Ministry of Transport and Communications
The Republic of Mozambique

THE PREPARATORY SURVEY REPORT ON THE PROJECT OF URGENT REHABILITATION OF NACALA PORT DEVELOPMENT IN THE REPUBLIC OF MOZAMBIQUE

NOVEMBER 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

ECOH CORPORATION
ORIENTAL CONSULTANTS CO., LTD.

PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to ECOH CORPORATION / ORIENTAL CONSULTANTS CO. LTD. JV.

The survey team held a series of discussions with the officials concerned of the Government of the Republic of Mozambique, and conducted a field investigation. As a result of further studies in Japan, 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.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Mozambique for their close cooperation extended to the survey team.

November, 2012

Mr. Kazunori MIURA
Director General
Economic Infrastructure Department
Japan International Cooperation Agency

Summary

SUMMARY

(1) Country Brief

The republic of Mozambique has a land area of 799 thousand km^2, and it is a country in Southeast Africa bordered by bordered by the Indian Ocean to the east, Tanzania to the north, Malawi and Zambia to the northwest, Zimbabwe to the west and Swaziland and South Africa to the southwest.

Many languages are spoken in Mozambique; except of Portuguese spoken by 50.3% of the population, which speak it as the first and second language, even the Emakuhuwa-speaking group, the majority the Bantu-group languages of Mozambique, is only 25.4%.

The census in 2007 revealed that Christian made up 56.1% of the population and Muslim comprised 17.9% of the population. 7.35 of the population held other briefs and 18.7% had no religious beliefs.

The gross national product (GDP) is US$12.8 billion, GDP per capita is US$535 and the economic growth rate is 7.7% in 2011. The record of consumer price index (CPI) since 2006 has shown the yearly fluctuation between several percent and over 10%. The GDP by sector is 32% for agriculture, 24% for industry and 44 for services.

In terms of foreign trade in 2011, the export amount recorded US$3.7billion, which was reached by the commodities of aluminum, prawns, cashew nuts, cotton, sugar, etc. The import amount recorded US$5.8 billion, which is achieved by the commodities of machinery, vehicles, fuel, chemicals, metal, etc.

Economy in Mozambique used to be supported mainly by aluminum and prawns; however, development of mining of natural gas, coal and iron ore activates the economy; the industry is expected to mainly support the economy. In addition to the development, Technical Cooperation Project of ProSAVANA-JBM aiming at regional and agricultural development of Nacala Corridor is just commenced to create the environment for investment by foreign firms. The project is also expected to highly contribute the economy development in Mozambique. .

(2) Background and Summary of the Project

Nacala Port renders services of the two deep sea berths of -15m and needs no dredging of the waterways, while other ports in Mozambique need dredging of their waterways. Promotion of the development of the Nacala Corridor and mining of mineral resources in Zambia and Malawi is expected to increase of cargo throughput in Nacala Port. It is also expected to increase transit cargo volume due to overcapacity of handled cargo volume in Durban Port.

JICA conducted the Preparatory Survey on Nacala Port Development Project in the Republic of Mozambique (hereinafter referred to as “F/S”) during May 2010 and June 2011. The survey report shows that throughput cargo in Nacala Port will reach the 10 million metric ton in 2030,

while the throughput in 2011 is about one million metric ton. In terms of number of containers, the throughput is 583 thousand TEUs in 2030 and 89 thousand TEUs in 2011.

The F/S report presents the phased development plan toward the Short-term development Plan; two packages of the projects named Urgent Rehabilitation Project Part-1 and Part-2, are separated from the Short-term Development Plan for urgently implemented components.

The Government of Mozambique confirmed implementation policy of the very urgent components as the first phase of the Part-1, and requested of Government of Japan the Project under the Grant Aid scheme. The survey team dispatched by JICA for Collection and Confirmation of Port Activities in Nacala Port" during October and November, 2011 and confirmed necessity of the Project under the Grant Aid scheme. The study team confirmed the change of port activities; one berth of the South Wharf would be preferentially occupied by Vale in 2012 and the number of containers was increasing than expected in the Feasibility Study Report prepared June 2011 by JICA.

The study team and the Government of Mozambique agreed that the project target be modified for rehabilitation of the North Wharf and provision of cargo handling equipment, considering the change of present port activities and future port development plan of Nacala Port.

(3) Summary of Study and Components of the Project

The Government of Japan decided to conduct the preparatory survey on the basis of the request of the Government of Mozambique and dispatched the study team as follows;

Field Survey	: April 7 to May 11, 2012
Explanation survey of Draft Report	: October 13 to October 22, 2012

The Project aims at enhancement of stacking capacity in the container yard and improvement of safe operation of fuel, containers and general cargo in Nacala Port. The Project also targets contribution to the comprehensive development of Nacala Port.

Natural conditions surveys and environmental surveys were conducted as well as surveys of the existing port facilities and the present operation. As a result, the bottlenecks stated above were recognized and great necessity and urgency of the requested Project were understood. Draft Final Report were prepared based on the comprehensive examination of necessity and urgency of each component, determination of basic concept of required facilities and equipment, design of each component, finalization of construction schedule and cost estimation of the project. The explanation survey team was dispatched for the above period to present the Draft Final Report to Mozambican side. The project contents and undertakings made by the Mozambican side were discussed and agreed between the Mozambican side and the survey team.

In terms of the North Wharf, cap concrete of the quay structure, rubber fenders, bollards and water pits will be rehabilitated and the apron will be divided into two functions, namely, a liquid bulk berth of 120m and a container berth of 190m for operation with reach stackers, located at the

southern side of the liquid bulk berth. The whole apron will be renovated with applying countermeasures against the settlement.

The new container yard in the North Wharf will be provided for RTG operation. The new container yard is composed of two blocks of stacking place where two RTGs will be operated. Layout of the yard will match the overall layout plan of the container yards prepared by the Technical Cooperation team for the Project for Improvement of Nacala Port in Republic of Mozambique.

The Mozambican side will introduce two reach stackers in advance for handling the containers increasing year by year, while the same number of the equipment will be supplied in the Project.

Loading/unloading arms for fuel will be installed at the North Wharf and the firefighting system against tankers will be provided with two monitors.

The outline of the project components are tabulated below.

Component	Structure	Details
◇Repair of North Wharf		
Liquid bulk beth		L=120m
・Cap concret	Gravity type	L=120m
・Countermeasure for settlement	Steel sheet piles	L=110m
・Apron pavement	Interlocking concrete blocks	Area =2,714 m^2
・Accessories		Fenders （13）、bollards (4)、Loading arm foundation、Monitor foundation
Container berth		L=190m
・Cap concrete	Gravity type	L=190m
・Countermeasure for settlement	Steel sheet piles	L= 203m
・Apron pavement	Interlocking concrete blocks	Area =4,365 m^2
・Accessories		Fender (16)、Bollards (6), etc.
◇Container Yard Pavement		
・Foundation for RTG lanes	RC	22 bays×6 row×2 blocks
・Foundation of plates for stacking	RC	46
・Other yard pavement		Area ＝10,806m^2
・Drain system	Foundation of plates for stacking	
	Open channel	L=290m
	Culvert	L=110m
◇Firefighting system		
・Intake pipe system	Main structure: RC	Culvert: L=14m Vertical pipe: L=7m
	Protection with seawalls	Volume =2,043m^3
・Equipment of pumps and tanks	A house of RC Foundation, roofing, columns: RC Wall: hollow locks	Floor area =81.96m^2
		Firefighting system (pumps, mixing machine, monitors, hydrant)

(4) Estimated Project Cost and Implementation Schedule

The project cost born by the Mozambican side is estimated at 32 million yen in implementing the project under the Grant Aid scheme. The implementation period needs 24 months in total, comprising of 6 months for the detailed design and the tender, and 18 months for construction and procurement.

(5) Project Evaluation

1) Relevance

The hinterland of Nacala Port covers the wide range of the area of the Northern Provinces, Malawi and Zambia through Nacala Corridor. Benefitted population with implementation of the Project seems to be 36 million in the hinterland. Nacala Port plays a role of the gateway for import/export of products to the international markets.

Almost of the facilities in Nacala Port are deteriorated and there remain a concern about the insufficient port capacity to meet the future demand of port cargo. In addition to the above bottlenecks, preferential use of a berth by a mining firm and rapid increase of number of containers hamper the operation in Nacala Port. It is, therefore, understood that efficient use of the existing yard area should be made and efficiency of containers operation should be improved. In terms of the fuel handling facility and firefighting facility, they remain far from the requirements of IMO and they should be improved promptly.

In a viewpoint of the above, the necessity and urgency of the project are confirmed with understanding that the project targets the improvement of capacity of Nacala Port for operation of increasing cargo volume and the maintenance of international safety standard for handling fuel.

The Project for the urgent rehabilitation of the North Wharf under the Grant Aid takes the position of the first stage toward the comprehensive Urgent Rehabilitation Project and Short-term Development Plan.

Through the comprehensive consideration as above, the Project for improvement of cargo handling efficiency and maintenance of the international safety standard is appropriately evaluated based on understanding of the position of Nacala Port. Implementing a part of the Project under the Japan’s Grant Aid scheme adequately fulfills the relevance and significance in view of the scheme policy.

2) Effectiveness

The outcome of quantitative and qualitative effects with implementing the Project is shown below.

- Quantitative Effects
  - Handling volume of containers in the yard will increase from 89,714 TEUs to 161,590 TEUs with implementation of the Project.
  - All the calling tankers will unload/load fuel safely with using loading arms in the Project, while unloading /loading fuel with the existing facility remains unsafe in the North Wharf.

- Qualitative Effects
  - The rehabilitation of the quay structure and apron enables the North Wharf to prolong its facility life for further utilization.
  - Safe mooring of ships at the North Wharf is secured with installation of fenders for all the sizes of ships to be moored there.

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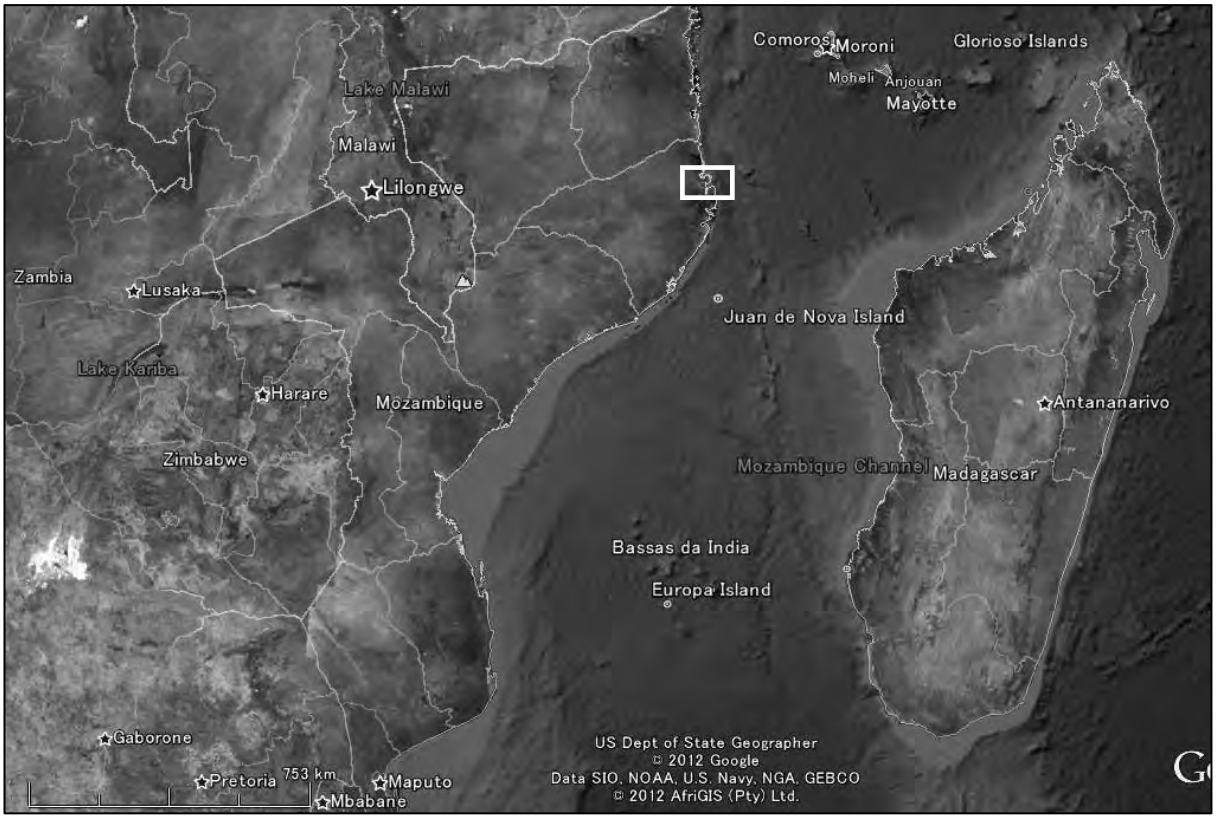
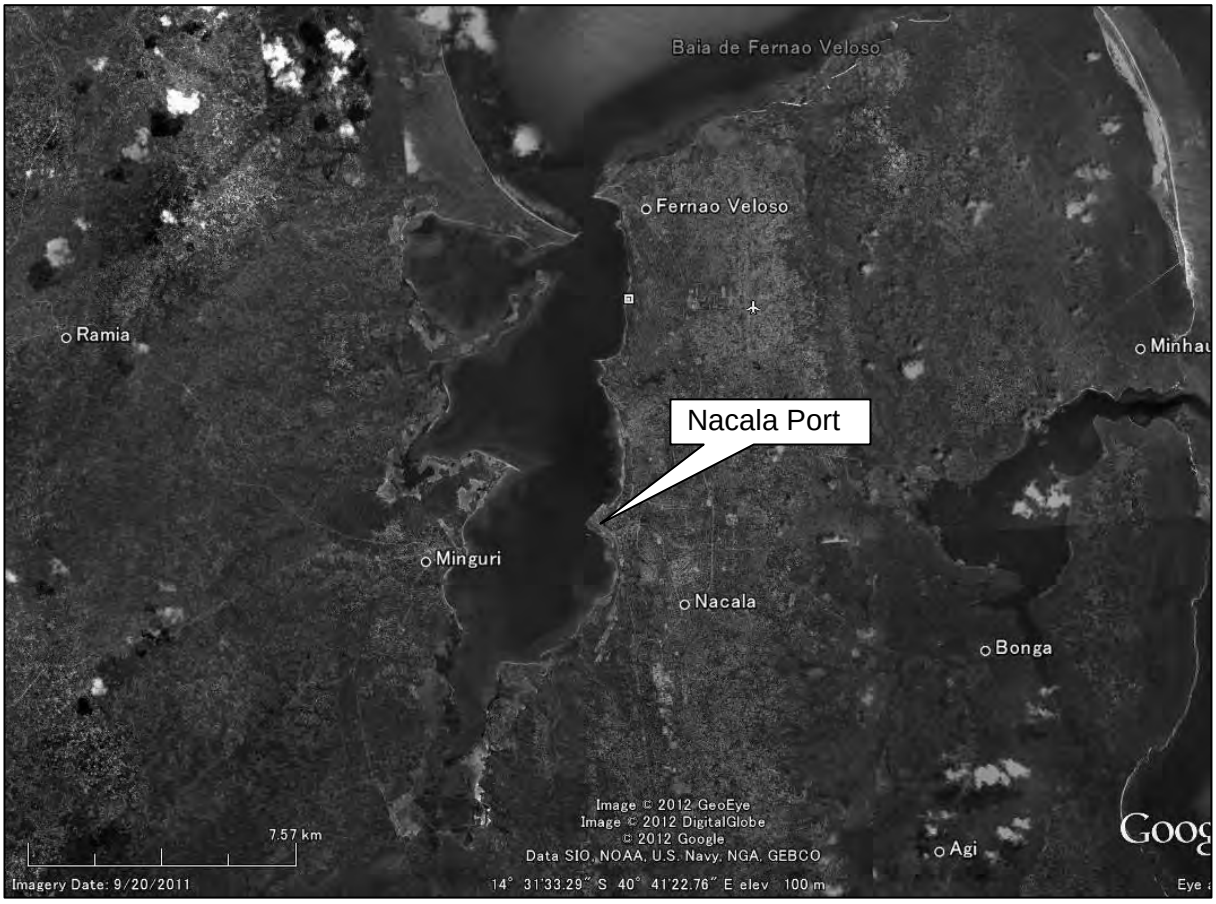
Location Map of Nacala Port





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Abbreviations

A	AP	Authorization to Pay
	AfDB	African Development Bank
B	BA	Banking Arrangement
	B/L	Bill of Lading
C	CBR	California Bearing Ratio
	CDL	Chart Datum Level
	CDN	Corredor de Desenvolvimento do Norte
	CFM	Portos e Caminhos de Ferro de Moçambique, E.P.
	CIF	Cost, Insurance and Freight
	C/P	Counter Part
	CRB	Contractors Registration Board
D	DDT	Dichloro-diphenyl-trichloroethane
E	EIA	Environmental Impact Assessment
	EIS	Environmental Impact Statement
	E/N	Exchange of Notes
	EU	European Union
G	G/A	Grant Agreement
	GAZEDA	Gabinete das Zonas Económicas de Desenvolvimento Acelerado
	GDP	Gross Domestic Product
F	F/S	The Preparatory Survey on Nacala Port Development Project
	IEE	Initial Environmental Examination
I	IEE	Initial Environmental Examination
	IMF	International Monetary Fund
	ISO	International Organization for Standardization
	IVA(VAT)	Imposto sobre Valor Acrescentado (Value Added Tax)
J	JBIC	Japan Bank for International Cooperation
	JICA	Japan International Cooperation Agency
L	LDC	Less Developed Country

M	MICOA	Ministry of Coordination of Environmental Affairs
	MTC	Ministry of Transport and Communications
N	NGO	Non-Governmental Organization
O	OCDI	The Overseas Coastal area Development Institute of Japan
	ODA	Official Development Assistance
P	PCB	Polychlorinated Biphenyl
	PETROMOC	Petróleos de Moçambique, SA
	PN	Porto do Norte
	PPP	Public Private Partnership
R	RTG	Rubber-tired Gantry Crane
S	SADC	Southern African Development Community
	SEZ	Special Economic Zone
T	TBT	Tributyltin
	TEU	Twenty-Foot Equivalent Unit
	TOR	Terms of Reference
U	UN	United Nations
	UNDP	United Nations Development Program
	UNHCR	United Nations High Commissioner for Refugees
	USAID	U.S. Agency for International Development
W	WB	The World Bank

Chapter 1 Background of the Project

Chapter 1 Background of the Project

1-1 Background and Summary of the Project

(1) Background

The major commercial ports in Mozambique are Maputo Port, Beira Port and Nacala Port. Cargo throughput in each port is shown as follows:

- Maputo Port: 8.2 million M. ton / 85,851 TEUs
- Beira Port: 3.2 million M. ton / 91,029 TEUs
- Maputo Port: 1.3 million M. ton / 52.088 TEUs

The hinterland of each port is described below:

- Maputo Port: the urban area of Maputo and South Africa
- Beira Port: the area between the urban area of Maputo and Nacala Corridor and Zimbabwe
- Nacala Port: Neighboring area of Nacala Corridor and Malawi and Zambia

Major commodities handled in each port are shown below:

- Maputo Port: containers, alumina, aluminum, fuel, etc.
- Beira Port: containers, fuel, clinker, etc.

Nacala Port: containers, agricultural products, etc.

Nacala Port needs no dredging of the waterways and no breakwaters, which minimizes capital expenditure for its maintenance, while Beira Port, which handles the maximum number of containers among the three ports, needs huge maintenance dredging along the waterways and size of calling ships is limited.. The extensive area of the hinterland of Nacala Port has high potential of development. The Mozambique Government has established policy to promote the development of the Nacala Corridor in the field of agriculture and industry. Mining of mineral resources in Zambia and Malawi likely produces active cargo traffic between Mozambique and the countries. These economic activities are expected to increase of cargo throughput in Nacala Port. It is also expected to increase transit cargo volume due to overcapacity of handled cargo volume in Durban Port in South Africa.

The container throughput in 2011 is 89,000TEUs, which shows the increase of 17% from the volume in 2010; it results in excess of 7 % over 10% increase presented in the Final Report on the Preparatory Survey on Nacala Port Development Project in the Republic of Mozambique (hereinafter referred to as “F/S Report”). It is understood that efficient use of the existing yard area should be made and efficiency of containers operation should be improved.

JICA conducted the F/S during May 2010 and June 2011. The survey report shows that throughput cargo in Nacala Port will reach the 10 million metric ton in 2030, while the throughput in 2011 is about one million metric ton.

The F/S Report presents the phased development plan toward the Short-term development

Plan; two packages of the projects named Urgent Rehabilitation Project Part-1 and Part-2 are separated from the Short-term Development Plan for urgently implemented components.

The survey team was dispatched by JICA for the study of Collection and Confirmation of Port Activities in Nacala Port" during October and November, 2011 and confirmed necessity of the Project under the Grant Aid scheme. The study team also confirmed the change of port activities; one berth of the South Wharf would be preferentially occupied by Vale in 2012 and the number of containers was increasing than the number expected in the Feasibility Study Report prepared June 2011 by JICA.

The study team and the Government of Mozambique agreed that the project target be modified for rehabilitation of the North Wharf and provision of cargo handling equipment, considering the change of present port activities and future port development plan of Nacala Port.

(2) Summary of the Project

1) Upper Goal

Economy in Mozambique is developed with implementation of the Project.

2) Project Goal

Safe and efficient operation in the port is conducted with recovery of the port function.

3) Prospective Outcome

The port facilities in Nacala Port are renovated.

4) Project Components

The Project under the Grant Aid scheme was requested the Government of Japan in June 2011. The components of the Project were modified and agreed through the discussions between the both parties. The comparison of the requested components is shown below.

Original Contents of Components (June 2011)	Modified Contents of Components (June 2011)
✧ Facilities - Fenders (at South Wharf; L = 372m) - Yard pavement of RTG foundation (Area: 13,500 m^2) - Apron pavement and repair of wharf cap concrete (L = 310m, Area: 7,000m^2) ✧ Equipment - Reach stackers: 4 units - Yard chassis: 6 units - RTG: 2 units	✧ Facilities - Installation fenders - Apron Pavement ✧ Equipment - Reach stackers: 4 units

5) Project Site

Nacala Port in Nampula Province

6) Government Organization and Agency Concerned

Responsible Agency : Ministry of Transport and Communications (MTC)
Implementation Agency : Ministry of Transport and Communications (MTC)
: Portos e Caminho de Ferro de Mozambique, E.P. (CFM)

1-2 Natural condition

(1) Temperature and precipitation

Meteorological data in Lumbo, which is located approximately 50 km to the south of Nacala, are considered to be almost the same as Nacala. Average temperature is 25 in centigrade throughout a year and maximum temperature is around 30 degree in September to May. Soil and form shall be wet during concreting and curing the concrete after concrete placing in order to maintain the concrete quality. Table 1.2-1 shows the collected temperature from 2009 to 2011 in this study in addition to the data of the F/S report from 1999 to 2008.

