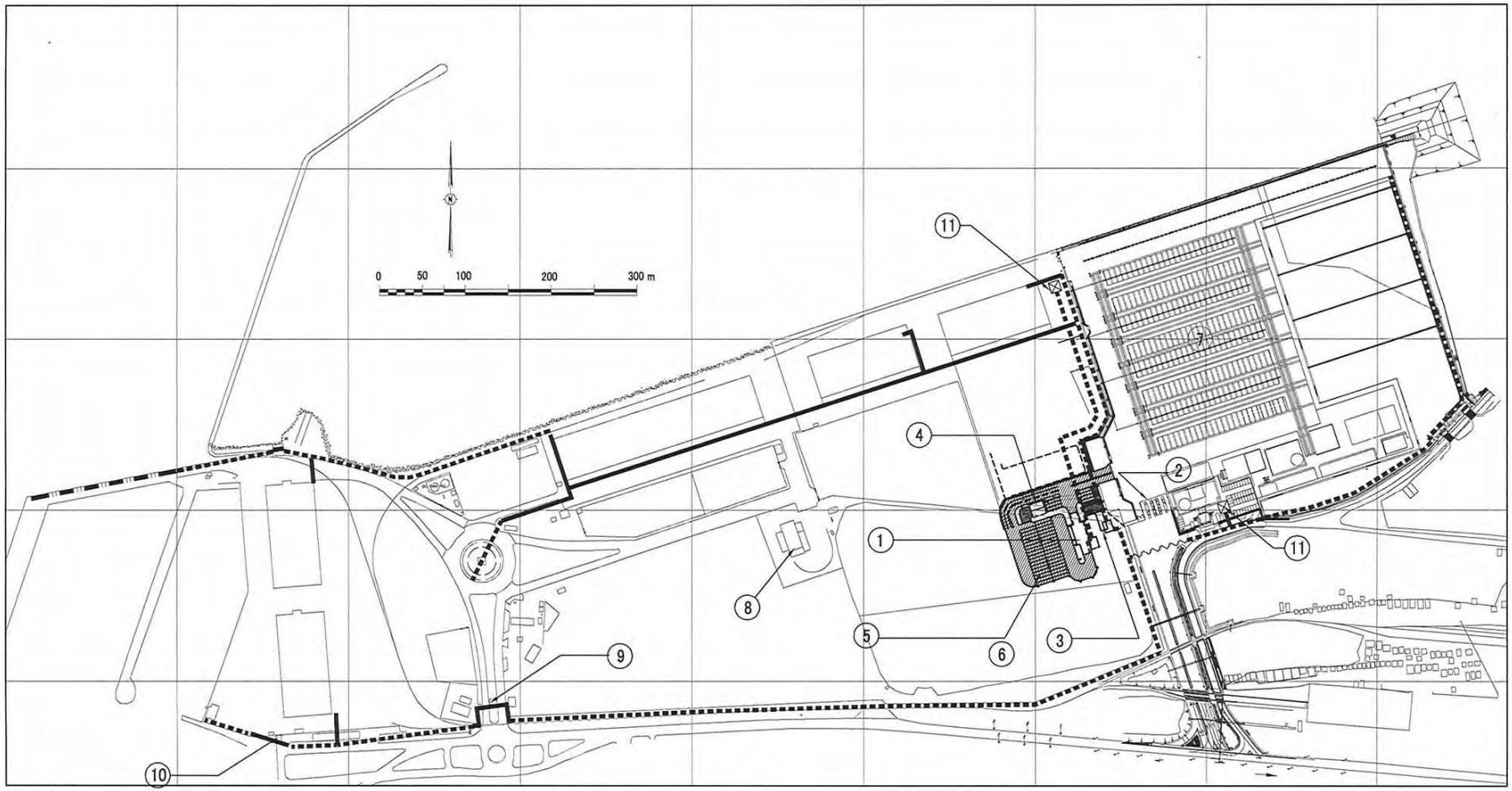
Fig.C-3 Security Station: Structure (PAS)

Fig.C-4 Security Station Layout (PAS)