Table 1.2-1 Monthly Average Temperature (Lumbo, 1999-2011)

(Unit. Celsius degree)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1999	28.4	28.6	26.9	25.8	24.0	22.5	21.8	22.5	23.5	24.3	26.0	26.2	25.0
2000	27.4	26.8	26.2	25.9	23.1	22.1	21.7	22.2	24.4	26.3	27.8	28.3	25.2
2001	28.3	28.2	27.4	26.8	25.8	23.3	22.9	23.2	24.7	26.6	28.2	28.5	26.2
2002	28.7	28.4	27.9	26.9	25.2	23.2	24.7	23.2	-	26.3	27.6	27.9	26.4
2003	28.1	28.4	28.3	26.7	25.3	23.5	22.8	22.8	24.3	26.1	28.6	29.4	26.2
2004	28.6	-	28.4	27.0	24.5	23.1	22.4	23.4	25.3	26.9	28.2	29.0	26.1
2005	28.8	28.9	28.6	27.1	25.1	-	23.1	23.1	25.0	26.6	28.4	29.9	26.8
2006	28.8	28.6	28.3	27.2	24.9	23.7	22.7	23.4	24.0	26.6	27.9	28.1	26.2
2007	28.4	28.1	28.5	27.4	25.9	23.8	23.3	23.4	24.5	26.3	28.3	28.6	26.4
2008	27.3	26.8	26.2	25.1	24.6	22.1	21.8	22.3	23.5	27.0	28.7	28.6	25.3
2009	26.7	27.3	26.5	24.5	23.5	22.4	21.9	21.8	23.6	25.1	27.4	27.1	24.8
2010	28.4	28.2	27.4	26.6	25.4	22.3	21.9	21.8	23.6	25.5	26.9	28.2	25.5
2011	28.1	26.9	27.3	27.8	26.8	25.2	23.6	24.4	24.7	27.0	27.7	29.1	26.6
Average	28.2	27.9	27.5	26.5	24.9	23.1	22.7	22.9	24.3	26.2	27.8	28.4	25.9

Average precipitation is 10 mm from May to November and 200 mm from December to April, therefore, there is no problem for the construction of the works due to the precipitation. However, it has been recorded 50 mm as maximum precipitation per hour in December to April in rainy season. Drainage system in the container yard and apron should be planned to meet the degree of the precipitation. Table 1.2-2 shows the collected precipitation from 2009 to 2011 in this study in addition to the data of the F/S report from 1999 to 2008.

Table 1.2-2 Monthly Rainfall (Lumbo, 1999-2011)

(Unit. mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1999	131.2	79.5	338.4	135.0	10.1	21.5	21.9	7.8	0.0	0.3	100.5	146.4	992.6
2000	49.9	83.0	253.3	61.9	6.6	36.7	10.7	21.9	0.0	62.5	108.1	98.9	793.5
2001	209.5	134.2	339.7	65.2	7.2	0.2	8.9	2.2	0.5	52.5	0.0	31.9	852.0
2002	113.9	180.8	205.4	78.8	5.0	117.9	7.0	8.0	-	0.5	110.8	116.8	944.9
2003	489.5	224.0	141.7	23.0	0.0	45.7	63.4	0.0	0.0	14.5	0.0	130.5	1,132.3
2004	188.8	-	127.6	171.5	49.4	71.3	31.6	17.2	0.0	0.0	0.0	143.5	800.9
2005	215.6	203.5	56.0	8.4	59.0	116.4	21.9	0.0	0.0	0.9	12.5	2.6	696.8
2006	268.6	99.1	196.6	136.0	0.0	31.2	37.1	126.5	1.5	5.2	21.7	48.5	972.0
2007	917.6	592.6	197.1	347.7	17.3	30.5	23.7	28.0	36.4	5.3	1.0	440.7	2,637.9
2008	261.3	517.1	361.9	10.0	15.0	52.1	60.8	23.0	0.0	1.8	16.0	180.5	1,499.5
2009	439.9	412.3	218.5	141.7	54.4	24.8	38.7	4.1	1.2	0.0	24.4	83.6	1,443.6
2010	265.5	251.6	39.2	91.1	28.9	28.7	38.1	32.2	3.0	0.0	28.3	12.4	819.0
2011	88.1	298.4	124.1	28.8	10.0	46.0	14.6	2.1	0.0	1.8	16.8	180.5	811.2
Average	280.0	256.3	200.0	99.9	20.2	47.9	29.1	21.0	3.6	11.2	33.9	124.4	1,107.4

(2) Wind

Wind data also collected from weather station of Lumbo approximately 50 km to the south of Nacala. Wind direction and wind velocity are similar conditions to the F/S report as indicated

Figure 1.2-.1.

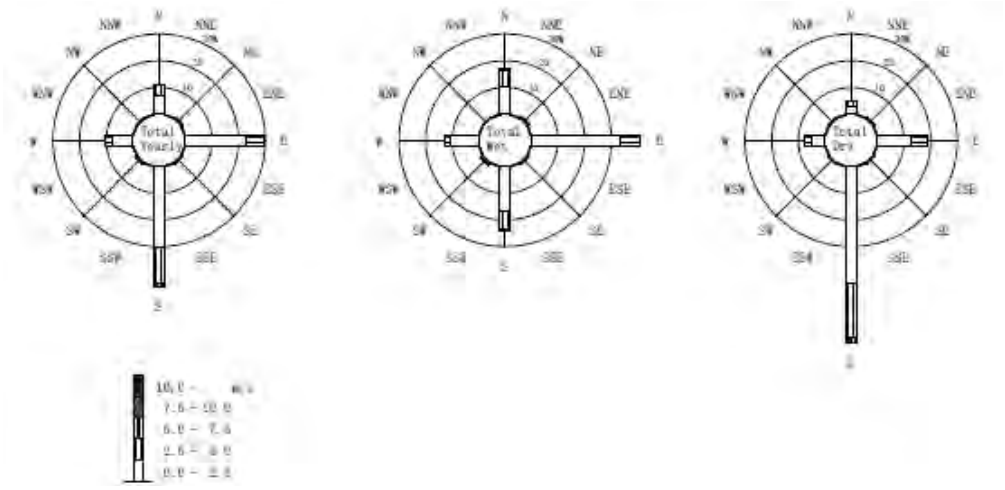


Figure 1.2-1 Wind Roses at Lumbo (2006－2011)

(3) Tide

There is no remarkable discrepancy between the collected tide table published by INAHINA in this study and F/S report. Tide conditions in Nacala Port are described below.

Mean monthly-highest water level: + 4.40m

Mean sea level: + 2.25m

Mean monthly-lowest water level: + 0.30m

Chart datum line: + 0.00m

(4) Wave

Since the offshore waves (H_0=6.4m) are sheltered by the land area, and the wave deformation coefficient is considered less than 10%, it is understood that the maximum wave at project site is waves generated in Nacala Bay. According to the F/S report, wave direction, wave height and wave period for the maximum waves generated in Nacala Bay is North, H=2.4m, T=4.3sec respectively.

(5) Earthquake

Seismic coefficient is Kh=0.05 same as F/S report.

(6) Topographic survey

Topographic survey was conducted in the project site in order to obtain the basic information of the topographic configuration and location of the existing structures for the study on planning, designing, construction methodology. Topographic survey was conducted by GPS and total station based on the bench mark established in the FS study. Figure 1.2-2 shows the area of the conducted topographic survey and the survey result is attached in the Appendix.

Figure 1.2-2 Area of Topographic Survey

(7) Bearing capacity and soil investigation

Bearing capacity and soil investigation was conducted on the existing apron and container yard at the project site for the design of port facilities. Four bearing tests (plate loading test), six site-in-situ CBR tests on the sub-grade of the apron and container yard and two case of design CBR tests in the laboratory as per contract. And to clarify the possibility to utilize the quarry material for sub-base course, material tests of sample materials from Namialo quarry site were conducted. Location of the site-in-situ tests and test results are indicated below.

According to the test results of the bearing capacity and site-in-situ CBR, it is appropriate for the sub-grade of the pavement. And the sample material from quarry site is also suitable for sub-base course and base course. Based on the test result, pavement design is made.

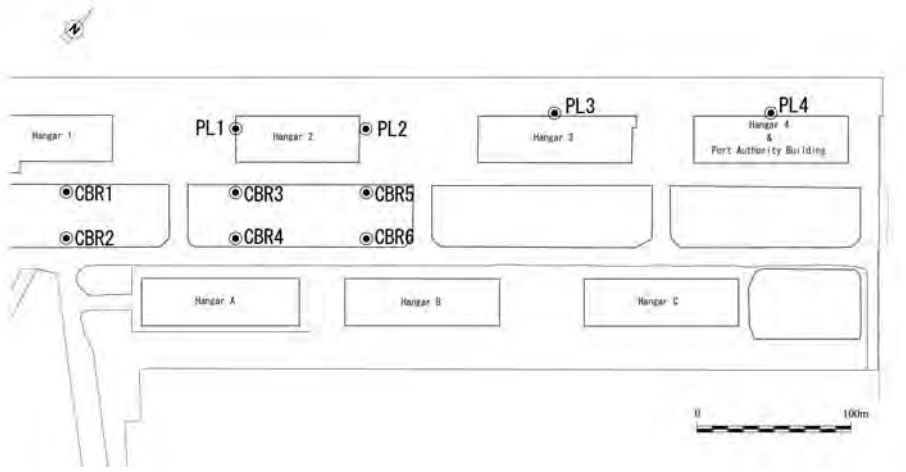


Figure 1.2-3 Locations of Bearing Tests and Site-in-situ CBR Tests

Table 1.2-3 Results of Bearing Test

Location of test	PL1	PL2	PL3	PL4
K_{30} (N/cm^3)	100	160	200	240

Table 1.2-4 Results of Site-in-situ CBR Tests

Location of test	CBR1	CBR2	CBR3	CBR4	CBR5	CBR6
CBR (%)	93	33	36	24	25	45

Table 1.2-5 Results of Design CBR

Case of test	Design CBR	Modified CBR
CBR (%)	240	190

(8) Site investigation of the superstructure and pile foundation for North and South pier

As stated in F/S report, top parts of concrete piles are damaged and corroded re-bars are exposed. Concrete damage and re-bar corrosion are investigated at the same points of piles and slab of superstructure of the F/S report in order to clarify the progress of the damage of concrete and re-bars. According to the survey result, almost all points and locations of the damaged concrete and corrosion are the same condition as F/S report stage except the progress of some points of concrete damage and corrosion of re-bars. Progress of damage of concrete and re-bar corrosion is observed at six (6) locations out of forty seven (47) locations including minor damage. Detail photos, locations and conditions of damages are attached in the Appendix. Compression strength of the concrete piles and props is measured with a rebound hammer at almost same places as F/S report to compare the differences of strength. The result of average strength of the piles in this study is 20.6 N/mm2 against 24.3 N/mm2 on the F/S report in 2010. It is understood that the above strength of the piles is not reduced from the strength measured at F/S stage on the basis of the following reasons:

- Slight differences of measurement locations among the two test occasions in spite of the same surfaces of piles to be measured
- Inherent accuracy of the rebound hammer
- Little significant difference of the maximum and minimum strength between the results of this survey and those of the F/S report
- Uneven quality of concrete of the piles, which is confirmed through the wide range of the max. and min. strength measured

(9) Underwater investigation for the north concrete block type wharf

In order to clarify the present condition of the existing concrete block type container berth and liquid berth, underwater structural investigation was conducted by divers. Investigation items are ① alignment of face line ② damages and deterioration of coping concrete ③ damages and deterioration of concrete block of the berth ④ scouring and/or deposition of seabed ⑤ drainage system on the berth. According to the investigation results, basically there are no major structural damages of concrete block of the berth except minor issues of the spacing between blocks. Underwater investigation was conducted 340 meters long along wharf against required improvement quay length of 310 meters. Figure 1.2-4 and Figure 1.2-5 shows the area of underwater investigation and summary of the investigation and the detailed result.

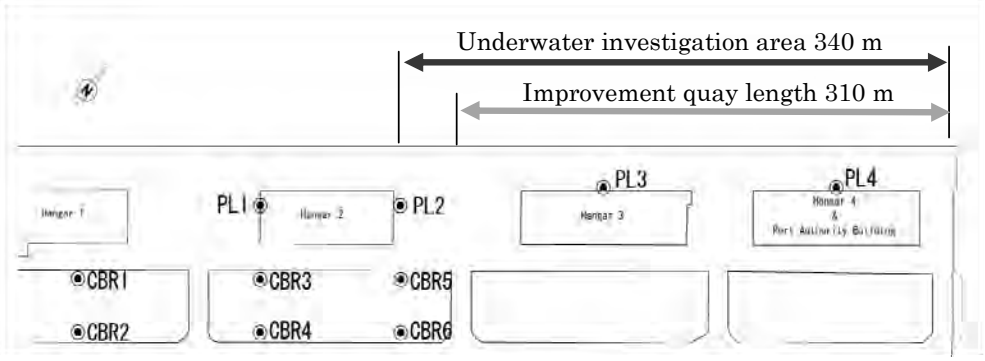


Figure 1.2-4 Area of Underwater Investigation

Item of Inspection			Method of Inspection	Evaluation Criteria		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Inspecção para Diagnóstico - Periódica Geral	Quay Alignment	Uneveness, Protuberances	Visual (Includes measure with scale, etc. The same applies to the items below) ·Horizontal shift volume	Existência de reentrância com mais de 20cm em relação ao troço ente	a	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Existência de reentrância de 10~20cm em relação ao troço adjacente	b	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■
				Para outros casos diferentes dos acima citados, com existência de reentrância com menos de 10cm em relação ao troço adjacente.	c	■	■	□	□	□	□	□	□	□	□	□	■	■	□	□	□	□	□	□
				Sem alteração	d	□	□	■	■	■	■	■	■	■	■	□	□	■	■	■	□	□	□
	Superstructure (Lateral)	Concrete Deterioration, Damages	Visual ·Crack, Exfoliation, Damage ·Corrosion of iron bar ·Signs of deterioration, etc.	Existence of damage that causes quay wall function loss.	a	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■
				Existence of Crack of more than 3mm of width.	b	■	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□
				Exposure of iron bar in a broad extension.		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Existence of Crack of less than 3mm of width.	c	□	■	■	■	□	□	□	■	■	□	□	□	□	□	□	■	□	□
				Localized Exposure of iron bar		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				No alteration	d	□	□	□	□	■	■	■	□	□	□	■	□	■	■	□	□	□	□
	Main Structure (Wall)	Concrete Deterioration, Damages	Visual ·Crack, Exfoliation, Damage ·Corrosion of iron bar ·Signs of deterioration, etc.	Existence of perforation, Crack or loss leading to binding material (agregates) outflow.	a	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Existence of Crack of about 3mm of width in many directions.	b	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Exposure of iron bar in a broad extension.		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Existence of Crack of about 3mm of width in only one direction.	c	□	■	□	■	■	■	■	■	■	■	□	□	■	■	□	■	□
				Localized Exposure of iron bar.		□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□
				No alteration.	d	■	□	■	□	□	□	□	□	□	□	■	■	□	□	■	□	■
	Sea Ground	Scouring Soil and sand accumulation	Diving survey, Depth survery ·Undulation of sea bed ground ·Tendenciy of scouring or accumulation	Scouring of more than 1m of depth in front of the wall.	a	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Effects at the wall mound or wall body along the scouring are seen.		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Occurrence of scouring of more than 0.5m and less than 1m in front of the wall.	b	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Scouring or accumulation of less than 0.5m of height/depth.	c	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
				No alteration.	d	■	■	■	■	■	■	■	□	■	■	■	■	■	■	■	■	■	■
	Draining Facilities	Fracture of draining facilities, deformation of the drainage cover, corrosion	Visual (Includes measure with scale, etc. The same applies to items below) ·Clogging of drainage ·Fracture, deformation ·Corrosion of drainage cover	Occurrence of fracture of drainage channel, drainage box	a	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	■	□
				Loss of drainage cover.		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Clear deformation/ corrosion of the drainage cover. Does not present resistance enough for use.		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				- - -	b	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Ocurrence of deformation/corrosion of drainage cover.	c	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				No alteration	d	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
	Ladder	Fracture, Painting, Corrosion of the main body	Visual ·Fracture, Deformation ·Painting situation ·Corrosion (In case of metallic materials)	Loss.	a	■	□	□	□	□	□	□	■	□	□	□	□	□	□	■	□	□
				Clear Deterioration/ Corrosion. Its use is dangerous.		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				- - -	b	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				Deterioration/ Deformation of main body, with painting peeling of or occurence of rust.	c	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
				No alteration	d	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

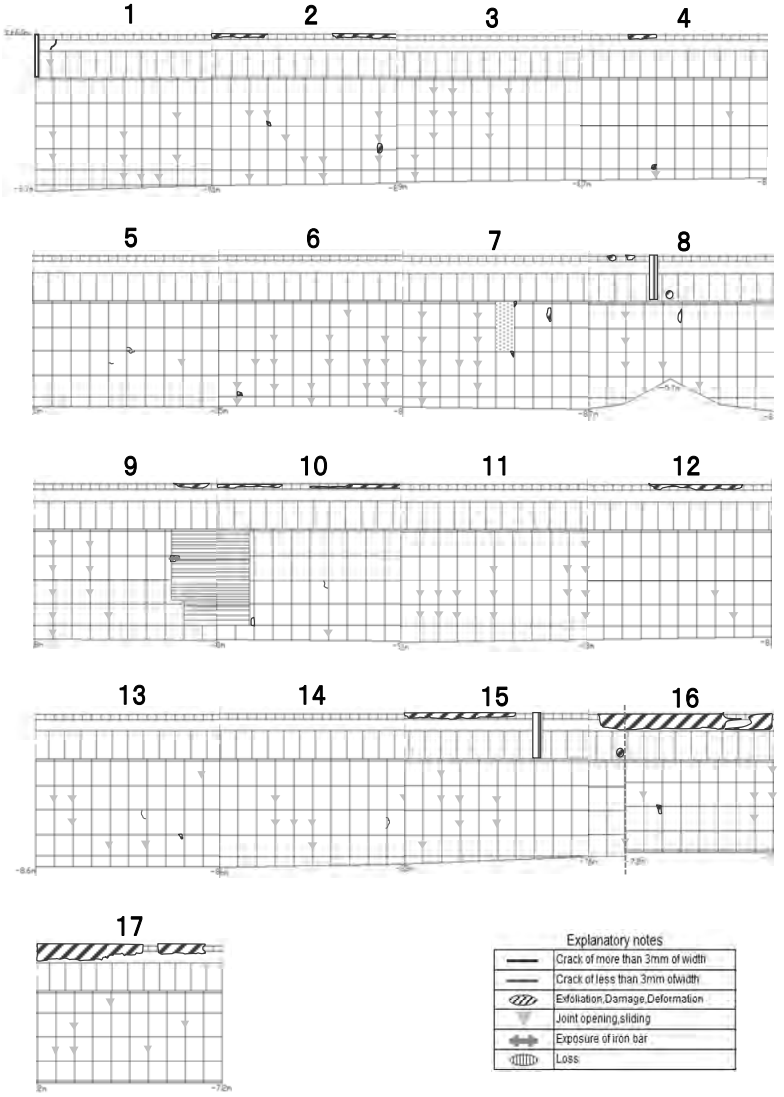


Figure 1.2-5 Summary of -Underwater Investigation for the North Concrete Block Type Wharf

1-3 Environmental Impact Assessment (EIA)

Environmental and social considerations studies were conducted based on the old JBIC Guideline in the Preparatory Survey on Nacala Port Development Project, June 2010-May 2011. This project is classified as environmental category B based on JICA Guidelines for Environmental and Social Considerations (April, 2010) (hereinafter referred to as "JICA Guidelines"). Therefore, in this preparatory survey, the studies were conducted tailored to the category B.

(1) Project Components

The project components which may affect environment are shown as below.

- Repair of North Wharf with installing Fenders
- Pavement of Apron at North Wharf
- Container Yard Pavement at North Wharf (Expansion of Yard)
- Sea Water Intake System for Fire Fighting

(2) Environmental and Social Conditions as Baseline

The baseline is shown in Table 1.3-1 and Table 1.3-2 information required for scoping works about natural environment, social environment and pollution in and around Nacala Port.

Table 1.3-1 Description of Project Site (1)

Point		Present Situation
Social environment	Affected people/ Related people/ Group: (Livelihood/ People/ Gender/ Residents / Informal settlers/ NGOs/ Poor people/ Indigenous people, Ethnic minority and Socially vulnerable groups/ People's awareness to the project, etc.)	・According to the 2007 census, Nacala District (area: 324km^2) has a population of 206,449 (male: 102,342, female: 104,107), which is growing at an average rate of 4% annually. Nacala District is constituted of 23 sub-districts. The population of Maiaia sub-district, where the Port is located, - is 14,270. ・According to the 2007 census, about 56.1% of the population are Christians (including 28.4% Catholics), 17.9% are Muslim, 7.3% adheres to traditional beliefs and 18.7% do not associate with a specific religion. ・Poverty rate in Nampula Province for 2008/09 years was 54.7%, which improved from 68.9% for 1996/97 （MURC: Mitsubishi UFJ Research and Consulting）. ・There were no informal settlers in and around the Port. ・Bantu people comprise 97.8% of the population, with the rest including White Africans (largely of Portuguese ancestry), Euro-Africans (mestiço people of mixed Bantu and Portuguese heritage), and Indians. Roughly 45,000 people of Indian descent reside in Mozambique.
	Land use and local resource utilization: (Urban area/ Rural area/ Industrial and commercial area/ Historical area/ Scenic spot/ Fishing ground/ Seaside industrial zone/ Historical legacy, etc.)	・The Municipality of Nacala has recently approved Land Use Plan of Nacala District, which covers the upcoming 15 years. According to the proposed plan, the southern and northern coastline of the Port is allocated for port/industrial activities. However, the northern area of Point Zuani is reserved for eco-tourism. ・There are 9 and 6 main fish-boat landing centers (centros de pesca) in Nacala District and Nacala-a-Velha, respectively. ・ Beach seine and dredge were often observed at the beach immediately south of the Port. Also, hand line and encircling gill net were often observed offshore of the Port. Although prohibited, some fishermen even pass or fish inside the Port jurisdiction area.
	Local infrastructure/ Social organization: (Decision-making organization of the	・Three ferry lines (with sailing boats) exist in Nacala Bay to transport passengers and goods between Nacala District and Nacala-a-Velha District. At the Nacala District side, ferries depart from three locations, beach south of the Port, beach near the

	area /Education /Transportation network /Drinking water / Well, Reservoir, Water supply /Electricity / Sewage system/ Wastes, Bus and ferry terminal, etc.)	cement factory and Naherengue. ・The Nacala-Port Municipal Government is responsible for waste management. Wastes are collected in and around the urban areas. The collected wastes are transported to the disposal site leading to a national road 17km south from the city center and are simply incinerated. ・In Nacala there are 38 lower primary schools (EP1 : five-year course) , 20 upper primary schools (EP2 : two-year course) and 11 secondary schools (ESG1 : three-year course or ESG2 : two-year course).There are also 2 high schools (ETP : maximum seven-year course), one university and one technical college. ・Although the waterworks of Nacala are from Nacala Dam, it is insufficient for supplying all the population. 49% of all the population takes the water from waterways, 31% from wells and 18% from springs (National Statistic Office (INE), 2008). ・Electricity is supplied to 25% of all the population of Nacala. As fuel, 72% uses propane and 2% uses firewood. ・The sewer of rain water is installed in the Lower Nacala and Upper Nacala. Human waste and general effluent treatment come under Nacala. The city collects, carries and disposes the human waste from toilets at the place about 7km away.
	Economy: (Agriculture / Fishing / Industry / Commerce/ Tourism, etc.)	・The main industries of Nacala are agriculture, fishery, tourism, trade, port service, and secondary industry (cement refining, lumber, cashew nut processing, etc.). There are several salt farms in the opposite shore of the Port. ・Fisheries in Nacala Bay are conducted only at an artisanal or subsistence level (i.e. no industrial fishing). There are 3,793 fishermen and 350 fishing boats based in Nacala District, and 676 fishermen and 101 fishing boats based in Nacala-a-Velha (IDDPE 2007 census). ・Agricultural products are corn and cassava other than cashew nut and cotton which are the agricultural products for commerce. ・The tourism potential of Nacala consists of tourist facilities relevant to a beach. Companies of tourist hotel and sightseeing boat applied for business in Special Economic Zone (SEZ) and got permission. The number of tourists visiting Nampula Province in 2004 was 48,000.
	Nation's health and hygiene: (Infectious disease such as disease/ HIV/ AIDS, Hospital, Sanitary custom, etc.)	・Ten hospitals in Nacala have health facilities. The main disease type in the city is malaria, cholera, and sexually transmitted disease. ・In 2008, 48.5% of people can access safe water in whole Mozambique. By province, Nampula Province has the lowest percentage, 31%, and Maputo Province has the highest, 70%. ・In whole Mozambique, the infant mortality rate in 2009 (per 1,000 people) is 93 and the adult's (15-49) AIDS infection rate is 11.5%, and the malaria infection rate (per 10,000 people), 94. AIDS infection rate tends to increase.