・General Layout

Fig.-1 General Layout Plan of Sihanoukville Port

Fig.-2 General Layout Plan of Phnom Penh Port

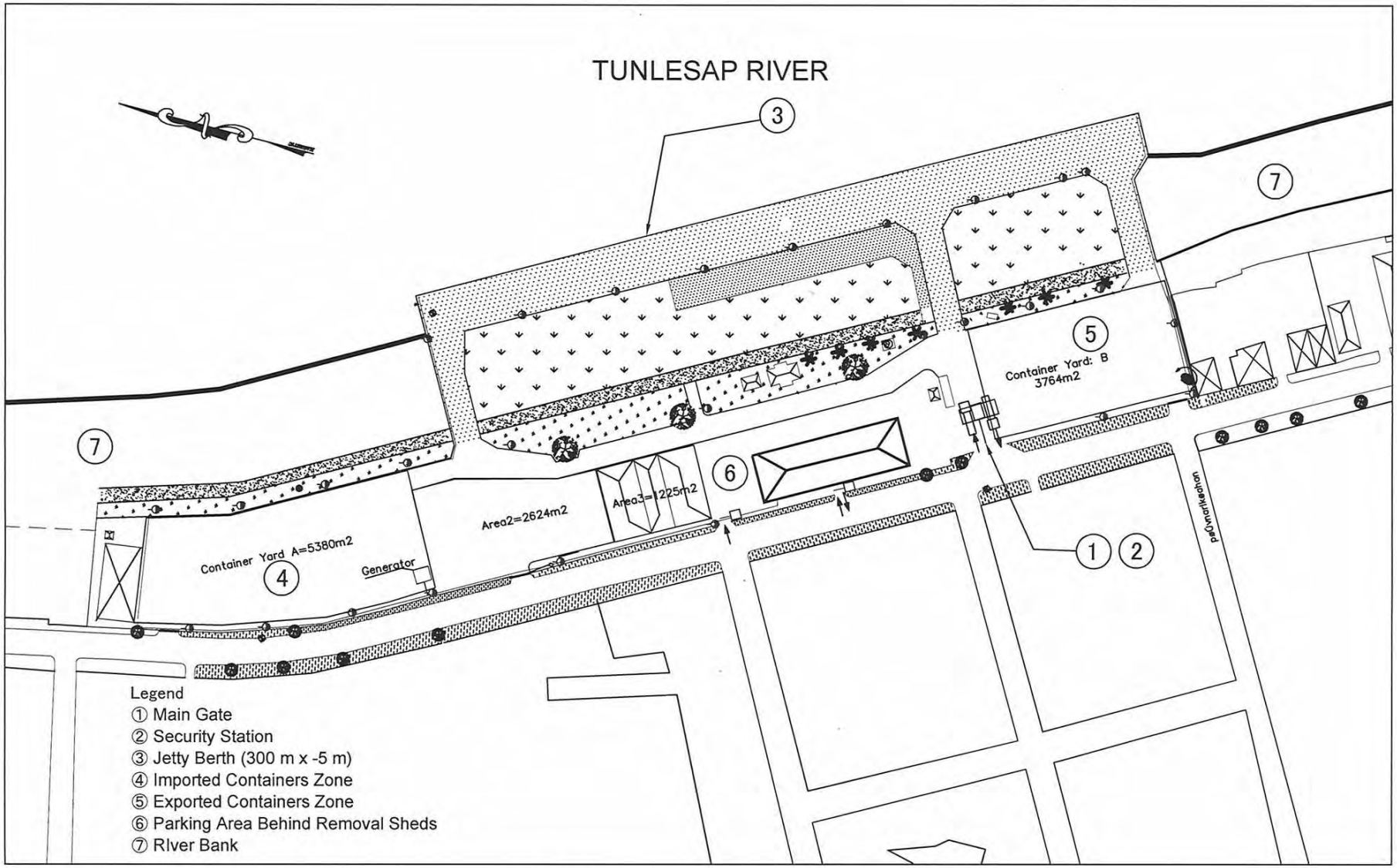


Legend

① X-Ray Container Screening System
② Gate No3
③ Security Station
④ Visual Inspection Room
⑤ Parking Area for Waiting Inspection
⑥ Pond
⑦ Container Terminal
⑧ Existing Gamma Container Screen System
⑨ Gate No. 2
⑩ Gate No. 1
⑪Terminal Point