Notes: The table was compiled based on the information that JICA Study Team collected.

Table 1.3-2 Description of Project Site (2)

Point		Present Situation
	Geographical feature and Geology: (Steep slope/ Soft ground/ Wetland/ Fault, etc.)	・Nacala Bay coastline is characterized by a sequence of rock dominated shores and sand beaches. Coral limestone rock headlands form rugged cliffs often fringed with extensive coral reefs. Two main different geological formations occur around Nacala Bay. The coastal areas to the east of the Bay are made up primarily of sedimentary materials including coral limestone and calcareous sandstone of the Pemba formation. These are overlain by lithic and sandy soils. To the west of Nacala bay granite of the Nampula Super Group dominates the landform. ・The eastern margin of Nacala Bay comprises a mosaic of lithic soils (Eutric Letosols) and medium textured brown soils (Haplic

		Arensols) associated with the calcareous sandstones of the Pemba formation. Both types are soils prone to erosion in the rainy season. The erosion situation in Nacala City is very serious. Heavy rains may cause siltation downtown at the port area, destruction of paved roads and extensive ravine formation.
Natural Environment	Fauna, Flora and Habitat: (Protected area/ National park/ Rare species/ Mangrove/ Coral reef/ Aquatic life, etc.)	・There are no legally designated protected areas within the Nacala Bay area. There is forest reserve located in the western headland that forms the entrance to Nacala Bay: the Baixo Pinda Forest Reserve. The Matibane Forest Reserve is located in Mossuril district, approximately 30 km south of Nacala along the coast. ・The terrestrial habitats in the vicinity of Nacala Port have been largely disturbed or removed by human intervention. Small thickets occur in some of the ravines that lead towards the bay north of the Port. These are characterized by the presence of coastal tree species such as Carissa bispinosa, Commiphora shlechteri, Euclea natalensis, etc. Although these ravine thickets are small in extent they play an important role in preventing gully erosion. As most of the natural habitats have been removed, faunal diversity is low consisting of small mammal and reptile species such as rodents, lizards and geckos. ・Small and disperse patches of coral colonies occur inside Nacala Bay. However, the most well developed coral are at the entrance of Nacala Bay: Fernão Veloso Reef, Mulala Reef and Naeli Reef. ・Mangrove formations are largely absent from the eastern shore of Nacala Bay (i.e. the shore along which Nacala Port is located) although scattered mangrove trees occurs sporadically along the shoreline. The mangroves at the head of Nacala Bay have been affected by the construction of salt pans. ・18 species of marine mammals, from dolphins, whales, dugongs and seals, have been recorded for the Mozambican coast of which 8 have been reported for the littoral waters of Nampula Province. The occurrence of a humpback whale and a bottlenose dolphin in Nacala Bay was reported. ・Five species of marine turtles (listed in the IUCN Red Data List as endangered species) occur along the Mozambican coast. Extensive sandy beaches occur along the headlands at the entrance to the Bay. These beaches provide suitable habitats for nesting turtles. They are two species known to nest on the beaches of northern Nampula Province: the green turtle and the hawksbill turtle. ・Ichtyofauna from Nacala area seems to be very diverse and abundant. Captures, from the trawling fishery in Nacala Bay comprise manly by species from Mullidae, Labridae, Carangidae and Clupeidae families. A very high diversity of fish species is associated with coral reefs.
	Coast and sea: (Erosion/ Sedimentation/ Flow / Tide / Water depth/ Ocean current, etc.)	・The northern coastal sector of Mozambique, which runs almost N-S between the Tanzanian border and the town of Mossuril (40 km to the south of Nacala) is highly indented. Nacala is the biggest bay along this stretch of coast. The bay of Nacala is composed of small sub-bays. Nacala Bay communicates with the ocean through a thin channel of considerable depth. ・Nacala Bay has a north-south orientation, and is connected to the sea in the far north side by an 18 km long, 4 km wide and 20 m deep in average. ・The oceanographic conditions at Nacala Bay nearby sea are characterized by warm ocean waters of the Mozambique Current, flowing southward by seasonal upwelling due to

		north-east monsoon winds. The currents are driven mainly by anticyclonic vortices with magnitudes between 20 and 50 cm/s. ・The tide height varies from 0.5 to 3 m in neap and spring tides, respectively. The tidal prism in Nacala Bay is about 0.06 km3 (during neap tides) and 0.2 km3 (during spring tides). It is during the spring tides that most of the water of the bay is renewed. Nacala Bay nearby sea is calm most of the time, but waves can reach 2 meters in height during strong cyclones (high energy).
	Lake, River system, Seashore/ Climate: (Water quality, Flow, Precipitation, etc.)	・Average annual precipitation for Nacala is 1120 mm. The climate is characterized by a distinct warm wet season (November to April) alternating with a cooler drier season (May to October). Highest rainfall occurs during the months of January, February and March. The lowest rainfall occurs during the months of May to October. The average annual temperature for Nacala is 24.6°C. There is little variation in average monthly temperatures (approximately 6 º C variations), with November the hottest month and July the coolest month. ・Historically and statistically Nampula province is recognized as having a high risk of occurrence of cyclones. Between 1968 and 2009, Nacala was struck by the cyclones: GLADYS in 1976, NADIA in 1994 and Jokwe in 2008. ・No permanent rivers flow into Nacala Bay. To the west of the bay numerous drainage lines arise from higher ground to leading into the Bay. Drainage lines also occur to the east of the Bay although these are less numerous compared to the west. One important drainage line occurs 400 m to the south of Nacala Port. This discharges runoff waters from urban Nacala during rainy periods.
Pollution	Present pollution: (Air, Water, Sewer, Noise, Vibration, etc.)	・The JICA F/S Team conducted a water quality survey at 13 sites around the Port and Nacala Bay on July 16-17th, 2010. The main findings were: - Turbidity tended to be high in the inner bay and shallow areas - T-N concentration was highly variable between sites and layers, and was particularly high at the bottom layer of St. 6 (0.96 mg/l) in the inner bay. - Total hydrocarbon concentration was either below or near the quantification limit (0.2 mg/l), except the middle layer of St. 6. - The highest numbers of E. coli was recorded at the surface layer of St. 10, which is located near a small runoff to the south of the Port. However, the numbers were still low (246 CFU/100 ml) enough that it satisfied the European water quality standard (Directive 2006/7/EC) for 'excellent quality', which is 250 CFU/100 ml. ・The JICA F/S Team conducted a sediment quality survey at 6 sites around the Port on July 14th, 2010. The main findings were: - T-N, T-P and T-S concentration respectively showed the highest value at a station in front of the container berth. - Several stations in front of the North Wharf and the South Wharf were contaminated by high levels of one or more heavy metals (chromium, lead or nickel) that were below SQG-high in the case of ocean dumping of dredged soil.. - All the sites were contaminated by high levels of one or more harmful organic compounds. Contamination was most significant in front of the North Wharf, in particular for DDT, PCBs and TBT. DDT and TBT were all above SQG-high as described above.
	Complaint which people make the biggest concern	No information

	Countermeasures against pollution: (Measure on systems such as rules/compensations)	The Nacala CDN Port was certified according to ISO-14001 for environmental management systems, and is performing the environmental management of the port.
Others		

Notes: The table was compiled based on the information that JICA Study Team collected.

(3) Institutional Framework and Organizations in Mozambique

1) Laws and regulations

Here, is mainly described the process of the environmental license acquisition for the Nacala Port short-term development project, and are explained the related laws and regulations.

The entrepreneur of a development project in Mazambique has to acquire an environmental license from Ministério para a Coordenação Ambiental （MICOA） which is an organization reviewing EIA. A development project required for a license is classified into one of three of categories A, B and C depending on the degree of the impact of the project on the environment and society based on the attached document No.1 of Environmental Law 45/2004.

Nacala Port short-term development project was classified into category A according to MICOA. MTC submitted “REHABILITATION AND EXPANSION OF NACALA PORT, ENVIRONMENTAL PRE-FEASIBILITY AND SCOPE DEFINITION (EPDA) AND TERMS OF REFERENCE FOR THE EIA” to MICOA in February 2012 (Figure 1.3-1 and Table 1.3-3).

EIA is conducted by an environmental consultant firm, “IMPACTO”, under contract with MTC. IMPACTO has not only a good record of the environmental assessment in Mozambique, but also performed investigation of a legal framework, and a formulation of the environmental auditing and the management system, in order that the Nacala CDN Port might acquire ISO 14001 (environmental management system). Then, it performed regular environmental auditing after acquisition. It also carried out the EIA for the Nacala Port grain elevator construction project.

According to MTC, the EIA report (draft) will be completed in June, 2012, and the environmental license will be issued from MICOA in October at the earliest.

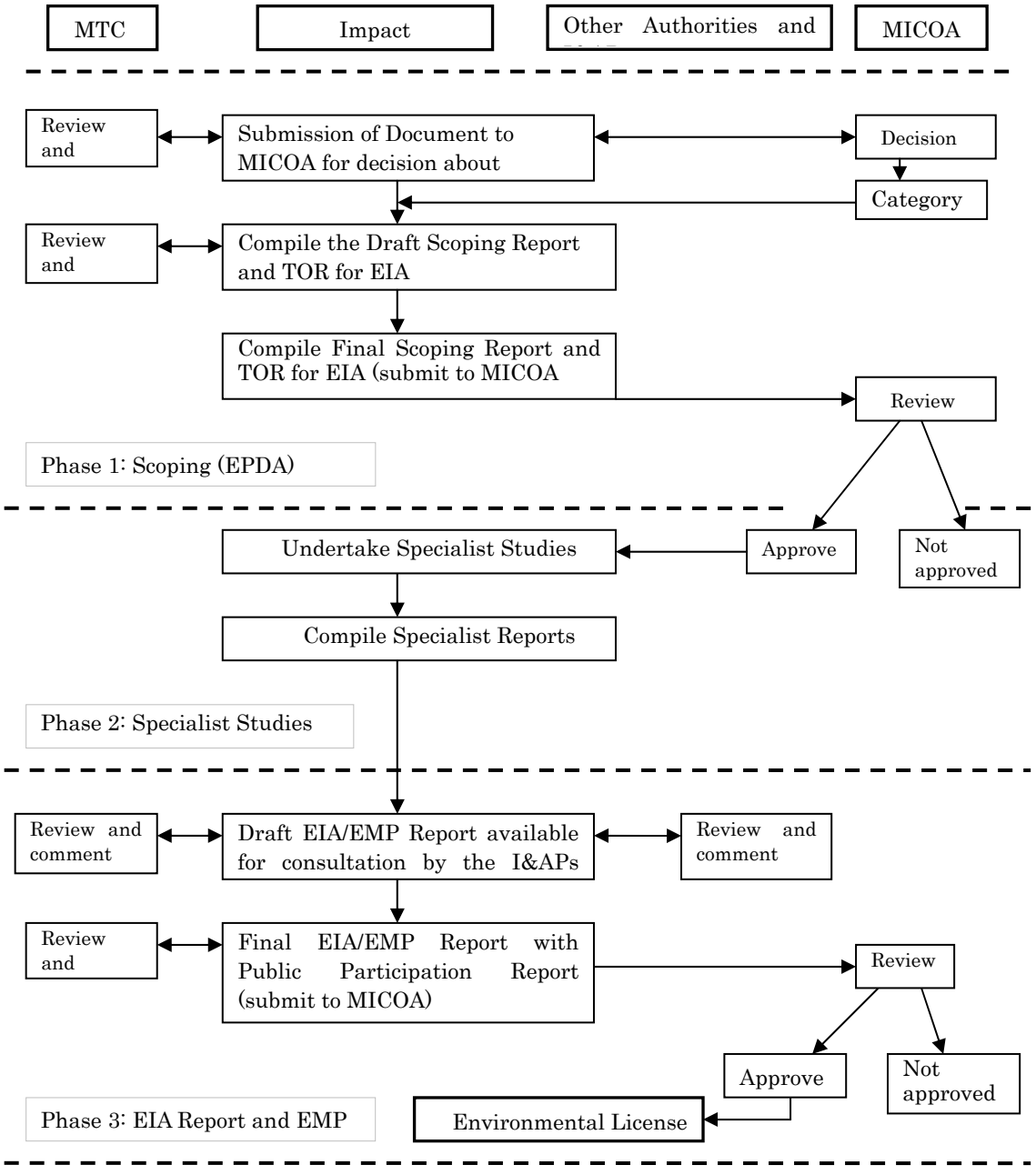


Figure 1.3-1 EIA procedures for the Nacala Port Short-term Development Plan

Table 1.3-3 Contents of Environmental Pre-Feasibility and Scope Definition (EPDA) and Terms of Reference for Environmental Impact Study

ENVIRONMENTAL PRE-FEASIBILITY AND SCOPE DEFINITION (EPDA)	TERMS OF REFERENCE FOR ENVIRONMENTAL IMPACT STUDY
1. INTRODUCTION 2. PROPONENT AND EIA TEAM 3. LEGAL REQUIREMENTS 4. DESCRIPTION OF THE PROPOSED PROJECT 5. PROJECT ALTERNATIVES 6. ENVIRONMENTAL BASELINE – BIOPHYSICAL 7. ENVIRONMENTAL BASELINE - SOCIO-ECONOMIC 8. POTENTIAL ENVIRONMENTAL IMPACTS 9. POTENTIAL “FATAL FLAWS” 10. FINAL CONSIDERATIONS AND RECOMMENDATIONS	1. INTRODUCTION 2. EIA OBJECTIVES 3. EIA APPROACH AND METHODOLOGY 4. PROJECT ALTERNATIVES 5. OVERVIEW OF ACTIVITIES TO COMPLETE THE EIA PROCESS 6. INFORMATION REQUIREMENTS 7. SPECIALIST STUDIES 8. IMPACT ASSESSMENT METHODOLOGY 9. MITIGATION MEASURES 10. EIS STRUCTURE 11. ENVIRONMENTAL MANAGEMENT PLAN 12. PUBLIC PARTICIPATION PROCESS (PPP) 13. EIA TEAM

(Source: REHABILITATION AND EXPANSION OF NACALA PORT, ENVIRONMENTAL PRE-FEASIBILITY AND SCOPE DEFINITION (EPDA) AND TERMS OF REFERENCE FOR THE EIA, MTC, February 2012)

The project will be in compliance with the following:

- Regulations for the Environmental Impact Assessment Process (Decree 45/2004 of 29 September and Decree 42/2008 of 4 November)
- Regulations for the Prevention of Pollution and Protection of the Marine and Coastal Environment (Decree 45/2006)
- Regulation for Environmental Quality Standards and Effluent Emissions (Decree 18/2004 and Decree 67/2010)
- International Environmental Agreements (signed, but not ratified as of 2012)

+ International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), London 1973 and 1978
+ United Nations Convention on the Law of the Sea LOS Convention, Montego Bay, 1982.
+ Framework Convention on Climate Change (UNFCCC), New York, 1992.
+ Kyoto Protocol - greenhouse gas emission reductions
+ Convention on Biological Diversity (CBD), Nairobi, 1992.
+ The Convention on Wetlands of International Importance, especially as Waterfowl Habitat, Ramsar, 1971.
+ Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973.
+ Convention to Combat Desertification (CCD), Paris, 1994.
+ Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Basel, 1989.
+ Montreal Protocol on Substances That Deplete the Ozone Layer, Montreal, 1989

2) Conformity with JICA Guidelines

Environmental laws of Mozambique does not stipulate that for projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage. However, "Category A" project requires 3 public consultations, the first one at a pre-construction stage, the second at a construction stage and the third at an operation stage. Table 1.3-4 shows Conformity of EIA System of Mozambique with JICA Guidelines.

Table 1.3-4 Conformity of EIA System of Mozambique with JICA Guidelines

Main Considerations	JICA Guidelines	EIA System of Mozambique
Impacts to be Assessed	The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.	As an initial step, a project proponent is required to submit an application form (Annex IV of Decree No. 45/2004) to the respective Provincial Directorate for Coordination of Environmental Affairs (DPCA). The decree does not stipulate each impact to be assessed, but simply "ecology, socio-economic conditions and natural environment in the project area".
Alternatives	Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.	According to the Decree No. 45/2004, thorough analysis and comparison of alternatives must be addressed in the EIA. The decree stipulates that future environmental situations should be predicted, whether mitigation measures are taken or not.
Information Disclosure and Consultations with Stakeholders	JICA itself discloses information on environmental and social considerations in collaboration with project proponents etc., in order to ensure accountability and to promote the participation of various stakeholders.	Environmental laws of Mozambique does not stipulate that for projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage. However, category A project requires 3 public consultations, the first one at a

	JICA incorporates stakeholder opinions into decision-making processes regarding environmental and social considerations by ensuring the meaningful participation of stakeholders in order to have consideration for environmental and social factors and to reach a consensus accordingly. For Category A studies, after the disclosure of the scoping drafts, project proponents etc. conduct consultations with local stakeholders based on stakeholder analyses. For Category B studies, project proponents etc. consult with local stakeholders after the disclosure of scoping drafts when necessary.	pre-construction stage, the second at a construction stage and the third at an operation stage. And, category B project requires public consultations depending on the situation.
Categorization	Category A: Proposed projects are classified as Category A if they are likely to have significant adverse impacts on the environment and society. Category B: Proposed projects are classified as Category B if their potential adverse impacts on the environment and society are less adverse than those of Category A projects. Category C: Proposed projects are classified as Category C if they are likely to have minimal or little adverse impact on the environment and society.	Appendix I, II and III of Decree No. 45/2004 show the type of activities that are classified as Category A, B or C, respectively. Following are the main characteristics of each category. • Category A: Projects that may have a significant impact on the environment and therefore require an EIA. The EIA process is governed by MICOA. Prior to implementation of the EIA, the proponent is required to submit TOR of the EIA together with Environmental Pre-Viability Report and Scope of Definition (EPDA). Public participation is also mandatory during the EIA process. • Category B: Projects that do not significantly affect communities or environmentally sensitive areas. The likely negative impacts are expected to be of minor duration, intensity, extent, magnitude and significance compared to Category A projects and few impacts are likely to be irreversible. The impacts that may occur can readily be mitigated. Therefore, only a Simplified Environmental Report (SER) is required. The process is governed by DPCA. • Category C: Projects that are likely to have an insignificant, negligible or minimal effect on the environment, none of which are likely to be irreversible. The benefits of the project clearly outweigh the negative impacts. Therefore these projects do not require either an EIA or SER.

(Source: Study Team)

3) Roles of Related Agencies

a) MICOA: Ministério para a Coordenação Ambiental

Figure 1.3-2 shows Organization Chart of MICOA. The role of MICOA regarding EIA process was described earlier.

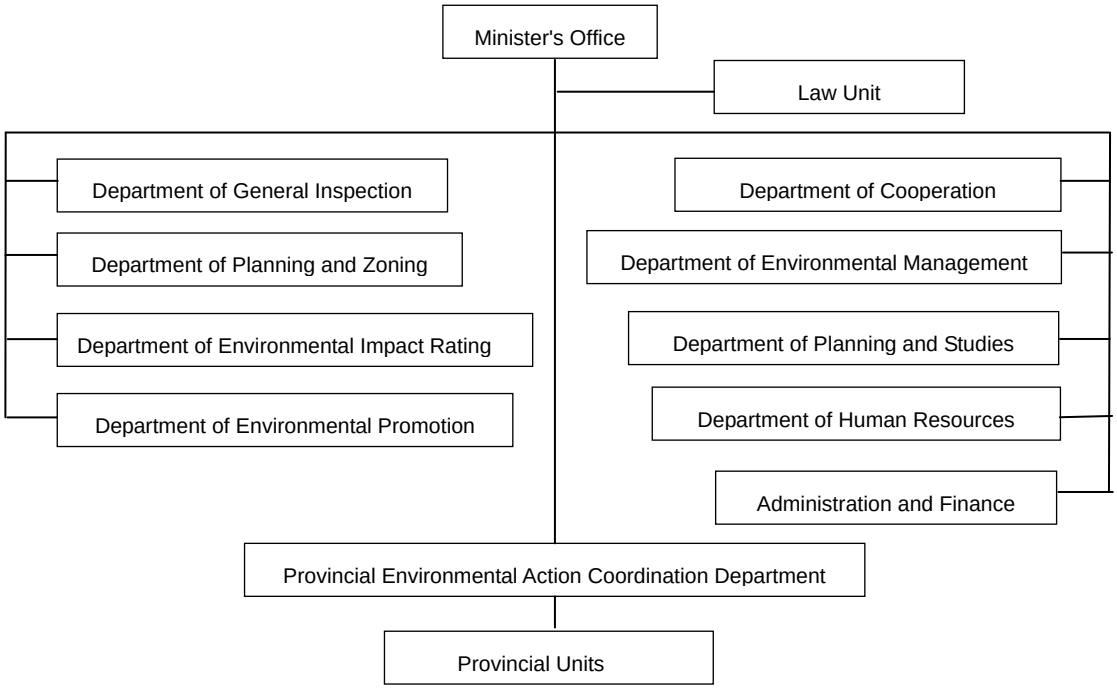


Figure 1.3-2 Organization Chart of MICOA

b) CDN: Corredor de Desenvolvimento do Norte

When CDN managed the Nacala Port, it was necessary for CDN to acquire an environmental license from MICOA. A duty of updating was imposed upon this every five years. At the time of the environmental license acquisition, "Environmental Management Plan" was created, and CDN was striving for the solution of the problem of every aspect of social environment, natural environment and pollution according to the plan. -CDN acquires ISO 14001 other than an environmental license. CDN collects cooking oil and waste oil from the industrial waste generated from the Port, and CFM has a facility for waste oil recovery etc. related to pollution control. Education about HIV/AIDS prevention is carried out for the full-time staff and part-time workers of CDN Nacala Port and the customers of CDN.

c) CFM: Portos e Caminhos de Ferro de Moçambique

The main business in the Nacala Port is administrative operation of the oil terminal, the oil pipeline, and the oil tanks outside the Nacala Port. For environmental license acquisition for the Nacala Port management, CDN mainly made the environmental management plan submitted to MICOA, however, since CFM also had the executive responsibility of the oil pipeline, it cooperated in making the plan. The department belonging to the CFM human resources office has been carrying out education about HIV/AIDS prevention over six years or more. Land use of the coastline of the Nacala Port and the Nacala Bay is under jurisdiction of CFM.

(4) Alternatives

The alternative plans for a container pier were evaluated in the Preparatory Survey on Nacala Port Development Project, 2010-2011.