図-20 シハヌークビル港全体平面図

Fig-20 GENERAL LAYOUT PLAN OF SIHANOUKVILLE PORT



プノンペン港全体計画図
GENERAL LAYOUT PLAN OF PHNOM PENH PORT

A. Security Equipment (Ⅰ) Land Side.

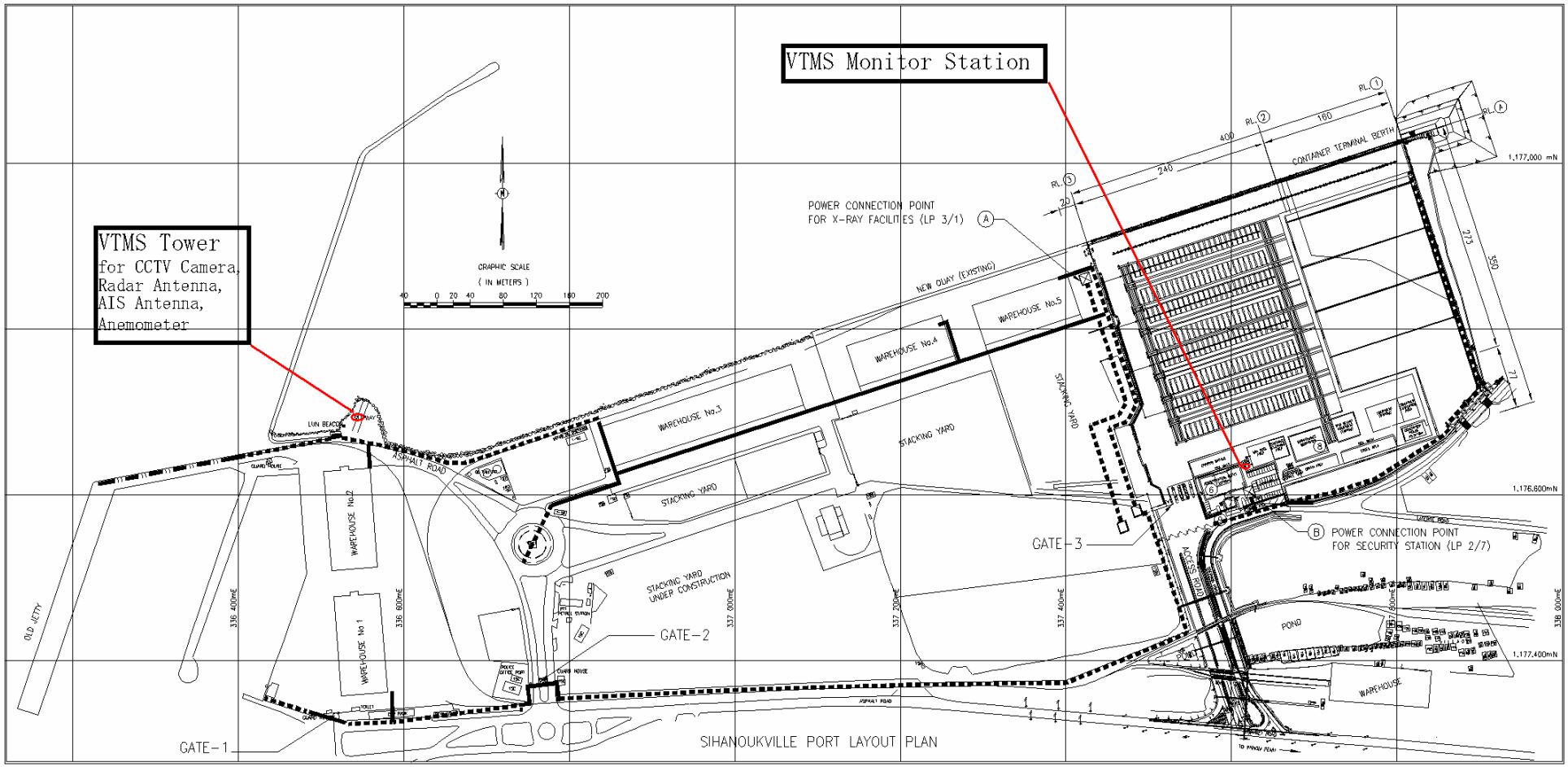
(Sihanoukville Port)