As the Project for Improvement of North Warf of Nacala Port includes improvement of the pier for liquid bulk cargoes, it is necessary to take measures to maintain the facility at the construction stage. Therefore, as shown in Table 1.3-5 the alternatives to functions of liquid bulk cargoes at the construction stage were evaluated from the viewpoint of development effect, cost and environment. The alternatives included zero-option (do nothing).

As a result, were evaluated as reasonable Alternative 1 and Alternative 2, the former is "Construction works shall be stopped while a tanker is berthing", and the latter, "Oil loading/unloading point will be moved to the center of North Warf temporarily".

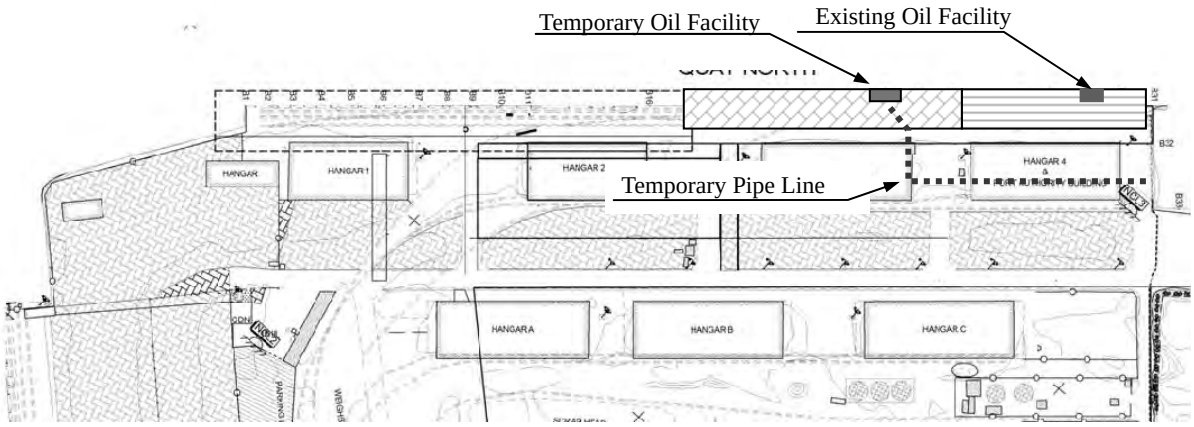
Table 1.3-5 Options for Preservation of Function of Fuel Handling in the Construction Stage

	Option 1	Option 2	Option 3	Zero-option
Description	Construction works shall be stopped while tanker is berthing.	Oil loading/unloading point will be moved to the center of North Warf temporarily.	Oil loading/unloading point will be constructed offshore.	As is
Project effect	- No change of existing operation. - Pavement works will need longer period than originally expected.	- No change of existing operation. - For hedging of against risks of accidents, 20 m should be kept off a tanker. Oil protection tank shall be constructed.	- Bigger oil vessels can be accommodated and capacity and productivity of the oil berth will be increased. - The period between survey and operation will be at least three years.	- No change of existing operation. - Risks of accidents caused by pavement works
Cost	Reasonable	Reasonable	Very high	No additional cost
Environment	No impact	No impact	The construction works may cause impacts on marine ecology. The EIA study is required.	Risks of fire accidents caused by pavement works may be increased.
Evaluation	Desirable	Most desirable	Least desirable	Not recommended

(Source: Study Team)

The evaluation results in selection of Option 2, which requires relocation of the facility to the container berth area for temporary use in the North Wharf. Figure 1.3-3 illustrates the location of the temporary facility in the construction stage.

A new facility with equipping loading/unloading arms will be constructed at the original place, while the temporary facility will be demolished on completion of works of renovating the liquid bulk berth.



(Source: Study Team)

Figure 1.3-3 Temporary Oil Facility

(5) Scoping

Impacts of the Project for Improvement of North Warf of Nacala Port on the environment (society, nature and pollution) were evaluated during pre-construction, construction and operation stages. As a result, no major negative impacts（A-）were expected. Scoping results are shown in Table 1.3-6.

Moderate negative impacts (B-) were expected as follows;

Pre-construction: No impact expected**.**

Construction:

- Possibility of behavioral change of fish species in the vicinity of the construction work (due to noise generated by machinery, vehicles, ships)
- Human wastes of construction workers could degrade local sanitary conditions.
- Construction workers could spread communicable diseases (e.g. AIDS) into the local community.
- Deterioration of air quality due to fugitive dust and exhaust emissions from construction activities and construction vehicles.
- During construction of the sea water intake system for fire fighting, the excavation for foundation generates some soil, and may cause impact of turbidity on the environment.
- Risk of water contamination increases.
- Construction will generate wastes of concrete and asphalt.
- Noise from construction trucks and fixed plant noise could have adverse impacts on the local residents.
- Higher risk of construction and road accidents due to construction works and traffic of construction trucks.

Operation Stage :

- Deterioration of air quality due to exhaust emissions from cargo trucks.
- Risk of water contamination increases.
- Noise from cargo trucks could have adverse impacts on the local residents.
- Contamination of bottom sediment through leaching of pollutants (e.g. TBT) from ship anti-fouling paint.
- Higher risk of road accidents due to increase in cargo-truck traffic.

Table 1.3-6 Scoping results

No.	Item	Project stage	Rating	Reason
Social Environment				
1	Involuntary Resettlement	P, C, O	D	There will be no resettlement.
2	Local Economy such as Employment and Livelihood, etc.	P	D	No impacts expected.
		C	B+	Generation of construction related employment.
			D	No impacts expected.
		O	B+	Generation of operation related employment.
3	Land Use and Utilization of Local Resources	P	D	No impacts expected.
		C	B-	Behavioral change of fish species in the vicinity of the construction work (due to noise generation by machinery, vehicles, ships).
		O	D	No impacts expected.
4	Social Institutions such as Social Infrastructure and Local Decision - making Institutions	P, C, O	D	No impacts expected.
5	Existing Social Infrastructures and Services	P, C, O	D	No impacts expected.
6	The Poor, Indigenous and Ethnic people	P, C, O	D	No impacts expected.
7	Misdistribution of Benefit and Damage	P	D	No impacts expected.
		C	B+	Possible benefits in regards to local employment, economy and so on.
			D	No impacts on fishing activities expected due to works mainly at land.
		O	B+	Possible benefits in regards to local employment, economy and so on.
			D	No possible hindrance to fishing activities.
8	Cultural heritage	P, C, O	D	There are no cultural heritages in the project site.
9	Local Conflicts of Interest	P, C, O	D	No impacts expected.
10	Water Usage or Water Rights and Communal Rights	P, C, O	D	No impacts expected.
11	Sanitation	P	D	No impacts expected.
		C	B-	Human wastes of construction workers could degrade local sanitary conditions.
		O	D	No impacts expected.
12	Hazards (risk) Infectious Diseases such as	P	D	No impacts expected.
		C	B-	Construction workers could spread communicable diseases (e.g. AIDS) into the local community.

	HIV/AIDS	O	D	No impacts expected.
Natural Environment				
13	Topography and Geographical Features	P, C, O	D	No impacts expected.
14	Soil Erosion	P, C, O	D	No impacts expected.
15	Groundwater	P,C,O	D	No impacts expected.
16	Hydrological Situation	P, C, O	D	No impacts expected.
17	Coastal zone (mangrove, coral reef, tidal flat, etc.)	P,C,O	D	No impacts expected since the project has no impact on water quality.
18	Flora, Fauna and Biodiversity	P,C	D	No impacts expected since the project has no impact on water quality.
		O	D	No impacts expected.
19	Meteorology	P, C, O	D	No impacts expected.
20	Landscape	P, C, O	D	No impacts expected.
21	Global Warming	P, C, O	D	No impacts expected.
Pollution				
22	Air Pollution	P	D	No impacts expected.
		C	B-	Deterioration of air quality due to fugitive dust and exhaust emissions from construction activities and construction vehicles.
		O	B-	Deterioration of air quality due to exhaust emissions from cargo trucks.
23	Water Pollution	P	D	No impacts expected.
		C,O	B-	During construction of the sea water intake system for fire fighting, it may cause impact of turbidity on the environment. Risk of contamination increases.
24	Soil Contamination	P, C, O	D	No impacts expected.
25	Waste	P	D	No impacts expected.
		C	B-	During construction of the sea water intake system for fire fighting, the excavation for foundation generates some soil. Construction will generate wastes of concrete and asphalt.
		O	D	No impacts expected.
26	Noise and Vibration	P	D	No impacts expected.
		C	B-	Noise from construction trucks and fixed plant noise could have adverse impacts on the local residents.
		O	B-	Noise from cargo trucks could have adverse impacts on the local residents.
27	Ground Subsidence	P, C, O	D	No impacts expected.
28	Offensive Odor	P, C, O	D	No impacts expected.
29	Bottom Sediment	P,C	D	No impacts expected.
		O	B-	Contamination of bottom sediment through leaching of pollutants (e.g. TBT) from ship anti-fouling paint.
30	Accidents	P	D	No impacts expected.
		C	B-	Higher risk of construction and road accidents due to construction works and traffic of construction trucks.
		O	B-	Higher risk of road accidents due to an increase in cargo-truck traffic.

Legend of project stage
P: Pre-construction Stage
C: Construction Stage
O: Operation Stage

Rating criteria
A-: Major negative impact A+: Major positive impact
B-: Moderate negative impact B+: Moderate positive impact
C-: Impact uncertain
D: No impact expected. No need for further assessment

(Source: Study Team)

(6) TOR for EIA Study

As for TORs for EIA Study, are shown "TOR of Initial Environmental Examination (IEE) for Improvement of North Warf of Nacala Port" and "TOR of EIA for REHABILITATION AND EXPANSION OF NACALA PORT" as follows:

TOR of Initial Environmental Examination (IEE) for Improvement of North Warf of Nacala Port

(1) Study area

The IEE study area will cover the North Warf of Nacala Port and its adjacent area.

(2) Project Activities

The Project covers three improvement activities as follows;

i) Repair of North Warf

ii) Pavement of Apron at North Warf

iii) Container Yard Pavement at North Warf (Expansion of Yard)

(3) Method

1) Collection of existing data and site reconnaissance

Present social and natural environment will be obtained and analyzed by collection of the data and site reconnaissance. And information regarding Mozambique EIA system and environment license will be collected.

2) Scoping

To prepare scoping drafts by collecting related information, conducting field surveys, and consulting with project proponents etc.

The scoping table shall be submitted to JICA at the end of the field survey.

3) Environmental checklist

JICA conducts an environmental review in accordance with the project category, and refers to the corresponding environmental checklists for each sector when conducting that review as appropriate.

The environmental checklist for improvement of North Warf of Nacala Port shall be submitted to JICA at the end of the field survey.

It shall include the following categories and items related to the environment.

Category	Item
1. Permits and approvals, explanations	• EIA and environmental permits • Explanations to the public
2. Anti-pollution measures	• Air quality • Water quality • Waste • Soil contamination • Noise and vibration • Subsidence • Odor • Sediment
3. Natural environment	• Protected areas • Ecosystem • Hydrology • Topography and geology • Management of abandoned sites
4. Social environment	• Resettlement • Living and livelihood • Heritage • Landscape • Ethnic minorities and indigenous peoples • Working conditions (including occupational safety)
5. Other	• Impact during construction • Accident prevention measures • Monitoring

4) Environmental impact

Impacts will be assessed at the phases of construction and operation.

5) Mitigation Measures and Environmental Monitoring Plan

All of mitigation measures introduced to reduce impact given on each environmental item will be confirmed and arranged into environmental management plan.

During construction and operation, all of mitigation measures have to be preserved and monitored to evaluate impact in comparison to criteria and/or environmental standards.

Mitigation measures and planning of monitoring will include approximate cost and capacity development.

(4) Report

This report shall be made in accordance with JICA Guidelines.

The table of contents is proposed as follows:

0. Executive summary
1. Policy, legal, and administrative framework
2. Project description
3. Scoping and TOR for IEE study
4. Baseline data
5. Environmental impacts
6. Analysis of alternatives
7. Environmental Monitoring Plan
8. Environmental Management Plan (EMP)
9. Consultation
10. Appendices
    - List of references

(Source: Study Team)

TOR of EIA for REHABILITATION AND EXPANSION OF NACALA PORT

1 INTRODUCTION

The project proponent is the Ministry of Transport and Communication (MTC). This project was classified as “Category A” by the Ministry for Coordination of Environmental Affairs (MICOA).

2 EIA OBJECTIVES

The purpose of the EIA is to:

- Assess the potential impacts (positive and negative) of the Project and Project-related activities on the environment (including biophysical and socio-economic resources) in the areas of direct and indirect influence of the project;
- Identify mitigation measures, where applicable, to avoid or minimize negative impacts, and to report the significance of the residual impacts that remain following mitigation;
- Design environmental management plans to minimize the potential negative impacts of the project;
- Identify measures that can enhance potential benefits (including identification of synergies with projects already established and plan for the area).

3 EIA APPROACH AND METHODOLOGY

The approach to the EIA complies with the applicable Mozambican environmental legal requirements and will assess the impacts associated with the rehabilitation and expansion of Nacala Port.

The EIA process consists basically of three phases that are described in detail below.

Phase 1: Scoping Phase

Phase 2: Specialist Study Phase

Phase 3: EIS, EIA Report and Associated Environmental Management Plan (EMP)

4 PROJECT ALTERNATIVES

The following alternatives could be considered:

- Alternative to the project: the EIA should consider a “no action” alternative scenario.
- Alternative project location
- Alternative on technology used (*e.g.* dredging technology, dredge disposal containment technology, “land reclamation” technology, waste disposal options, etc.).

5 OVERVIEW OF ACTIVITIES TO COMPLETE THE EIA PROCESS

The EIA will be conducted by a multidisciplinary team consisted of specialists. The EIA should cover the main activities listed below:

- Activities Planning;
- Desktop studies;
- Field work and Specialist Studies.

6 INFORMATION REQUIREMENTS

The information requirements for the EIS are summarized below.

- A detailed description of the activities planned for the rehabilitation and expansion project;
- A detailed layout of the port (actual and future);
- A description of current activity at the Port, shipping traffic volume, bulk storage piles, shipping lanes and

navigation routes, etc.;

- For the 11 listed construction components on EPDA of the rehabilitation and expansion, identify:
  - o The duration of the activity;
  - o Information on the activity, e.g. earth clearing, drilling/blasting, material storage (stockpiles), vehicles and construction equipment being used, etc.

7 SPECIALIST STUDIES

The Specialized Studies will be conducted by a multidisciplinary team with distinctive areas of expertise relevant to the assessment of potential environmental impacts of the proposed Project. It is therefore considered necessary to perform at least the following specialist studies:

- Terrestrial Ecology
- Marine Ecology
- Geohydrology and Geology
- Oceanography
- Air Pollution
- Noise
- Socio-economic
- Fisheries
- Traffic
- Ports
- Legal review

8 IMPACT ASSESSMENT METHODOLOGY

The impact assessment will be based on appropriate techniques, based on predetermined criteria. These criteria are specified in the Table

Table: Criteria adopted for potential environment impact assessment

Item	Criteria
State	Positive, Negative
Probability	Unlikely Probable Highly Probable Definitive
Extension	On-Site Local Regional National Transboundary/International
Duration	Short-term Mid-term Long-term Permanent
Magnitude	Low Moderate High
Significance	Not significant Minor Moderate Major

9 MITIGATION MEASURES

One of the key objectives of an EIA is to identify mitigation measures that are socially, environmentally, technically and cost effectively acceptable. Mitigation measures are developed to avoid, reduce, remedy or compensate for any negative impacts identified, and to create or enhance positive impacts such as environmental and social benefits.

10 EIS STRUCTURE

The EIS will be compiled in accordance with the requirements of Decrees 56/2010 and 45/2004and Ministerial Diploma nº 129/2006. An outline of the proposed contents of the main volume of the EIS is provided below:

VOLUME 1: Non-Technical Summary and EIS Report

o Non-Technical Summary

o EIS Report

i. Contents

ii. Abbreviations and acronyms

iii. Identification of the EIA team.

iv. Introduction

v. Legal Framework

vi. EIA Objectives

vii. EIA Process and Public Participation

viii. Assumptions, limitations and uncertainties of the EIA

ix. Project Description and Alternatives

x. Delimitation of the area of direct and indirect influence

xi. Description of the Biophysical Environment and Socio-Economic baseline

xii. Impact Assessment

xiii. Mitigation Measures.

xiv. Recommendations

xv. Conclusions

xvi. Bibliographic references

xvii. Appendix (e.g. specialist studies, sampling results, etc.)

VOLUME 2: Environmental Management Plan (EMP) and Monitoring

VOLUME 3: Public participation report

11 ENVIRONMENTAL MANAGEMENT PLAN

Based on the evaluation of potential impacts and associated mitigating measures an Environmental Management Plan (EMP) will be prepared.

The main objectives of an Environmental Management Plan (EMP) are:

- Compliance with environmental legislation;
- Identification and description of means to ensure the effective implementation of mitigation measures;
- Specify the roles and responsibilities for environmental management, environmental monitoring and auditing.

12 PUBLIC PARTICIPATION PROCESS (PPP)

The Public Participation Process will be undertaken in accordance with the EIA Regulations (Decree nr. 45/2004) and the Public Participation General Directive (Ministerial Diploma 130/2006, for Category A projects). The Public Participation Process will aim to be both transparent and integrative, allowing the Interested and Affected Parties (I&APs) to understand the project and to enable them to identify issues of concern. A public meeting will be held in Nacala to present the findings of the draft of the EIA report and to collect comments/suggestions prior to submission of the Report to MICOA. The draft EIA Report will be made available to the public two weeks before the public consultation meeting.

13 EIA TEAM

The proposed team for the EIA is composed by not only technicians who should conduct specialized studies, but also those who will be involved in public consultation and support staff.

(Source: REHABILITATION AND EXPANSION OF NACALA PORT, ENVIRONMENTAL PRE-FEASIBILITYAND SCOPE DEFINITION (EPDA) AND TERMS OF REFERENCE FOR THE EIA, MTC, February 2012)

(7) Results of EIA Study

The JICA F/S Team conducted a water quality survey at 13 sites around the Port and Nacala Bay on July 16-17th, 2010.

The main findings were:

- Turbidity tended to be high (maximum 1.4FNU) in the inner bay and shallow areas. This value was below the portable water quality standard (2.0 degree (almost FNU)) in Japan. It explained “almost transparent below the standard”.
- T-N concentration was highly variable between sites and layers, and was particularly high at the bottom layer of St. 6 (0.96 mg/l) in the inner bay. This was comparable to Class IV (less than 1mg/l) in the environmental quality standard of sea water in Japan.
- Total hydrocarbon concentration was either below or near the quantification limit (0.2 mg/l), except the middle layer of St. 6.
- The highest numbers of E. coli was recorded at the surface layer of St. 10, which was located near a small runoff to the south of the Port. However, the numbers were still low (246 CFU/100 ml) enough that it satisfied the European water quality standard (Directive 2006/7/EC) for ‘excellent quality’, which was 250 CFU/100 ml.

The JICA F/S Team conducted a sediment quality survey at 6 sites around the Port on July 14th, 2010.

The main findings were:

- T-N, T-P and T-S concentration respectively showed the highest value at a station in front of the container berth. These values are comparable to those of the sediment in the inner part of the Tokyo Bay.
- Several stations in front of the North Wharf and the South Wharf were contaminated by high level of one or more heavy metals (chromium: 116mg/kg dw, lead: 85 mg/kg dw or 125 mg/kg, nickel: 40 mg/kg dw). These values were all below SQG-high (chromium: 370 mg/kg dw, lead: 220 mg/kg dw, nickel: 52 mg/kg dw) from the guideline values in the case of ocean dumping of dredged soil shown in “Guideline for

dredging, 2009”by Australian Government. On the other hand, the Japanese sediment survey team found the relationship between concentration of heavy metals and number of kinds of benthic species in 2002. Those high level values in front of the wharfs were, however, all above the ERL (chromium: 80mg/kg dw, lead: 46.7 mg/kg dw, nickel: 20 mg/kg dw), the limited concentration in which kinds of benthic species were found in relatively abundance.

- All the sites were contaminated by high level of one or more harmful organic compounds. Contamination was most significant in front of the North Wharf, in particular for DDT（2057.6μg/kg dw）, PCBs(89.1μg/kg dw) and TBT(193.0μg Sn/kg dw) which were all above SQG-high (DDT:46μg/kg dw、TBT: 70μg Sn/kg dw) compared to the guideline values in case of ocean dumping of dredged soil as described above.

The followings are the main points from the EIA report for the Rehabilitation and Expansion of Nacala Port, MTC, June 2012.

In Mozambican waters are reported to occur 5 of the 7 species of marine turtles occurring in the world (MICOA, 2009). All 5 species are present in the north of the country. The 5 species of seaturtles are listed in the IUCN Red Data List as endangered/critically endangered (Table 1.3-7) and are also protected by Mozambican law (Hunting Law 7/1978, Decree 117/1978; Forest and Wildlife Law Regulation, Decree 12/2002; Recreation and Sport Fishery Regulation, Decree 51/99).

Sandy beaches are not extensive within Nacala Bay. However, extensive sandy beaches occur along the headlands at the entrance to the Bay (Fernão Veloso in the east and Baixa Pinto in the west). These beaches provide suitable habitats for nesting turtles. The catch by fishermen and egg collections for consumption are major threats to seaturtles population, which probably is a common practice in Nacala area.

These endangered sea turtles inhabit near the mouth of Nacala Bay that is about 10km north to the Port. The project has no impact on water quality due to works mainly at land. Although behavioral change of fish species may occur due to noise/vibration generation by construction machinery, the affected area will be in the vicinity of the Port. Therefore, no impacts of the project on sea turtles are expected.

Table 1.3-7 Sea turtle species occurring in the North of Mozambique (TRANSMAP, 2007)

Scientific Name	Common Name	Status in Mozambique	IUCN Red List
Caretta careta	Loggerhead	Common; probably nesting	Endangered
Dermochelys coriacea	Leatherback	Common	Critically endangered
Chelonia mydas	Green	Common; nesting	Endangered
Eretmochelys imbricata	Hawksbill	Common; nesting	Critically endangered
Lepidochelys olivacea	Olive Ridley	Rare; nesting	Endangered

(Source: EIA for the Rehabilitation and Expansion of Nacala Port, MTC, June 2012

Noise measurements were done in Nacala-Port in order to assess the noise impact of future Port expansion operations. Measurements were carried out at several positions around the property. The characteristic and coordinates of these locations can be seen in Table 1.3-8. In summary, the noise levels at the suburban areas (Nacala1 and Nacala3) in Nacala-Port are already above the noise levels indicated in SANS 10103 Code of Practice. In the industrial areas, near the port, the levels are within the noise limits specified in the standard mentioned.