Fig.-1 Arrangement of VTMS

Fig.-2 Configration Diagram (Plan)

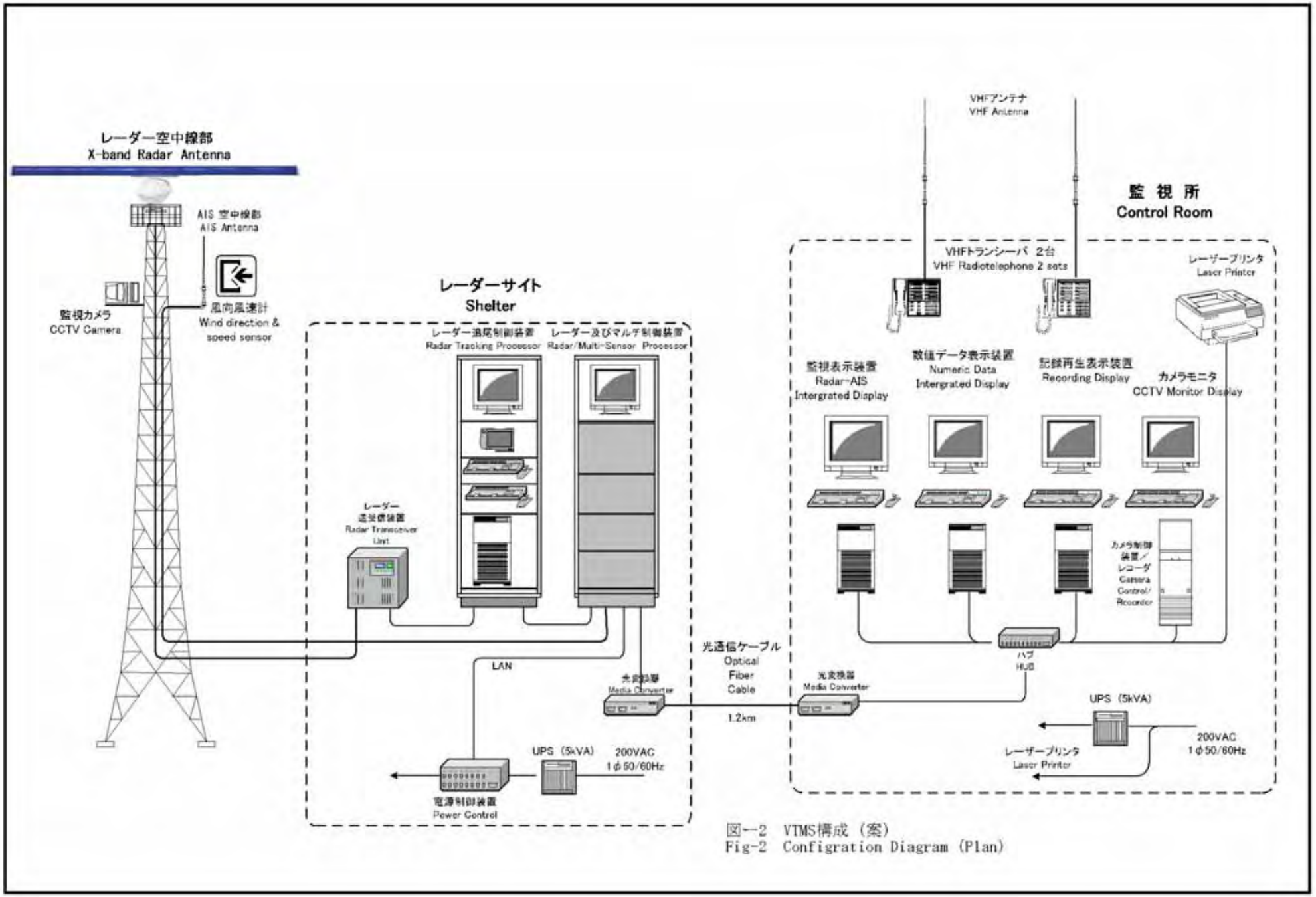
Fig.-3 General Arrangement of Patrol Boat