Table 1.3-8 Noise Levels at Each Monitoring Point

Position No.	Location	Characteristics	Noise level Leq (Daytime)	SANS 10103 guidelines Leq (Daytime)	Environmental quality standards for noise in Japan Leq (Daytime)
Nacala 1	Outside Nacala Central Mosque and next to the school (14° 32.456'S, 40° 40.288'E)	Suburban with little traffic	59.3	50 (Suburbs)	55 dB or less (A or B: areas used exclusively or mainly for residences)
Nacala 2	Eastern corner of the port boundary fence (14° 32.369'S, 40° 40.304'E)	Industrial Zone boundary	56.7	70 (Industrial zone)	60 dB or less (C: areas for commerce, industry and a significant number of residences)
Nacala 3	In front of the Cathedral (14° 32.502'S, 40° 40.593'E)	Suburban with little traffic	54.7	50(Suburbs)	50 dB or less (AA: areas where quietness is specially required)
Nacala 4	On the main transport route from the Port of Nacala at the boundary with the Mogas property (new by-pass road to the Port will enter the port area here) (14° 33.031'S, 40° 40.459'E)	Industrial Zone boundary	65.7	70 (Industrial zone)	65 dB or less (Area B facing roads with two or more lanes, and Area C facing a road with one or more lanes)

(Source: Compilation of the table of Noise Levels at Each Monitoring Point from EIA for the Rehabilitation and Expansion of Nacala Port, MTC, June 2012)

(8) Environmental Management Plan

Mitigation measures were developed to avoid, reduce, remedy or compensate for any negative impacts identified during construction stage and operation stage in the Preparatory Survey on Nacala Port Development Project, 2010-2011. Impact Evaluation and Mitigation Measures during construction stage and operation stage are shown in Table 1.3-9 and Table 1.3-10 respectively.

Table 1.3-9 Impact Evaluation and Mitigation Measures during construction stage

No.	Impact	Evaluation	Mitigation Measures	Implementing Entity	Responsible Entity
Social Environment					
3	Land Use and Utilization of Local Resources	Behavioral change of fish species in the vicinity of the construction work (due to noise generation by machinery, vehicles, ships).	Regular meetings with representatives of local fishermen	MTC	MTC/CFM
11	Sanitation	Human wastes of construction workers could degrade local sanitary conditions.	Installation of temporary toilets at construction sites.	Construction contractor	MTC/CFM
12	Hazards (risk) Infectious Diseases such as HIV/AIDS	Construction workers could spread communicable diseases (e.g. AIDS) into the local community.	Implementation of regular health checks and education programs.	Construction contractor	MTC/CFM
Pollution					
22	Air Pollution	Deterioration of air quality due to fugitive dust and exhaust emissions from construction activities and construction vehicles.	- Use of well maintained trucks and implementation of regular vehicle maintenance - Covering of loading space with sheet cover to minimize dust spills - Loading and unloading bulk construction should be in areas protected from the wind in calm conditions. - Vehicles carrying dusty materials should be washed before leaving the site (washing facilities should be available). - Limit access to construction site to construction vehicles only - Impose vehicle speed restrictions on the construction site - Maintain high moisture content on exposed surface and roads by spraying with water	Construction contractor	MTC/CFM
23	Water Pollution	- During construction of the sea water intake system for fire fighting, it may cause impact of turbidity on the environment. - Risk of contamination increases.	- A silt fence is installed to avoid impact of turbidity on the environment. - Installation of drainage system at construction sites.	Construction contractor	MTC/CFM
25	Waste	- During construction of seawater intake system for fire fighting, the excavation for foundation generates some soil. - Construction will generate wastes of concrete and asphalt.	- The excavated soil is not put on the land, but on the seabed next to the excavated place. - Construction wastes (wastes of concrete and asphalt) are properly disposed to the damping site in the city.	Construction contractor	MTC/CFM

26	Noise and Vibration	Noise from construction trucks and fixed plant noise could have adverse impacts on the local residents.	- Use of well maintained trucks and implementation of regular maintenance of vehicle - Strict abidance of speed limit and avoidance of unnecessary revving - Avoidance of night-time travelling of trucks whenever possible	Construction contractor	MTC/CFM
30	Accidents	Higher risk of construction and road accidents due to construction works and traffic of construction trucks.	- Notification of truck drivers of high risk areas -Strict compliance with speed limit	Construction contractor	MTC/CFM

(Source: Study Team)

Table 1.3-10 Impact Evaluation and Mitigation Measures during operation stage

No.	Impact	Evaluation	Mitigation Measures	Implementing Entity	Responsible Entity
Pollution					
22	Air Pollution	Deterioration of air quality due to exhaust emissions from cargo trucks.	- Use of well maintained trucks and implementation of regular vehicle maintenance	CDN	CDN
23	Water Pollution	Risk of contamination increases.	- The project will install a new oil loading/unloading arm, which should reduce the risk of oil spillage from the oil loading/unloading operation.	CDN and Ship Owners	CDN
26	Noise and Vibration	Noise from cargo trucks could have adverse impacts on the local residents.	- Use of well maintained trucks and implementation of regular vehicle maintenance - Strict abidance of speed limit and avoidance of unnecessary revving - Avoidance of night-time travelling of trucks whenever possible	CDN and Truck Owners	CDN
29	Bottom Sediment	Contamination of bottom sediment through leaching of pollutants (e.g. TBT) from ship anti-fouling paint.	-The port should encourage ships to refrain the use of harmful anti-fouling paint. - Ratification of the AFS Convention is also recommended.	CDN and Ship Owners	CDN
30	Accidents	Higher risk of road accidents due to an increase in cargo-truck traffic.	-Notification of truck drivers of high risk areas. -Strict abidance of speed limits.	CDN and Truck Owners	CDN

(Source: Study Team)

(9) Environmental Monitoring Plan

Two different meetings should be held during the construction and operation phases. One with representatives of local fishermen is to confirm any adverse impacts on fishery and the other with those of local residents is to confirm impacts of the moving vehicles on local residents along the road.

Regarding monitoring of air quality and noise level, a quantitative method is also introduced by applying the monitoring plan shown in "EIA for the project on the rehabilitation and expansion of Nacala Port" by MTC.

During the implementation stage of the project, the MTC and the CFM should establish Project Management Unit (PMU) (Refer to Chapter 2) Operation and Management Structure). The PMU is a government organization established for the purpose of smooth and swift implementation of the project and, therefore, it is given the legal power by the implementing agency of the project to conclude the contract and to disburse. The PMU has the responsibility not only to supervise and monitor the progress of the project, but also to ensure the safety of the construction and to monitor the impact on the social and natural environment over the period of project implementation. The PMU should be based at Nacala. The Environment Monitoring Section is responsible to ensure that all the activities related to the Project comply with the conditions prescribed by EIA Certificate and the environmental management plan of the Project. Regarding impact items (such as accident, air pollution, noise, water pollution, etc.), the PMU establishes a grievance redress mechanism for complaints from local residents and fishermen.

Table 1.3-11 Environmental Monitoring Plan-Construction Stage

No.	Impact	Environmental Monitoring	Frequency	Implementing Entity	Responsible Entity
Social Environment					
3	Land Use and Utilization of Local Resources	Regular meetings with representatives of local fishermen	2/year	MTC	MTC/CFM
11	Sanitation	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM
12	Hazards (risk) Infectious Diseases such as HIV/AIDS	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM
Pollution					
22	Air Pollution	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM
		Measurement of air quality (PM10), 2 points along access roads to the Port	4/year	Construction contractor	MTC/CFM
23	Water Pollution	Measurement by using a portable turbidity	1/week	Construction contractor	MTC/CFM

		meter			
25	Waste	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM
26	Noise and Vibration	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM
		Measurement of noise level, 2 points along access roads to the Port	4/year	Construction contractor	MTC/CFM
30	Accidents	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM

(Source: Study Team)

Table 1.3-12 Environmental Monitoring Plan- Operation Stage

No.	Impact	Environmental Monitoring	Frequency	Implementing Entity	Responsible Entity
Pollution					
22	Air Pollution	Regular meetings with representatives of local residents	1/year	CDN	CDN
		Measurement of air quality (PM10, SO2, NO2), 2 points along access roads to the Port	2/year	CDN	CDN
23	Water Pollution	Regular meetings with representatives of local fishermen	1/year	CDN and Ship Owners	CDN
26	Noise and Vibration	Regular meetings with representatives of local residents	1/year	CDN and Truck Owners	CDN
		Measurement of noise level, 2 points along access roads to the Port	2/year	CDN	CDN
29	Bottom Sediment	Regular meetings with representatives of local fishermen	1/year	CDN and Ship Owners	CDN
30	Accidents	Regular meetings with representatives of local residents	1/year	CDN and Truck Owners	CDN

(Source: Study Team)

(10) Stakeholder Meetings

According to the EIA regulations (Environmental law (2004) and guideline), category A project requires holding of a public hearing at least once. Category B project, however, also requires holding of a public hearing in the case of displacement of goods (stores etc.) other than households.

According to the Preparatory Survey on Nacala Port Development Project, June 2010-May 2011, stakeholder meetings were held as follows, and the sufficient consensus formation in the project has been achieved.

1st meeting: July 2, 2010	Participant: 62	Opinion: 7 persons
2nd meeting: December 16, 2010	Participant: 31	Opinion: 8 persons
3rd meeting: April 12, 2011	Participant: 43	Opinion: 11 persons

(Participants; MTC, CFM, CDN, Shipping agents, PETRONOC, Fishermen, etc.)

Moreover, the stakeholder meeting for fishermen was held on December 14, 2010, and the opinions and requests for construction of facilities have been grasped.

The Public Participation Process for Nacala Port short-term development project will be undertaken in accordance with the EIA Regulations (Decree nr. 45/2004) and the Public Participation General Directive (Ministerial Diploma 130/2006, for Category A projects).

A public meeting will be held in Nacala to present the findings of the draft of the EIA report and to collect comments/suggestions prior to submission of the Report to MICOA. The draft EIA Report will be made available to the public two weeks before the public consultation meeting. Contents of the public participation process report will include the following:

- Methodology used for Public Participation Process;
- Minutes of the meetings;
- Issues and Response Report (IRR); and
- Annexes: database of Interested and Affected Parties (IAPs), invitation letters, Background Information Document (BID), published advertisements, list of participants and comments received from the IAPs.

Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Short-term Development Plan Targeted the year 2020 and the Phased Plans

(1) Short-term Development Plan and Urgent Rehabilitation Plan by F/S Report

Nacala Port presently renders operation services at the South and North Wharves. The South Wharf acting as the main berth handles containers and bulk cargoes by large size vessels, while the North Wharf handles dry bulk and liquid bulk cargoes by relatively small size ships. However, the South Wharf berths are highly occupied in spite of the vulnerable structure and the necessity of alternative berths has been confirmed for the renovation. The Final Report on the Preparatory Survey on Nacala Port Development Project in the Republic of Mozambique in June 2011 prepared by JICA Study Team (hereinafter referred to as "F/S Report") proposes a new -14m container berth for the existing facilities. Considering these situations, the change for cargo handling functions of Nacala Port in the Short-Term Development Plan is planned to move the container berth function at the South Wharf to a new container berth at the North Wharf and at the same time, the South Wharf will be used only for bulk cargoes that the load on the jetty is lighter for extension of the life of the berth facilities.

(Source: F/S Report)

Figure 2.1.1-1 Overall Concept of Short-term Plan for Nacala Port

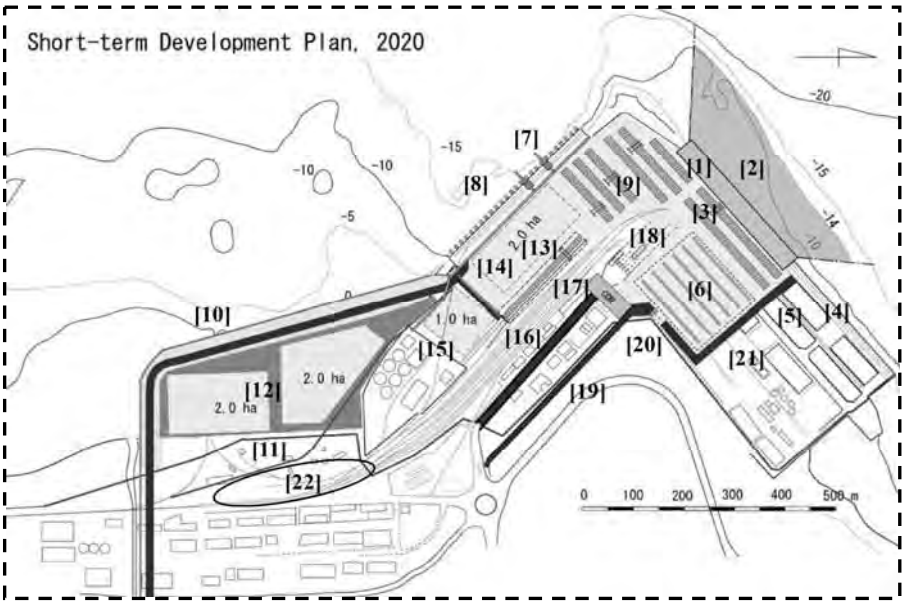
Based on discussions on alternative plans for minimization of influence on the port activities with consideration of deterioration of the South Wharf, the Short-Term Development Plan as shown in the Figure 2.1.1-2 is recommended for meeting the cargo volume forecasted for the year of 2020.

For implementation of the Plan, some facilities for minimization of hampering port activities under construction works and enhancement of cargo handling capacity are required prior to commencement of construction of the new berth. It is understood that a bypass road and an in-port container yard be constructed with top priority as the Urgent Rehabilitation Plan Part 1. During the period for implementation of this plan, the Urgent Rehabilitation Plan Part 2 is proposed to construct a new jetty and the related facilities as the second phase.

It is, therefore, recommended that the Short-term Development Plan be implemented with

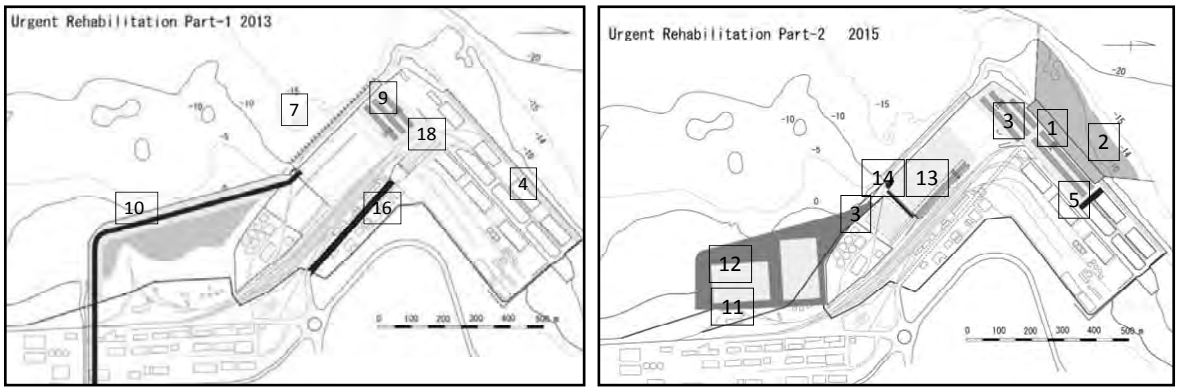
the two phased packages:

- Urgent Rehabilitation Project Part 1 for the components to be conducted with the first priority
- Urgent Rehabilitation Project Part 2 for the remaining components except the above
- The above mentioned Short-Term and Medium/long-term Development Plans have been approved by the Government of Mozambique and the necessity of prompt implementation of the Short-Term Development Plan is confirmed especially.



(Source: F/S Report)

Figure 2.1.1-2 Short-Term Development Plan for the Year 2020



Urgent Rehabilitation Plan Part 1 **Urgent Rehabilitation Plan Part 2**

（Source: F/S Report）

Figure 2.1.1-3 Two Packages of Urgent Rehabilitation Plans

(2) Situation Change in Nacala Port after Submission of F/S Report

Vale Lda. has obtained the license to preferentially use a berth at the South Wharf from January, 2013 for the berthing of 45,000 DWT class coal careers until the year of 2015 that the coal terminal will be constructed on the opposite shore of Nacala Port. The coal career is scheduled to call 2 times for staying for 15 days in a month.

The port facility to be used for loading coals under the preferential license is reserved at the southern berth 180 m of -15m depth and the adjoining stockyard for coal as shown in Figure 2.1.1-4. Even under the license, other vessels may be moored at the berth when the berth is not used by coal ships.

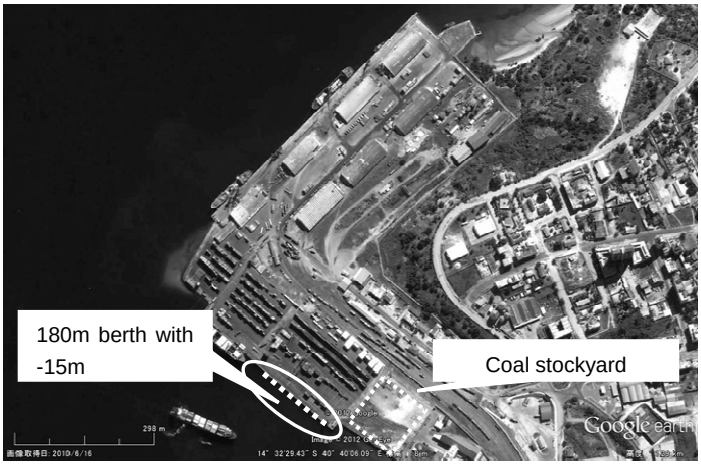


Figure 2.1.1-4 Port facilities to be used by Vale

As described above, although berthing days are planned as 15 days, the coal carriers may call at the port on an irregular base. It is predicted that loading coal may be irregular depending on the working conditions during their staying period. Therefore, it is quite obvious that operating container vessels or bulk carriers mooring the berth might be forced to move from the berth when a coal carrier calls at the port.

Remaining 180 m length at the northern side of the South Wharf is the only one -15m berth where can be freely used by other larger ships.

As described previously, Nacala Port owns the berthing facilities with three water depths of -15m along the South Wharf, and -10m and with -7.5m along the North Wharf. The northern side of the North Wharf of -10m part mainly serves liquid bulk handling. As the apron pavement in this berth is widely and severely deteriorated, containers cannot be handled at this moment, while it is occasionally used for the handling of break bulk cargoes. Under the present port situation as above, it is concerned that the preferential use of the South Wharf by Vale Lda. will lessen berthing time for container vessels and large scale bulk carriers to increase waiting time for berth only under their utilization of the existing South Wharf.

In terms of the number of handled containers, the number in year 2011 records about 89,700 TEU which shows increase of approximate 20,000 TEU and 17% comparing with the achievement in 2010. The result presents fair excess of handled container volume, compared with demand prediction of 11% stated in the F/S Report. Although the trade volume with Malawi is decreasing, booming of Nacala special economic zone is assumed to further promote the throughput at Nacala Port.

2-1-2 Project Concept

(1) Change of Requested Components under the Grant Aid

The F/S report proposed Urgent Rehabilitation Plan Part-1 for the facilities shown in Figure 2.1.1-3 separating into 2 packages for the facilities to be improved urgently out of Short-Term Development Plan. However, alleviating shortage of present port capacity is required since the great change of port activities is obviously arising, which was not assumed in the F/S Report, and the commencement time of the Urgent Rehabilitation Plan is behind the schedule.

As the first phase of the overall Urgent Rehabilitation Plan, the Government of Mozambique has requested assistance under the Grant Aid scheme to Japan for construction of the facilities with higher priority among the components in the Part-1 of Urgent Rehabilitation Plan.

However, depending on the change of economic activity situation around Nacala Port, the requested components had no other choice but changed, and the requested components are been finalized at the time of site survey in April, 2012 as shown in the following table.

Table 2.1.2-1 Confirmation of Requested Component

	Requested Component	
Original Component	【Civil Facility】 ・Installation of Fenders(L=372m at South wharf) ・Yard pavement including RTG foundation in south wharf(13,500m^2) ・Repair of cap concrete along North Wharf (L=310m) ・Apron pavement (appx. 7,000 m^2)	【Cargo Handling Machine】 ・4 Reach Stackers ・6 Trailers ・2 RTGs
Component after discussion	【Civil Facility】 ・Rehabilitation of north wharf berth (L=310m) ・Pavement of north wharf apron (back side of berth rehabilitation) ・Pavement on north wharf container yard	【Cargo Handling Machine】 ・4 Reach Stackers ・2 RTGs 【other facilities】 ・Firefighting system ・Liquid bulk handling facility

The above change of requested components was caused from the results of re-study of the following situations:

- Provision of container yards with RTGs in the South Wharf, which was the main component of the original request, becomes difficult due to the preferential use of a berth by Vale Ltd.
- Fenders along the South Wharf shall be installed by CDN in 2012.

The requested components confirmed finally is aspired to the same direction with the medium/long-term Development Plan for 2030 and the Short-Term Development Plan for 2020 and positioned as the first step of a shifting container terminal function to the north wharf.

And, in parallel with this Grant Aid Cooperation, the Government of Mozambique is promoting implementation of the remaining port facilities proposed in Urgent Rehabilitation Plan

with funding sauces such as Japan and African Development Bank aiming the completion in 2017. At the same time, JICA is conducting a Technical Cooperation for the promotion of improving Nacala Port until March, 2015. It aims at formulating Port Development Strategy (Short-Term Rehabilitation Plan, Review of Phased Rehabilitation Plan), etc. The output of the Technical Cooperation are given to this project, while the Technical Cooperation will be implemented incorporating the output of this study.

(2) Target of the Project under the Grant Aid Scheme

Port management becomes very difficult with the increase of container cargo volume being apart from the description in the F/S Report due to the preferential use by Vale Lda. It is no doubt that the countermeasures to these situations are executed and the port facility rehabilitation (Short-Term Rehabilitation Plan) is necessary to meet cargo demands in the future.

With these backgrounds, during the period from 2013 that the project by the Grant Aid Cooperation to be commenced to the time of completion of port rehabilitation by loan assistance (assumed it in 2017), construction works in the port at each phase may somewhat cause decline of the port functions of the existing port.

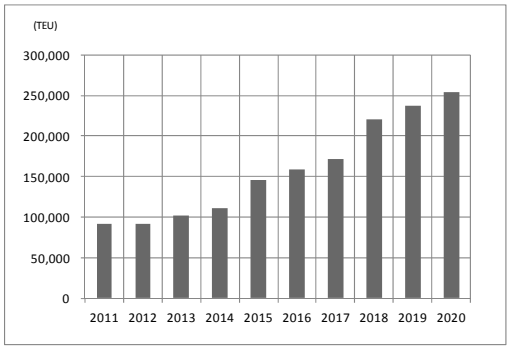
Furthermore, the container handling volume in Nacala Port shows the increasing tendency and the shortage of container yard already becomes obvious.

Since the Nacala Port situation is uncertain as stated above, OCDI (The Overseas Coastal Area Development Institute of Japan) shows the demand forecast of container throughput in Nacala Port at each stage of its development.

Table 2.1.2-2 Container Demand Forecast at Each Event Stage

Year	2011	2012.10	2014/2015.2	2015.12	2017	2020
Main event in Nacala Port	–	Vale Lda. commence use of South Wharf for coal carriers	Completion of Construction works under Grant Aid	Preferential use of South Wharf be completed by Vale Lda.	Construction works under Loans	Target year of Short-Term Development Plan
Container Demand (TEU)	89,700 (Actual Record)	90,000	109,000	144,000	170,000	252,000

(Source: OCDI)



(Source: OCDI)

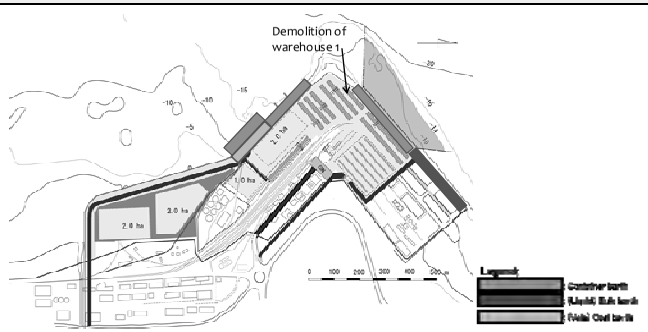
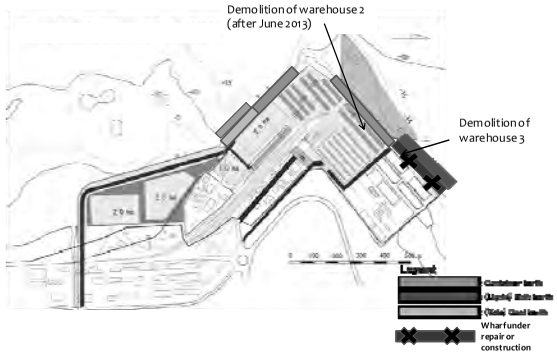
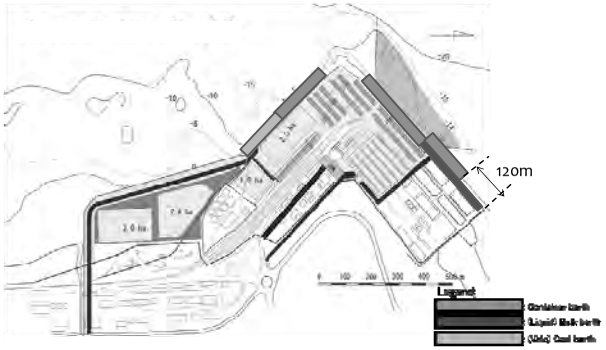
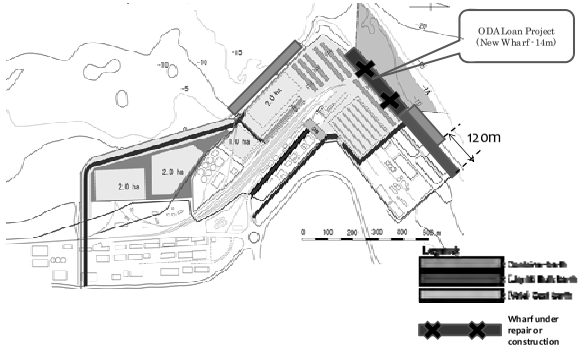
Figure 2.1.2-1 Demand Forecast of Containers in Nacala Port

Table 2.1.2-3 shows 2 berths (S1, S2) of -15m in South Wharf, 2 berths (N1, N2) of -7.5m and 2 berths (container berth N3+ liquid bulk berth N4) of -10m in North Wharf.

As mentioned above, the usage of berth has to be changed at each stage while the number of container handling is expected to increase year by year. At this moment, the construction schedule up to the year 2017, the completion year of Urgent Rehabilitation Plan by the loan scheme, is considered to be the shortest. Meanwhile, as the port will be congested due to construction works and port cargo handling works, the other countermeasures to avoid the congestion of cargo handling works would not be made. The capacity of port facilities provided under Grant Aid in early 2015, therefore, should meet the demand of containers during 2015 and 2017 as much as possible.

Therefore, it is considered that capacity of the port facilities provided under the scheme is required to cover the number of containers forecasted for 2017 for that purpose. Especially, considering that the capacity of container yard and the number of cargo handling equipment have direct influence on the yard operation, it is necessary to plan the capacity of the facilities with targeting 170,000 TEU in 2017.

Table 2.1.2-3 Berth Service Plan in Each Step and Prediction of Container Handling Volume

<table>
<tr><td colspan="2">Vale Lda. commence to handle coal in 2012</td><td colspan="2">Completion of construction works under Grant Aid in early 2015</td></tr>
<tr><td colspan="2"> 
</td><td colspan="2"> 
</td></tr>
<tr><td>Main container berth</td><td>S1＋S2</td><td>Main container berth</td><td>S2 ＋ (S1) + (N1)</td></tr>
<tr><td>Prediction of number of container</td><td>90,000 TEU</td><td>Prediction of number of container</td><td>109,000 TEU</td></tr>
<tr><td colspan="2">Vale Lda. complete coal handling in 2015</td><td colspan="2">Right before the completion of construction works by loan scheme in 2017</td></tr>
<tr><td colspan="2"> 
</td><td colspan="2"> 
</td></tr>
<tr><td>Main container berth</td><td>S2 + (S1) + (N1) + N3</td><td>Main container berth</td><td>S1 +S2 + N3</td></tr>
<tr><td>Prediction of number of container</td><td>144,000 TEU</td><td>Prediction of number of container</td><td>170,000 TEU</td></tr>
<tr><td colspan="4">S1：South side berth of south wharf(Priority use by Vale Ltd.)S2：North side berth of south wharf , N1：North wharf-7.5m(150m)　N2：North wharf-7.5m(150m)
N3：North wharf-10m(190m for container berth and etc.)N4：North wharf-10m(120m for liquid bulk berth)</td></tr>
</table>

(Source: Local JCC data of OCDI)

(3) Countermeasures for Shortage of Berth (Usage of -10m Berth of North Wharf)

1) Berth congestion by priority use of 1 berth at south wharf

Calculating the number of container vessels berthed along the South and North Wharf and their mooring time of each vessel from the records obtained from CDN, the results are shown in the following table. This table was made in view of sorting each vessel to proper berth depending on the draft in calling with consideration of the preferential use of the South Wharf by Vale Lda. This work is to obtain the number of vessels for assigning calling vessels to berths to use the existing -10m and -7.5m berths as much as possible. It is expected to result in mitigation of congestion of the -15m berths.

Container vessels basically use the South Wharf but a container vessel with shallow draft may use -7.5m berth in the North Wharf in case of full occupation of the South Wharf. Presently, liquid bulk carriers have the priority to use -10m berth and container vessels do not use -10m berth.

Out of bulk carriers, vessels with shallow draft may use the North Wharf, while the South Wharf serves operation of handling clinker or wheat that are unloaded from larger bulk carriers with the draft more than 10m.

Table 2.1.2-4 Number of Container Vessel Calls (2011)

Total number of calling vessels	South Wharf	North Wharf	
	Number of vessels needed - 15m berth (Vessel with more than 9.2m draft when calling)	Number of vessels that are proper to use - 10m berth (Vessels with the drafts between 6.7m and less than 9.2m)	Number of vessels to be able to use - 7.5m berth (Vessels with the draft less than 6.7m)
154	45	100	9

(Source: Study Team from CDN data)

Table 2.1.2-5 Number of Bulk Carriers Calls (2011)

Total number of calling vessels	South wharf	North wharf	
	Number of vessels needed - 15m berth (Vessel with more than 9.2m draft when calling)	Number of vessels that are proper to use - 10m berth (Vessels with the drafts between 6.7m and less than 9.2m)	Number of vessels to be able to use - 7.5m berth(Vessels with the draft less than 6.7m)
41	20	15	6

(Source: Study Team from CDN data)

The table below shows the calculated berth occupancy ratio of the South Wharf in 2011 from the records of mooring time of calling vessels. In this calculation, as there are unclear points in the berth use record made by CDN, the calculation is made partly under the premises with the following assumptions.

- Mooring time of vessels to be able to use -7.5m berth is excluded out of container vessels.

・Mooring time of vessels to be able to use -7.5m berth was excluded out of bulk carriers.

Table 2.1.2-6 Mooring time of calling vessels and Berth Occupancy Ratio of South Wharf

	Mooring time (hrs)
Container Vessels	9,589
Bulk Carriers	3,254
Total	12,843
Berth Occupancy	74%

(Source: Study Team from CDN data)

Standard berth occupancy ratio is 65% (UNCTAD), however, the ratio of Nacala Port is extremely high as above to cause long waiting time for berth as a result. In addition to this situation, the preferential use of about 180m berth of the southern side of the South Wharf will start by the coal carriers of Vale Lda. from October, 2012.

A calling schedule by Vale Lda. is as follows:

・Number of calling: 2 times/month

・Mooring days: 15 days/month= 360 hrs/month

As a result of the above arrangement, present berth occupation ratio of the South Wharf changes as follows:

Table 2.1.2-7 Change of Berth Occupation Ratio of South Wharf by Vale Carriers

	Mooring time (hrs)
Container Vessel	9,589
Bulk Carrier	3,254
Vale Carrier	4,320
Total	17,163
Berth Occupancy	98%

(Source: Study Team from CDN data)

As it is clear from the result, the berth occupancy ratio becomes 98% with additional calling of Vale carriers and the waiting time theoretically approaches infinity without limit. In order to smoothly handle containers and bulk cargoes in respect of port management, it is considered that another arrangement of a berth is inevitable to cover the shortage of the South Wharf.

2) Mitigation Measure for Berth Congestion (Utilization of -10m berth in North Wharf)

In the Short-term Development Plan as shown in the F/S report, only two -15m berths in the South Wharf will serves operation of handling cargoes which increase year by year before the completion of a new -14m berth in the North Wharf. As the preferential use of a berth in south wharf became clear after the submission of the report to the Government of Mozambique, it was not assumed in the short-term rehabilitation plan. However, as Technical Cooperation study that aims at modifying the Short-term Development Plan did not propose the possibility of the construction of another wharf; a new berth should not be proposed avoided as the component of this project

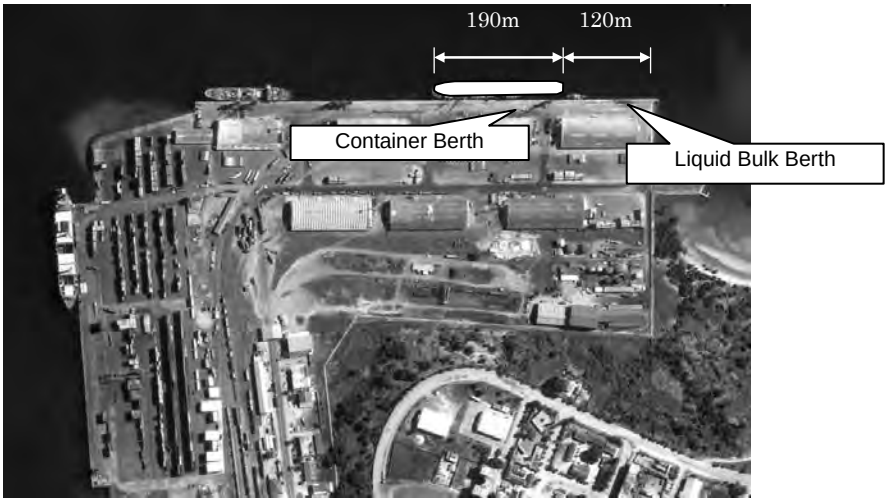
considering the position of this project as described previously.

From these points of view, although the necessity and the urgency of facility construction to mitigate the shortage of berthing capability are high, it is considered that construction of a new berth becomes difficult in this project study.

With that, it can be considered that this project should target maximum use of the North Wharf which has the second deepest depth next to the South Wharf and the target is the most effective countermeasure as the very realistic one.

Considering liquid bulk is handled at the northern Part of the North Wharf, a liquid bulk berth of 120m and a container berth of 190m are allocated in the North Wharf as shown in the Figure 2.1.2-2.

it is proposed that two berths of and the plan is to use the south side with 120m distance from the cargo handling facility by container vessels and etc.



(Source: Made by Study Team)

Figure 2.1.2-2 Concept of New Allocation Berths in North Wharf

This project for the North Wharf is to aim at provision of a container wharf with rehabilitation of apron pavement and berthing facility as well as rehabilitation of berthing facility of the North Wharf for alleviating shortage of berth in the South Wharf.

As shown in the Tables 2.1.2-4 and 2.1.2-5, there were 100 container vessels and 15 bulk carriers that are assigned to 10m berth from the in-port actual record in 2011 and the former shares 65 % of all in-port container vessels and the latter shares 37% of all bulk carriers. In other words, these ships can use the North Wharf even under the situation that the South Wharf be fully occupied by other vessels. Although there remained the inconvenience to use narrow apron, utilization the North Wharf is considered to be effective as the countermeasure for the berth congestion in Nacala Port. And, the existing cargo handling system on the berth will be maintained; unloading containers by ship’s gear, loading them onto trailers by reach stackers and transport to container yards are conducted.

3) Rehabilitation of Liquid Bulk Berth in North Wharf

The North Wharf remains in poor conditions that were caused by the hit of a mooring vessel in the cyclone; all the facilities for safe mooring are damaged such as fenders, bollards, cap concrete structure, etc. Especially, -10m berth where is expected as the alternative facility of the South Wharf remains deteriorated for the total length of 310m.

190 m of -10m berth shall be rehabilitated as a container berth, however, in this project remaining 120m of -10m berth for a liquid bulk berth shall also be rehabilitated in view of safe berthing of vessels.

However, as container handling machine (reach stacker) does not work at the apron behind the berth, the pavement shall be the structure with light design load.

(4) Yard Rehabilitation Corresponding to Increasing Number of Containers (North Wharf)

This North Wharf container berth and the South Wharf will be the berths for container vessels during 2015 and 2017. After completion of a new -14m container berth at the North Wharf, the North Wharf container berth is also expected to be used by comparatively small container vessels.

It is generally inevitable to allocate container yard directly behind the berth considering cargo handling efficiency in case of planning a container terminal, in this regard, a new container yard is necessary to be constructed being adjacent to the container berth at the North Wharf.

As far as continuing the existing cargo handling system by reach stackers, the wider area for the yard should be required since working space of 15m or more for reach stackers is necessary and stacking height is limited for the equipment. While, it is difficult to secure effective area for the container yard and demolition will be required since the warehouse for bulk cargoes is allocated at about 23 m land side from the quay face line.

Furthermore, the container yard in this project should meet the Short-term Development Plan targeted in 2020, which is being modified in Technical Cooperation study. The planning yard must not be the obstacle so as not to re-construct it when the urgent rehabilitation plan by a loan scheme be implemented.

Concerning the location, the container yard is not allocated just behind the North Wharf and with following reasons:

- Containers for smaller size container vessels at the -7.5m berth will remain by the year of 2015.
- Containers might be transported between the South Wharf and

(Source: Study Team and OCDI)

Figure 2.1.2-3 Proposed Container Yard Location

North Wharf.

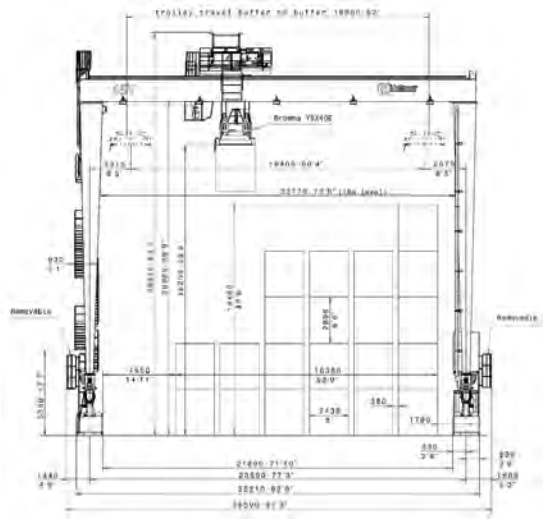
- The yard harmonizes the layout of the container yards proposed in Technical Cooperation study.

In planning a container yard to meet increasing number of containers in Nacala Port, the above conditions should be considered. As a result, the container yard is recommended to be located at the area connected with the North Wharf container berth as shown in Figure 2.1.2-3.

Operation using RTGs (Rubber Tired Gantry Crane as shown in Figure 2.1.2-4) in the yard is recommended as the most appropriate handling system, which will be applied to the yard system implemented with foreign finance.

In the period of 2015 to 2017 after the completion of this project, two South Wharf berths are expected to be serviceable for larger container and bulk cargo carriers in 2016 when Vale Lda. will have left the South Wharf and the North Wharf will also render operation services to vessels suitable for the water depth. This situation is already shown in Table 2.1.2-3.

The North Wharf yard except the yard under the Grant Aid will also become serviceable after 2016 with provision of loan finance. The container yard provided in the North Wharf as above will overall improve capacity of handling containers.



(Source: Manufacturer's catalogue)

Figure 2.1.2-4 RTG Profile

With introduction of RTGs the yard capacity increase and minimize its area in the limited port area due to higher stacking of containers. The introduction, which promotes systematic stacking, will induce efficient yard management.

(5) Facilities for Firefighting and Safe Cargo Handling

Nacala Port has a very important role as the only supply base of fuel and cooking oil to northern provinces in Mozambique. However, the existing cargo handling equipment for such liquid bulk cargo and firefighting facility at the wharf are in extremely poor conditions and strong requests from shipping companies are submitted to the Government to urgently improve necessary facilities.

1) Firefighting System

Nacala Port has no firefighting system for ship fire permanently installed at the wharf but the firefighting system is adapted by a chemical fire engine standing-by from arrival to departure of a tanker. This situation is shown below.

(Fire engine and extinguishing agent tank) (Mobile monitor)

Figure 2.1.2-5 Present Firefighting System in Liquid Bulk Berth

The above firefighting equipment for the oil berth is extremely poor and the corresponding capability to the fire of 50,000 DWT class large size tankers is inadequate. As the existing firefighting system in Nacala Port is in the situation that does not meet with the international standards of International Maritime Organization (IMO), the reiterated requests from the tanker shipping companies to install the system for meeting the international standards has been made to the Ministry of Energy and CFM.

Ship sizes of tankers calling at Nacala Port have wide variety from the minimum 1,100 DWT to the maximum 50,000 DWT that adjust her draft so as to moor at the -10 m berth. As this maximum size tanker is the same as Maputo Port, the firefighting system is planned to be equivalent with the system in Matola Area of the Maputo Port.

2) Liquid Bulk Handling System

Three types of fuel, gasoline, jet fuel and kerosene and cooking oil are unloaded with using pipes directly connected to manifolds of tankers. The existing pipes for 3 fuel types are shown in the figures below.

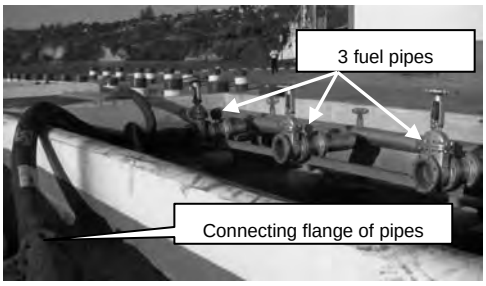


Figure 2.1.2-6 Pipes for handling liquid bulk

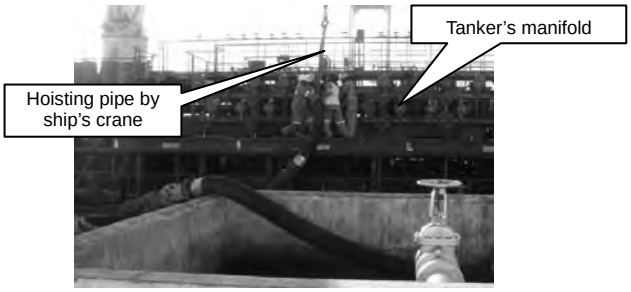


Figure 2.1.2-7 Connecting Pipes with Manifolds

The handling system is always fraught with risks of leakage/dispersion of oil from the connecting part of pipes and the same risks of residual oil from the pipes on completion of handling. Connecting pipes with manifolds takes long time by manpower. Tanker shipping companies expresses their strong complains for the unsafe and inefficient working conditions to

Figure 2.1.2-8 Handling System at Matola

Ministry of Energy and CFM. It is considered that this handling system is necessary to be urgently improved.

Effective handling fuel is basically made with using loading/unloading arms as shown in Figure 2.1.2-8. In terms of the system for handling liquid bulk cargo, the Project concentrates provision of loading/unloading arms only for fuel, while CFM expected to provide the system for cooking oil with its own finance.

(6) Basic Concept for the Rehabilitation of Nacala Port in this Project

This project is placed as the first step of the Short-term Development Plan of Nacala Port aiming at mitigating the shortage of port facilities caused by the situation change of Nacala Port. This project aims at urgent rehabilitation of the facilities in Nacala Port as described above.

The basic concept of the rehabilitation plan is shown overleaf.

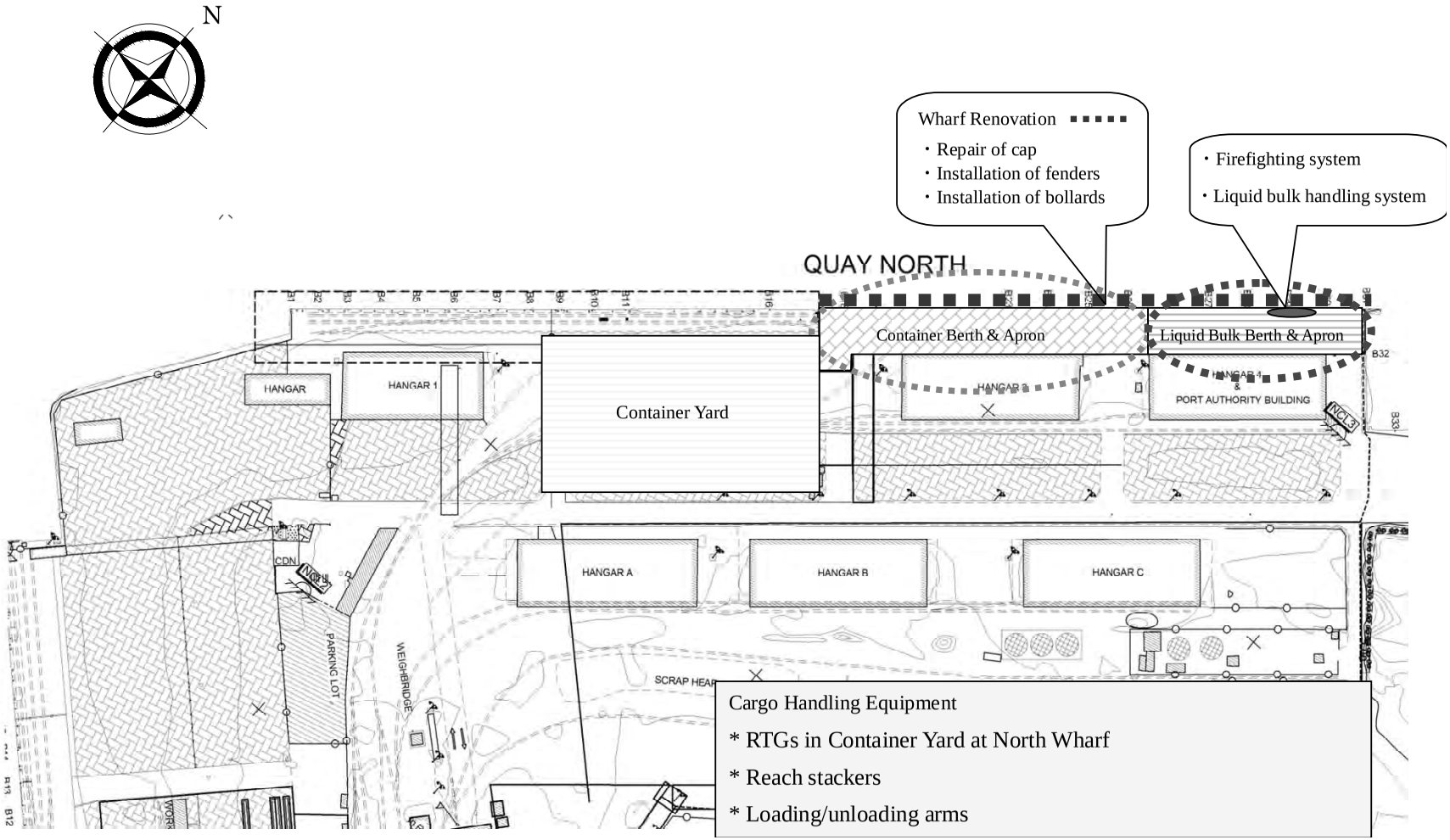


Figure 2.1.2-9 Basic Concept of North Wharf Rehabilitation Plan

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

As the first step of Short-term Development Plan targeted for the year of 2020, the port facilities that are urgently required shall be rehabilitated in this project in order to cope with the drastic change of the port situation. The subject facilities are the rehabilitation of the North Wharf berths, the apron and the construction of the container yard in North Wharf, and procurement of reach stackers and RTGs as port cargo handling equipment.