Fig.-4 Outline of Oil Skimming System

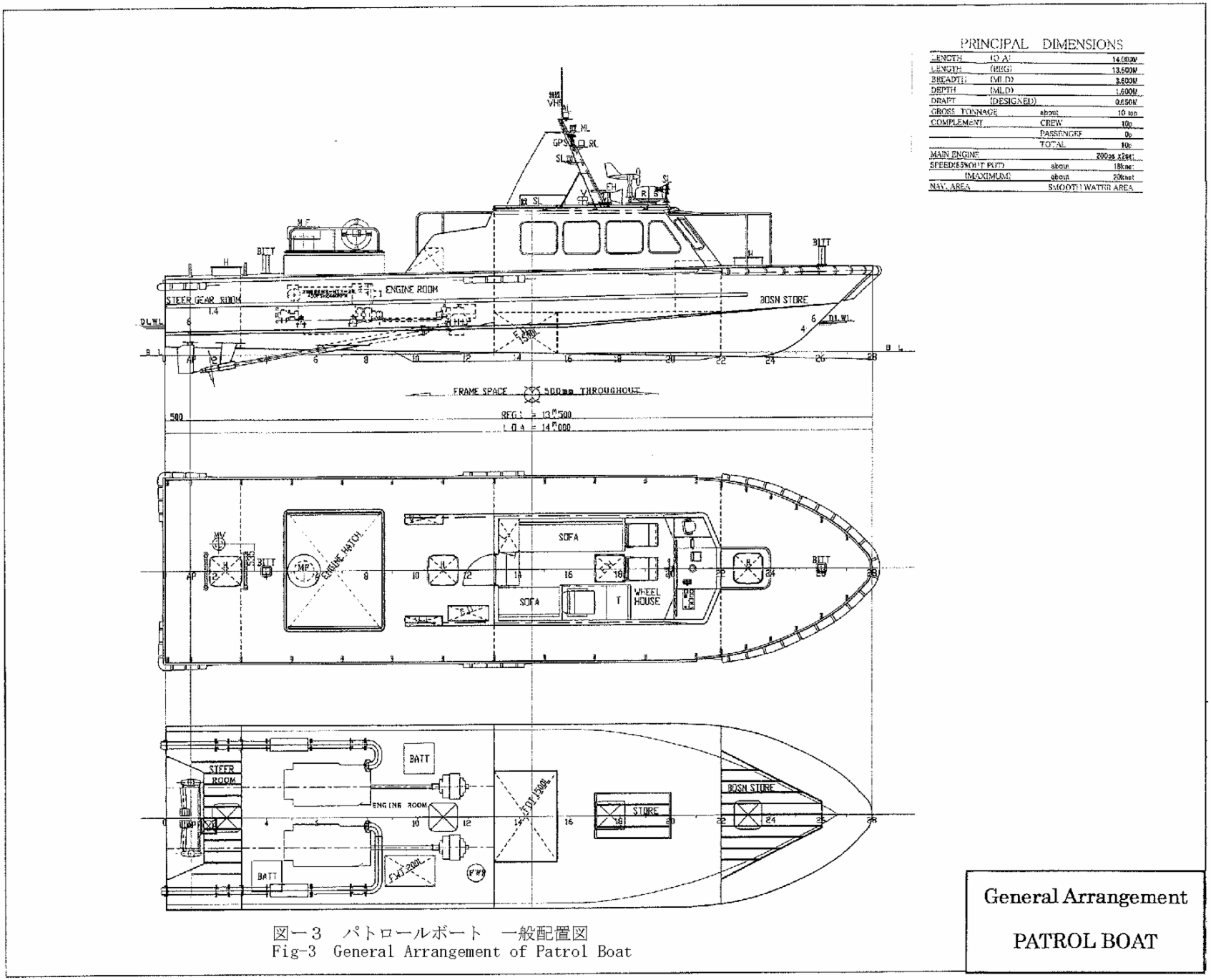


図－１　VTMS　配置図
Fig-1　Arrangement of VTMS

シハヌークビル港
SIHANOUKVILLE PORT



図−2 VTMS構成（案）
Fig-2 Configration Diagram (Plan)