Considering knowledge and information obtained through the site survey and the discussion results with the Government of Mozambique, this project is made up based on the following policies.

(2) Maintenance Operation of Liquid Bulk Facilities

It is necessary to maintain the function even during rehabilitation work period of North Wharf since the liquid bulk facility located at the north end of North Wharf is the base of fuel loading for Northern provinces in Mozambique. Therefore, in this project, sections with the oil berth part (120m) and the container berth part (190m) shall be separated for smooth implementation of construction works. Liquid bulk cargo handling facility will be relocated temporarily to the container berth part before the rehabilitation works of the existing oil berth for securing the fuel handling function. The rehabilitation works of the existing oil berth, thus, can be done safely with this facility relocation. After the rehabilitation, the temporary facility shall be removed to handle fuel cargoes at the original place, conditioning confirmation of the safe operation. On that basis, the rehabilitation works for the container berth part shall be commenced.

(3) Policy for Natural Conditions

1) Temperature

The average annual temperature is more or less 25℃ but the maximum temperature from September to May is about 30℃. In case of casting concrete, quality control of the concrete should be made with considering air temperature against wet conditions at its casting place and wet curing.

2) Precipitation

Influence such as the work stoppage by rainfall is considered to be minor. However, in the rainy season from December to April, the hourly rainfalls over 50mm were recorded. Therefore, the drainage plan of apron and yard shall not be too big facility as a whole and, at the same time shall study the plan for securing necessary drainage capacity.

(4) Policy for Social Economic Conditions

The prices of construction material and charter fees of machinery have been hiked and its

tendency is generally observed in Mozambique especially in 2012 and it is necessary to make the procurement plan considering these situations.

(5) Policy on Construction Business Situation

1) Design Standard

As it is confirmed at the time of F/S stage, Design Standard (design procedure) for port and harbor structures in Mozambique is not established. Therefore, the design for the port facilities shall be made in accordance with “Technical Standards and Commentaries for Port and Harbor Facilities in Japan” in this project.

2) Construction Business Situation

a) Construction Company

Construction companies holding capability of high quality control are not existed around Nacala Port. There are overseas affiliated construction companies or the branches from Portugal and South Africa in Maputo and these companies are considered to be utilized as sub-contractors of a Japanese construction company without any technical problems.

b) Labor

It is possible to employ skilled workers and general workers in Mozambique. Engineers or foremen are procured from South Africa and Portugal. In this project, under water work is partly necessary for the rehabilitation works of north wharf and these works require skilled technician (diver) who knows the port construction works to be dispatched.

c) Construction Machine

There is no market to purchase construction machinery in Nacala to be sufficiently used for the project. It is also necessary to study the procurement from neighboring countries or Japan upon the price or the use frequency.

d) Construction Material

There is no commercial ready-mixed concrete plant around Nacala Port and the installation of such concrete plant shall be inevitable for this project. And as this area is generally short of water, a desalination plant shall be installed for the stable supply of ready-mixed concrete. Aggregate will be purchased from a quarry in production for the located around 100km from Nacala. Other material will be bought from the market where cheapest material will be available among Mozambique, Japan, and the third countries. Interlocking blocks can be purchased from the manufacturer in Nacala.

Material for port such as fenders and bollards shall be procured from Japan considering the procurement merit and the quality.

e) Disposal Area

As the separation of general waste and industrial waste is not done, all the waste shall be disposed to the disposal area designated by the Nacala Municipal Government located 20km from Nacala Port.

3) Policy on Design of Facilities, Equipment, etc.

a) Renovation of Wharf

As the cap concrete berth structure is heavily deteriorated, the parts are chipped and concrete is newly cast. Locations of fenders and bollards will be determined based on the sizes of design vessels.

b) Apron

Settlement that is considered to be caused by fillings' outflow between the structure of concrete blocks is caused on the apron pavement. The type of pavement shall be selected considering the future maintenance works.

c) Container Yard

The pavement shall be done basically for the cargo handling method by RTG but at the same time, the pavement to be also used by reach stacker in south berth shall be considered. Drainage facilities for rainwater shall be installed at RTG passage and edge of the yard.

d) Water Supply Facility

Water taps will be installed in the cap concrete supplying water to ships. The two taps will be supplied for the container berth and liquid bulk berth respectively.

e) Lighting Facility

Lighting facility in the yard will not be included in this project because of availability of the existing lighting towers. The existing electric transformer station shall be relocated by the recipient side since it will be the obstacle for container handling. (as described in MD)

4) Policy on Construction Method and Period

a) Rehabilitation Plan of Existing Port Facilities

Design and construction plans for the project shall be formulated so as to minimize the influence to cargo handling operation. In order to control the influence to cargo handling operation, the facilities shall be handed over to the Client with the partial completion to the extent possible.

b) Cost Reduction and Maintenance of Quality

- Maintaining quality shall be the biggest target. Maintaining assured quality of structures and procurement equipment, the reduction of the total project cost shall be made with the avoidance of accident, reduction of initial maintenance cost and prevention of claim.
- Feasible plan and design shall be made considering the procurement merits and the cost comparing the procurements from the local market, the third countries and/or Japan.
- Plan and design shall be made meeting with the present situations, environments and conditions of the project site. Minimal scale and content in consideration of specific conditions and situations of the project site shall be made and the quality required as Japan's ODA shall be secured.

2-2-2 Basic Plan (Facility Plan/Equipment Plan)

(1) Berth Utilization Plan (Study on berth occupancy ratio)

In case of using the part of the North Wharf as a container berth, the situations of number of berthing ships and capacity of the container handling capability at the berth shall be evaluated based on the records of calling vessels in 2011. According to the annual report of CDN, about 89,700 TEU have been handled by 156 calls of ships in 2011. On the other hand, data per individual vessel that shows to handle about 88,900 TEU by 154 calls has been clarified according to the seaside operation record of CDN. The difference seems to be caused by miss-recording of one or two call(s). The examination on the subject is based on the latter individual data, which seems to show the real operation.

Tables 2.2.1-2 and 2.2.1-4 show the number of ship calls in a year and the hours to be berthed at the berth. Based on these tables, berth occupancy time for each berth is calculated. Berthing time of container vessels is made up with the following each category.

・A: Container vessel (arrival draft more than 9.2m: only south wharf can be used)
・B: Container vessel (arrival draft below 9.2m to 6.7m: -10m north wharf can be properly used)
・C: Container vessel (arrival draft less than 6.7m: -7.5m north wharf can be used)

The function of each wharf berth as described previously, considering the consistency with the short-term rehabilitation plan shall be planned as follows,

Table 2.2.21 Function Assignment of Nacala Port Berth

Berth		Function Assignment
1	Rehabilitating -10m berth in north wharf (1)	Container Cargo
2	-15m berth in south wharf	Container and Bulk Cargo
3	-7.5 m berth in north wharf	Bulk Cargo (only for small ships)
4	-10m berth in north wharf (2)	Liquid bulk cargo

(Source: Study Team)

Concerning the utilization of the north wharf container berth, the number of container vessel

to be almost equivalent TEU with stacking capacity of the north wharf container yard that will be explained later will be calculated since the examination aims at understanding the current capacity. Two berths are available in the south wharf as Vale Lda. leaves the South Wharf, and -7.5m berth in north wharf can be used only by small bulk cargo vessels.

Under these situations, the berth occupancy of container berth-I can be calculated as per below table, which shows 63 container vessels are able to berth.

Table 2.2.2-2 Berth Occupancy of -10m berth in north wharf

	Berthing Hour	Number of Vessel	TEU
Container vessel B	4,246	63	36,603
Total	4,246	63	36,603
Berth Occupancy Ratio	49%		

(Source: Made by Study Team).

And, the berth occupancy ration of the South Wharf berth (2 berths freely available) to be used by large container vessels and bulk carriers and the one of -7.5m berth of the North Wharf by bulk carrier are shown below in case that the above 63 comparatively small container vessels use the North Wharf berth.

Table 2.2.2-3 Berth Occupancy Ration of South Wharf (2 berths)

	Berthing Hours	Number of Vessel	TEU
Container vessel A	2,848	45	2,7060
Container vessel B	2,494	37	21,497
Bulk Carrier	3,029	35	
Total		124	48,557
Berth Occupancy	48%		

(Source: Made by Study Team)

Table 2.2.2-4 Berth occupancy of -7.5m berth in north wharf

	Berthing Hours	Number of Vessel	TEU
Bulk Carrier	2,110	6	
Container vessel C	542	9	3,797
Total	2,652	15	3,797
Berth occupancy	30%		

(Source: Made by Study Team)

And, present bulk cargo handled at -7.5 m berth of north wharf is considered to be handled at the South Wharf berth when -14m berth construction is newly made.

With the above study results, the number of container handling at the berth shall be about 36,000 TEU if 49% of berth occupancy is secured at the -10m container berth of North Wharf and the berth occupancy ratio of the South Wharf shall be about 51%. Considering the cargo handling volume at the berth, it is considered to be corresponded to the future increase of cargo volume to some extent.

However, in case of handling 170,000 TEU that is predicted value of containers handled in the year of 2018, considerable congestion is predicted also in the South Wharf berth even if the new container yard in the North Wharf is efficiently utilized as much as possible. It is required to make use of the South and North Wharves even if increase of waiting time for berth takes place in the port, since the construction of insufficient berth is not made for maximum 2 years by the completion of a new -14m container berth under the situation of limitation for larger container vessels berthing at -10m North Wharf.

(2) Basic Plan for rehabilitation of north wharf berth

1) Design conditions

Liquid Bulk Berth

1) Berth specification	Crown height	+ 5.80 m
	Planning depth	10.0 m
2) Design conditions	Maximum design ship（Tanker）	LOA：166m
		Maximum draft：9.3m
		DWT：20,000 tons
	Minimum design ship（Tanker）	LOA：63m
		Maximum draft：4.0m
		DWT：1,000 tons
	Tractive force（Bollard）	700kN
	Berthing velocity	0.1 m/sec
	Maximum gross tonnage	10,700 tons
3) Natural condition	Tide	MHWS:+3.88m, MLWS:+0.62m
	Maximum wind velocity	S 5.0～7.5m/sec

(Source: Study Team)

Container Berth

1) Berth specification	Crown height	+ 5.8 m
	Planning depth	10.0 m
2) Design condition	Maximum design ship （Container ship）	LOA：160m
		Maximum draft：9.0m
		DWT：15,000 tons
	Minimum design depth （Container ship）	LOA：139m
		Maximum draft：7.9m
		DWT：10,000 tons
	Tractive force（Bollard）	700kN
	Berthing velocity	0.1 m/sec
	Maximum gross tonnage	13,230 tons
3) Natural condition	Tide	MHWS:+3.88m, MLWS:+0.62m
	Maximum wind velocity	S 5.0～7.5m/sec

(Source：Study Team)

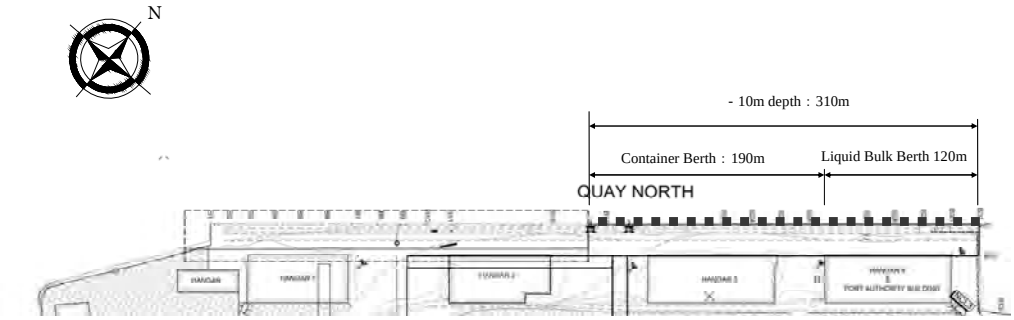
2) Rehabilitation Area and Structural Plan

a) Rehabilitation Area

As described in the basic concept of project, the facility of the North Wharf in the northern section of 310m, where water depth maintains -10m, is deteriorated seriously. The F/S report

highlights requirements of its rehabilitation for safe berthing and cargo handling of vessels. In the present situation the North Wharf berth must be utilized as a container handling berth, in addition to the above.

Essentially the North Wharf berth serves handling of liquid bulk cargoes, however, the project covers the renovation of the 120m section as the minimum necessary length for handling liquid bulk handling and of remaining the 190m section for handling containers.



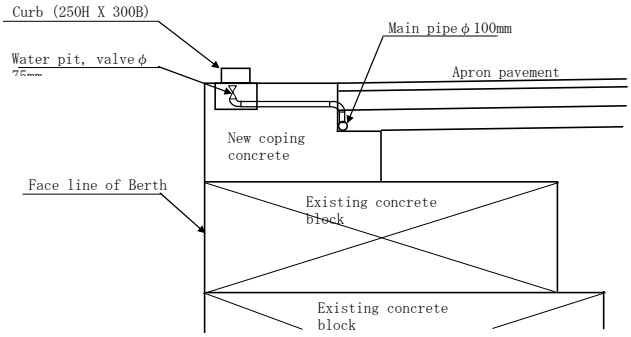
(Source: Study Team)

Figure 2.2.2-1 Function wise application of -10m berth in north wharf

b) Structural Plan

Coping concrete will be replaced by new concrete blocks due to deterioration of the concrete and new bollards, fenders and water supply pits on the coping concrete will be provided. Cylinder type fenders have been chosen considering the maximum and minimum target vessels, condition of concrete block berths, tidal change and maintenance of the fenders.

Foundation of bollards, loading arms and foam monitoring are recommended to be of the gravity type because of the difficulty of piling work due to back fill stones behind the concrete block berth. Water pits including gate valves and water meters will be provided on the coping concrete.



(Source: Study Team)

Figure 2.2.2-2 Improved Cap Structure of North Wharf

(3) Design Concept of Pavement of North Wharf Apron

1) Design Conditions

Liquid Bulk Berth

1) Berth specification	Crown height	+ 5.8 m
	Planning depth	10.0 m
2) Design condition	Maximum design ship （General cargo）	LOA：148m
		Maximum draft：9.2m
		DWT：15,000 tons
	Maximum design ship（Tanker）	LOA：166m
		Maximum draft：9.3m
		DWT：20,000 tons
	Tractor trailer	35,570 kg
	Forklift	10t
3) Natural condition	Design CBR	More than 10
	K_{30} at sub-grade	More than 70

(Source：Study Team)

Container Berth

1) Berth specification	Crown height	+ 5.8 m
	Planning depth	10.0 m
2) Design condition	Maximum design ship（Container）	LOA：160m
		Maximum draft：9.0m
		DWT：15,000 tons
	Tractor and trailer	35,570 kg
	Reach stocker	Lifting load 45t
3) Natural condition	Design CBR	More than 10
	K_{30} at sub-grade	More than 70

(Source：Study Team)

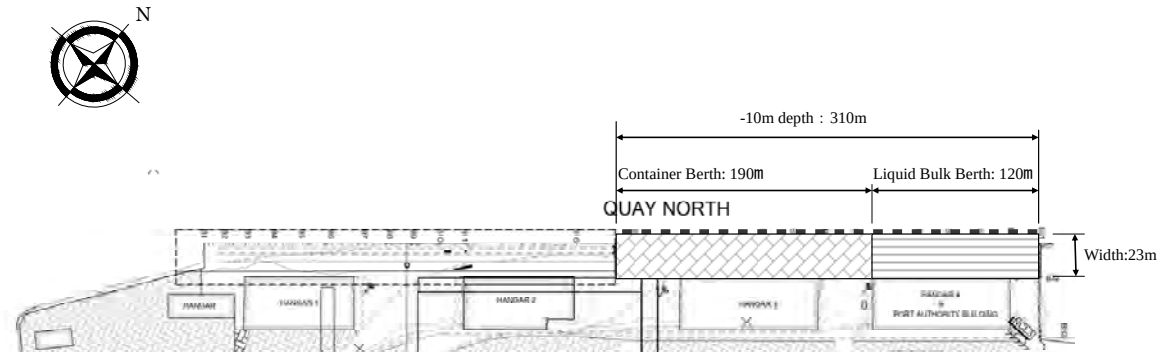
2) Study for Rehabilitation Area and the Rehabilitation Structural Plan

a) Rehabilitation Area

The rehabilitation of the facilities is considered to be inextricably linked with the berth rehabilitation stated above. The North Wharf berth shall be basically divided into the two functions of the container terminal and the liquid bulk terminal. The two different functions require different design concept of the respective pavement.

As described previously, the liquid bulk berth of 120m portion from north edge is located in the North Wharf, while remaining 190m portion is just connected the above berth. The aprons for the two functions are located as shown in Figure 2.2.2-3.

Aprons for container yard usually need the width from 25 m to 40m. As containers will be handled in the apron with ship’s gears and reach stackers, the apron width of 23m, which is width between the wharf face line and the warehouse, seems to be the minimum width for the use. Therefore, traffic of containers on the trailers should move along the one-way to be designated in the apron under operation using reach stackers.



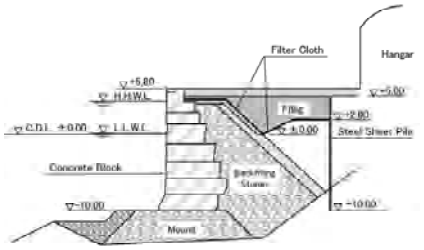
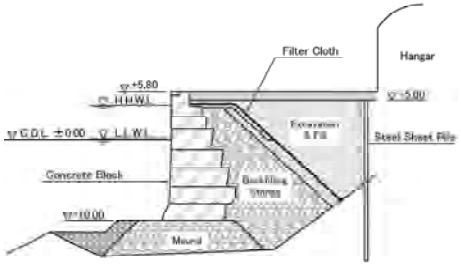
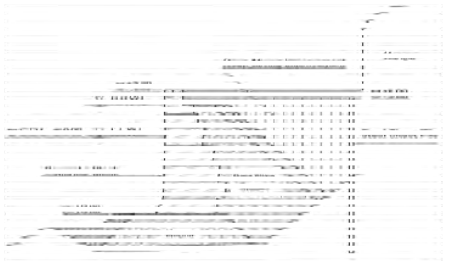
(Source: Study Team)

Figure 2.2.2-3 North Wharf Apron Pavement Area

b) Structural Planning

Improvement area of the apron in front of the warehouse at the container berth and liquid berth is 310 meters long and 23 meters wide. The slope of the apron is single drain from the warehouse to the seaside. Existing train rails will be removed and not provided anymore because they are not to be used in the future. Spots of settlement on the apron pavement are found, which may have occurred due to the discharge of the filling material through the backfilling of the concrete blocks. In order to prevent the settlement, a combination of filter cloth and steel sheet piles is recommended based on the comparative study considering adoptability, construction method, etc. as indicated in table 2.2.2-5. Type of new pavement structure for the apron is interlocking concrete block type considering construction method, maintenance and type of existing pavement as indicated in table 2.2.5-6.

Table 2.2.2-5 Comparison of Countermeasure of Settlement on Apron

Type of structure	Combination of filter cloth and steel sheet pile	Displacement method	Deep mixing method
Section of the improvement			
Concept of improvement method	・Combination of filter cloth and steel sheet pile ◎ ・Filter cloth is installed down to CDL ○ ・Top and bottom elevation of sheet pile are bottom of pavement and rock strata respectively ◎	・Installation of filter cloth on the backfill stone down to -8.0m after excavation of existing ground ○	・ Existing soil is covered with cement stabilizer by high pressure rotation machine and fill with hardener to construct the improved cylindrical solid ground ○ ・To improve sub-soil condition, all of the reclaimed area is improved by deep mixing method ○
	◎	○	○
Construction method	・Excavate down to ±0.0m behind backfill stone and other area is excavated down to +2.0m ○ ・Hydraulic piling machine is used for piling work in order to prevent the damage to warehouse ◎ ・Top portion of sheet pile (+4.0～+2.0m) can be a bulkhead of soil during excavation ○	・Difficulty of underwater excavation due to big tidal range × ・Temporary stock yard is necessary to stock large volume of excavated material × ・Difficulty of compaction for the underwater filling material (Possibility of settlement in future) ×	・Mixing machine will be set after excavation of soil down to bottom of pavement ○ ・Pulling time and number of rotations of nozzle will be adjusted after drilling down to specified elevation and construct solid ground ○ ・Necessity of soil removing after improvement × ・Small size of machine can be used for construction ◎
	○	×	○
Adaptability	・Reliability for all works of excavation, filter cloth installation, piling works ○ ・Economical ◎	・Difficulty of work due to narrow construction site × ・Bulkhead structure is necessary due to adjacent warehouse × ・Relatively economical ○	・Difficulty of construction behind backfill stone due to uneven slope of backfill × ・Necessity of facilities for removed soil × ・Expensive ×
	◎	×	×
Overall evaluation	◎	×	○

Note: ◎Most desirable, ○Desirable, X Least desirable

(Source: Study Team)

Table 2.2.2-6 Comparison of Pavement for Apron

Type of pavement	Interlocking block pavement	Concrete pavement	Asphalt pavement
Features of structure	・This pavement copes with a certain extent of differential settlement of the subgrade ◎ ・Durable for surface abrasion and oil spill ◎ ・Repair of pavement and underground utilities is easy and removed block can be reused ◎ ・Can be placed in service immediately as there is no curing time ○ ・Traveling performance is not good due to noise and vibration by the joints × ・Capable for big intensive contact pressure load ○	・This pavement can not cope with differential settlement due to the bearing capacity of the subgrade × ・Durable for surface abrasion and oil spill ◎ ・Repair of pavement and underground utilities is reconstruction of pavement × ・Can not be placed in immediate service due to curing time × ・Noise and vibration occurrs during high speed traveling × ・Capable for high intensive contact pressure machine and outrigger ○	・This pavement can cope with a certain extent of differential settlement of subgrade. Crack and difference in level are apt to occur. ○ ・Disadvantage for surface abrasion and oil spills × ・Repair of pavement and underground utilities needs asphalt plant × ・Can be placed into immediate service due to very short curing time ○ ・No noise or vibration during high speed traveling ◎ ・The pavement is weak for high intensive contact pressure machines and static load ×
	◎	○	×
Productivity	・In comparison with concrete plant, vibration equipment is added to compress material. ○ ・The material is aggregate, cement and water and it is produced and compressed at normal temperatures. ○ ・Production plant can be located at the site. ◎	・Concrete plant is easy to handle at project site. ◎ ・The material is aggregate, cement and water and it is produced and placed at normal temperatures ◎ ・Production plant can be located at the site. ◎	・Structure and operation is complicated compared with concrete plant due to built in banner and drum in the plant × ・Material is aggregate, asphalt and filler heated to over 150 degrees × ・Plant can not be located at the site × ・There is no available asphalt plant near Nacala port ×
	◎	◎	×
Workmanship	・Effective construction can be done by mechanized construction for large pavement area but it is a manual operation for the small areas ○ ・Compaction of block is required to level the surface of pavement and fill sand and it's compaction ○ ・Lean concrete shall be placed under ICB block ○ ・There are comparatively less problems in construction supervision of developing country ◎	・Effective construction can be done by mechanized construction for large pavement area but it is a manual operation for the small areas ○ ・It is possible to balance between curing period and construction period by conducting staggered construction method. ○ ・There are comparatively fewer problems in construction supervision of developing country ◎	・Certain degree of mechanized construction is necessary for large or small pavement areas ○ ・It is flexible to execute the progress construction step by step. ◎ ・Construction supervision is complicated due to treatment of coating of each layer, temperature control, Marshall stability test and weather control ×
	◎	◎	×
Maintenance and management	・Repair is easy because all of the existing container yard is ICB pavement. Repair can be done by the direction of the present supervisor. ◎ ・Durability of the block can be improved by high strength specification and thicker blocks. Surface abrasion resistance is very high. ◎ ・Removed blocks can be reused for repair. ◎	・Durability of concrete slab is high and expected life time of concrete pavement is long. ◎ ・Surface abrasion resistance is high and is tough against damages by containers. ◎ ・Removed base course can be reused but concrete pavement shall be placing again. ×	・Duration of life time is short and high frequency of repair is required. Repair is easy if asphalt plant is nearby. × ・It is weak for static load with high contact pressure or load repeatedly passing through same point. Deformaties and ruts are easily generated. × ・It is easy to be deteriorated by oil and heat so it is not usable at the place where oil leakage may occur. ×
	◎	○	×
Possible areas for application	Apron, container yard, harbor road, parking area of airport and sidewalks	Apron, container yard, public road and harbor road	Public road and highway
Overall evaluation	◎	○	×

(Source: Study Team)

(4) Basic Plan of North Wharf Container Yard

1) Design Criteria

Design condition for container yard is as follows,

1. Use condition	RTG (container stacking in 6 rows and 5 tiers)	Span : 23.5m
		Number of wheels: 8
		Wheel pitch: 0m, 2.5m, 3.9m, 2,5m
		Max. wheel load: 35t/wheel
	Tractor Trailer	34,210 kg
	Reach Stacker	Lifting load: 45t
	Container stacking yard	5 tiers（20, 40 ft container）
2. Natural condition	Design CBR	More than 10
	Subgrade with K30 value	More than 70

2) Layout Plan of Container Yard and Pavement Structural Plan

a) Layout of Container Yard

i) Determination of Container Handling Equipment at Yard

In the general condition of the cargo handling system consisting of container transfer by terminal tractors with trailers, the major mechanical and operational particulars are summarized for comparison as follows.