図－3　パトロールボート　一般配置図
Fig-3　General Arrangement of Patrol Boat

General Arrangement

PATROL BOAT

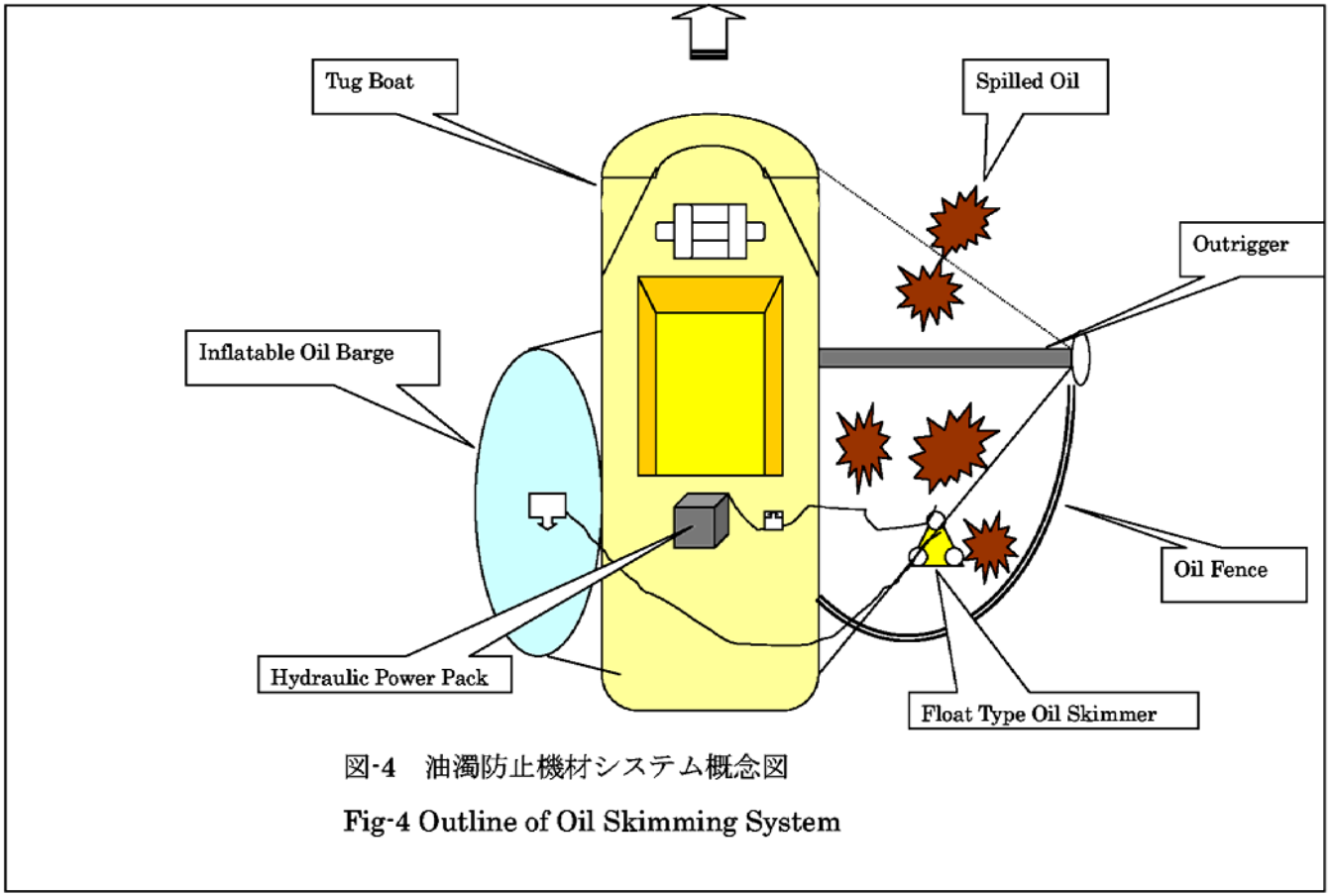


図-4　油濁防止機材システム概念図

Fig-4 Outline of Oil Skimming System