Reach Stacker

- Due to their versatility in operation, the reach stackers are often the best choice for small and medium size container terminals and for multi-purpose terminals. They are a good choice for the operators with less operating skill employed by terminals.
- Their versatility enables various yard/quay operations including stacking in the yard, loading and unloading of the trailers and transloading to the rail etc., and contributes to easy operation work planning.
- The reach stackers can also be used for short distance transportation when necessary, so that no additional equipment including trailer is required in arrangement.
- It enables to undertake dual tasks in parallel e.g. transloading to the trailers and temporal stacking at back reach during cargo operation at quay.
- A storage capacity of approx. 400-500TEU per hectare for 3-high stacking are common figure for this type of yard equipment although the maximum stacking height is 5 high at first row. However, much rehandling/reshuffling is unavoidable.
- The system with reach stackers can comply with change of the yard arrangement/relocation easily without problem.
- For a yard arrangement, the larger space for path and their operation are required. The increase of storage capacity is limited due to no practical increase of stacking height more than 5 high.

RTG

- RTG system can increase the storage capacity easily by high stacking density under limited space requirement but the effective yard storage management is required.
- As indicative guidance based on practical experience, the storage capacity of the yard is

approx.1000TEU per hectare with 4 high stacking.

- RTG yard is basically designed for effective usage of RTG. RTG can be mobilized between RTG yards.
- High productivity can be achieved in transloading to the trailers, subject to appropriate stacking allocation of the containers.
- There are several options to determine a type of RTG among automated equipment, hybrid and electric driven. The environmental friendly equipment are available.

For comparison of reach stacker yard and RTG yard, the calculation of storage capacity based on the same space is shown for general information as below.

Table 2.2.2-7 Capacity Calculation by Type of Equipment

Operation Type	Yard Space (ha)	Storage Space (m2)	No. of Bay	No.of Raw	Stacking Height	No. of Block	Yard Capacity (TEU)
RTG	1.3ha	8,250	22	6	4	2	1,056
Reach Stacker	1.3ha	3,168	27	2	3	4	648

(source：the study team)

The reach stacker yard requires the lager path and operating area so that the equipment can handle the containers easily and safely. Instead, the case of RTG yard can minimize the running space for the trailers and maximize the storage space within the limited yard space. As shown in the above calculation, RTG yard has advantage to the reach stacker yard in view of the storage capacity within the same space.

ii) Layout of Container Yard

As described above, the efficient operation of handling containers in the limited yard area can be made done with using RTGs. The project targets provision of RTGs in the new container yard. The target is determined with consideration of the scale of the yard area in the North Wharf and future provision of RTG yards in the Short-term Development Plan for the year 2020.

The rehabilitation project under the Grant Aid aims at provision of the yard capacity meeting the cargo volume of 170,000 TEUs forecasted for the year 2017.

Layout and capacity of container yard are discussed below for handling containers for the target year 2017.

ii-1) Location of Container Yard

The container yard provided in the project is positioned at the first stage of total Urgent Rehabilitation Project. It urges the yard to be located in the RTG yard at the backside of the North Wharf considering the consistency with the Short-term Development Plan.

On the basis of this basic policy, the container yard in this project shall be located in the container yard to be proposed at the Short-term Development Plan. The location is determined with

consideration of the following reasons.

- It is located at relatively short distance from the -10m berth of the North Wharf and the south wharf that is the existing container wharf as well.
- A construction period will be longer due to the congestion of apron pavement works and yard pavement works in case that the location be backside of -10m berth of north wharf.
- It is necessary to avoid the unnecessary external force by pavement works, since there lie anchor and tie wires to support the vulnerable wharf structure buried under the ground of the southern part of the North Wharf. Therefore, the yard construction works are not desirable at the area.

(Source: Study Team)

Figure 2.2.2-4 Location of proposed container yard

With the above result, the container yard in this project will be located around center of container yard in the Short-term Development Plan as shown in the above figure.

ii-2) Capacity of Container Yard

[Capacity of Existing Container Yard]

Dwell time of container at the container yard in Nacala Port is about 9 days according to the hearing survey from CDN, while 8.55 days in average are confirmed by the study team. The dwell time of 8.55 days is applied to the planning of the yard in the project.

According to the stacking plan in container yard made by CDN, the ground slots of container yard in the existing South Wharf is 1,353 TEUs and stacking capacity is 3,867 TEUs and the calculation process is shown in Table 2.2.2-8.

Table 2.2.2-8 Container stack capacity at south wharf

Containers		Ground slots	Stacking height	Running max. height	Stacking capacity
Laden containers	Import containers	256	3	2.25	576
	Import ocerspill	72	3	3	216
	Export container & prestacking loading	428	3	3	1,284
	Reefers	45	3	3	135
	Dangerous containers	12	3	3	36
	Transit import & prestacking for rail	192	3	3	576
	Subtotal for laden containers	**1,005**			**2,823**
Empty containers	AO01 - AO06	192	4	3	576
	9L01 - 9L07	121	4	3	363
	AR01 - AR15	35	4	3	105
	Subtotal for empty containers	**348**			**1,044**
	TOTAL	**1,353**			**3,867**

(Source: OCDI from CDN data)

The container yard capacity of the South Wharf is calculated with the following formula.

South Wharf yard capacity = (Yard stacking capacity) ÷ (Peak Factor × Reserve capacity) × (rate of rotation: 364 ÷ average dwell time)

Where,

Peak Factor: 1.2

Reserve Capacity: 1+0.1= 1.1

Average detention days: 8.55 days

With the above, the south wharf yard capacity shall be 124,720 TEUs.

South Wharf Yard Capacity=3,867÷(1.2×1.1)×364÷8.55=124,720（TEUs）

[Necessary Capacity of Container Yard in the Project]

As described previously, the container yard to be planned at the backside of north wharf is also a part of short-term development plan (OCDI is now under amending in Technical Cooperation Study) proposed by F/S Report and the scale to consider the urgency that handle container cargo by the rehabilitation works with the loan agreement in 2017.

According to the amendment of Short-term Development Plan by the Technical Cooperation Study, the construction of RTG yard is planned on land parallel to the container yard of this project, and the scale of a lane is obtained with the calculation in TEUs; 22 bays x 6 rows = 132 ground slots. The yard in the project is planned to be two lanes referring to the lane scale and the location stated in the Short-term Development Plan. The stacking height (container tier) will be 5 tiers, however, as the necessity of securing space for 4 containers at the 5th tiers operationally in order to remove containers from lower tiers and its re-handling, stacking height in average shall be planned as 4.33 tiers. This yard plan has been confirmed as the area to secure the maximum yard scale to be used

in this land.

Yard stacking capacity meeting the number of ground slots of RTG yard previously described is necessary, in order to obtain yard capacity for handling this number of containers in this yard.

The total ground slots are 132 x 2 = 264 for the RTG yard with 2 lanes in this yard and the yard stacking capacity shall be;

264 x 4.33 ＝ 1,143（TEU）

Therefore, RTG yard stacking capacity shall be;

RTG yard stacking capacity=1,143÷(1.2×1.1)×364÷8.55＝36,870（TEU）…(A)

While, as shown in Table 2.1.2-3, the container volume in 2017 is estimated to be 170,000 TEUs and the new RTG yard should hold the capacity of the difference between the required number and the existing container yard capacity. The difference is shown as below:

170,000 – 124,720 = 45,280 (TEU) …(B)

With this calculation, it is assumed that annually 45,280TEU is estimated to be short from the capacity required for meeting the demand in2017. Since the difference between the shortage of 45,280 TEUs (B) and 36,870 TEUs (A) is 8,410 TEUs, this number of TEUs shows the shortage of the capacity.

As discussed above, even by the construction of RTG yard, the yard capacity will remain insufficient as long as the current container dwell time be not improved.

The above yard capacity seems to be short as the result of calculation based on the number of container as of 2017. With the construction of RTG yards as Urgent Rehabilitation Project under the loan scheme, this shortage of yard capacity is expected to be solved within a very short period of time. As a result of the above discussions, the RTG container yard (1 over 5) is required with two blocks.

Since one-way traffic should be imposed within the yard, a lane between two RTG lanes will be provided for trailers that are unloaded and go directly to consignees. The following figure shows the operation of handling a container under a RTG.

(Source: Manufacturer's website)

Figure 2.2.2-5 Container Handling under RTG

Floor plan of this yard is shown in Figure 2.2.2-6.

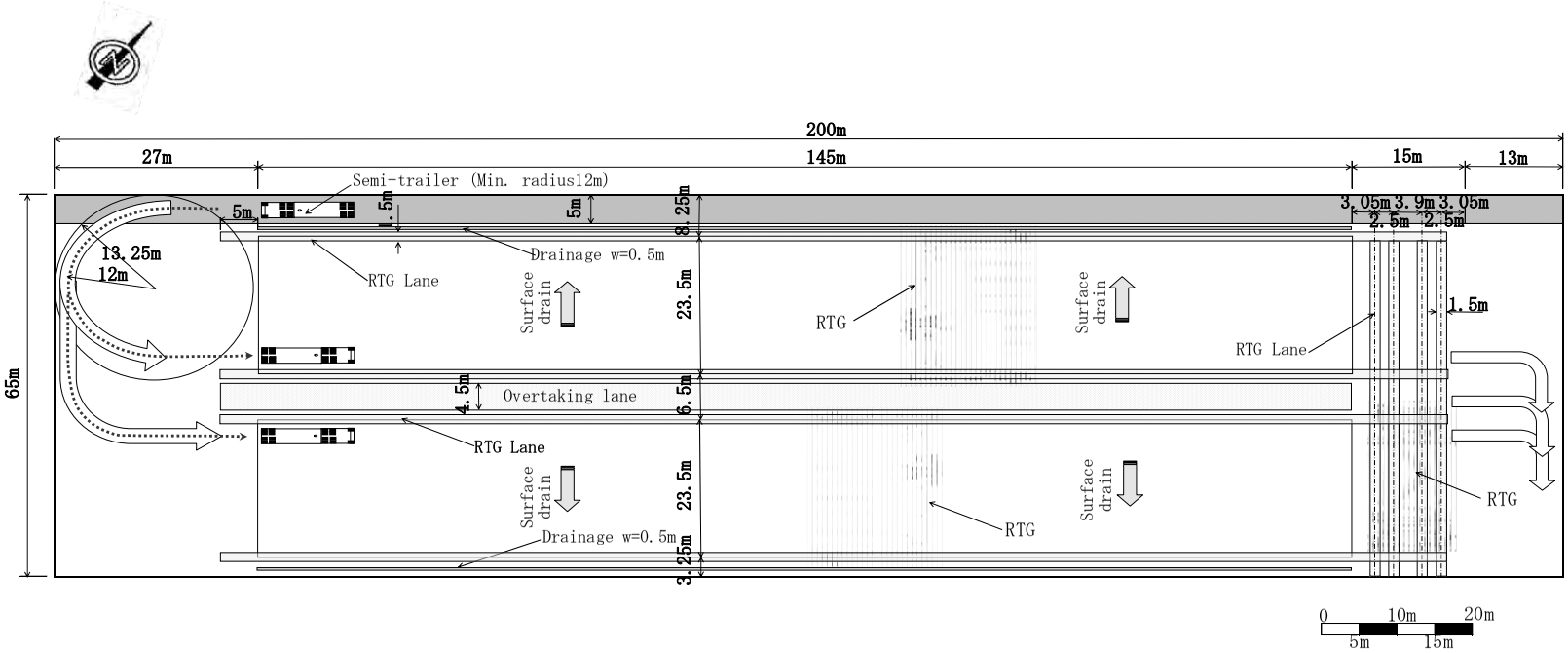


Figure 2.2.2-6 General Plan of RTG Yard

iii) Traffic Flow plan in/around RTG Yard

The container yard in the North Wharf will be located in the area covering the Warehouse No.2. Containers handled at the North Wharf container berth will be moving into/from the yard. A small of number of containers operated at the -7.5m berth in the North Wharf will be handled in the yard until commencement of construction of a new -14m berth. In addition to the above, traffic of small volume of containers from/to the South Wharf yard.

In planning the container yard, a traffic flow of containers by trailers in the port should be clarified in the port area for facilitating a systematic flow of containers moving toward several directions. The traffic flow is proposed as shown in Figure2.2.2-7, and the flow in the figure urges the trailers to keep left. The proposal is made on the basis of the following policy.

North Wharf Area

- A container yard under Grant Aid is formulated considering the yard layout proposed in the loan project. Traffic flows in the container yard in the project should be harmonized with them in the yards to be provided in Urgent Rehabilitation Project under loan schemes. The concept of the yard layout determines the whole traffic flow in the North Wharf. With consideration of the operation at the North Wharf container berth and at -7.5m berth, traffic flows should rotate counterclockwise in the North Wharf area as red arrows show flows in Figure2.2.2-7. Crossing of flows should be avoided in the yard for safe traffic.
- Containers landed at the North Wharf are transferred to the RTG yard and are stacked in the yard from tractor/trailers in the pathway. Tractor/trailers move outside the yard and move counterclockwise toward the North Wharf berth through the path between the Warehouses No.3 and No.4. The operation is repeated as above.
- Containers landed at -7.5m berth along the North Wharf are transferred counterclockwise in the apron. In transporting containers to the yard tractor/trailers enter at the southern end of the yard empty tractor/trailers move outside the yard and toward the North Wharf as stated above.
- Crossing flows at the intersections No.1 and No.2 cannot be avoided in the main in-port road in the North Wharf area. Staff should be stationed at the two points for safe traffic control.

South Wharf Area

- Traffic flows of containers in the area should rotate clockwise as green arrows show in Figure 2.2.2-7. Crossing flows should be avoided also in the area.

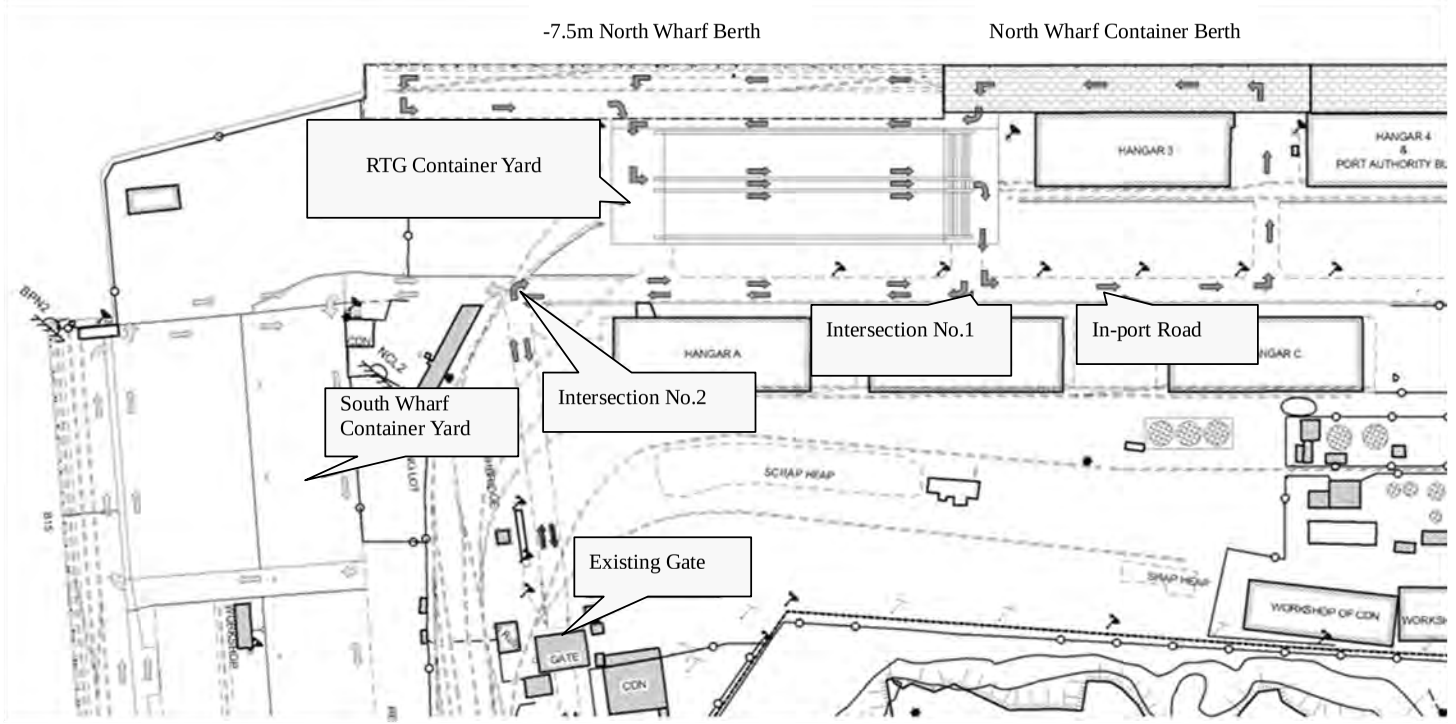


Figure 2.2.2-7 Traffic Flows in Nacala Port

b) Pavement structure

i) Container Stacking Yard

In stacking the containers five high, all the weight of the containers is concentrated at the four corners of ground containers. Conditioning the situation, a comparative study was made for reinforced concrete slab (RC), prestressed concrete slab (PC) and interlocking concrete blocks. RC slabs for ground containers are recommended considering economy, construction procedure and maintenance management as indicated Table 2.2.2-9. Other places in-between except the slabs are of interlocking concrete blocks.

Table 2.2.2-9 Comparative Study for Container Stock Yard Pavement

Type of pavement	Reinforced concrete slab （RC)	Prestressed concrete slab （PC)	Interlocking concrete block
Characteristics of structure	・This structure copes with certain extent of different settlement on the subgrade ◎ ・Durable for surface abrasion and oil split ◎ ・Partial repair of slab is possible, easy and economical ○ ・Curing concrete is necessary at site ○	・This pavement can not cope with a different settlement due to the bearing capacity of subgrade × ・Durable for surface abrasion and oil split ◎ ・Whole slab shall be replaced even partial damage and PC specialist shall supervise PC device and procedure car	・This structure copes with certain extent of different settlement on the subgrade ◎ ・Durable for surface abrasion and oil split ◎ ・Repair of pavement is easy and removed block can be reused ◎ ・No need concrete curing at site ○ ・Not applicable for five hig
	◎	×	×
Productivity	・Concrete plant is easy one to handle at project site. ◎ ・The material is aggregate, cement and water and it is produced in normal temperature ◎ ・Production plant can be located at site. ◎	・Concrete plant is easy one to handle at project site. ◎ ・The material is aggregate, cement and water and it is produced in normal temperature ◎ ・Production plant can be located at site. ◎	・In comparison with concrete plant, pressure structure is included. ○ ・The material is aggregate, cement and water and it is pressed in normal temperature. ○ ・Production plant can be located at site. ◎
	◎	×	○
Workmanship	・Normal concrete work and easy operation ◎ ・There are comparatively less problems in construction supervision of developing country ◎	・Normal concrete work and easy operation ◎ ・Construction of post tension slab needs supervising of specialist because of special work such as sheath setting, steel material, anchoring device, procedure of stressing, grouting, etc. × ・Construction supervi	・Effective construction can be done by mechanized construction for large pavement area but it is manual operation for the small area ○ ・Compaction of block is required to level the surface of pavement and fill sand and it's compaction ○ ・Lean concrete sha
	◎	×	○
Maintenance and management	・Durability of concrete slab is big and expected life time of concrete pavement is long. ◎ ・Surface abrasion resistance is big and is tough against damages by container. ◎ ・Repair is economical because only damaged portion can be repaired. ◎	・Durability of concrete slab is big and expected life time of concrete pavement is long. ◎ ・Surface abrasion resistance is big and is tough against damages by container. ◎ ・Repair is not economical because whole of slab shall be replaced for the partial d	・Repair is easy because all of the existing container yard is ICB pavement. Repair can be done by the direction of present supervisor. ◎ ・Not applicable for five high container stock × ・Removed block for repair can be reused. ◎
	◎	×	×
Overall evaluation	◎	×	×

(Source: Study Team)

ii) Tractor/trailer Marshaling Yard for Containers

Based on the comparative design for concrete pavement, asphalt pavement and interlocking concrete block pavement, interlocking concrete block pavement is recommended taking into consideration the economy of the structure, construction method, maintenance and adaptability to the existing container yard as an apron for the container berth and liquid berth. Refer to Table 2.2.6 Comparison of Pavements for Apron.

iii)RTG Lane

RTG moving lanes shall be provided in order to obtain no settlement and smooth area for movement of RTG. Reinforced concrete slab (RC) is recommended for RTG lane structure based on the comparative study for reinforced concrete slab (RC) and prestressed concrete slab (PC) considering the economy of the structure, construction method and maintenance the same as the container stock yard.

(5) Basic plan for Reach Stackers (R/S)

1) Determination of Number of equipment

a) Study of equipment handling volume

For planning the container handling equipment, the sufficient number of equipment which can handle the volume on the demand forecast of 2017 in Table 2.1.2-2 should be provided in consideration with current cargo handling condition. Based on the current equipment operation data which was collected in the study, the real move volume of the equipment in operation including re-handling is estimated for annual throughput, and the required number of equipment are planned to handle it.

For the forecasted throughput in previous chapter, the container cargo operation will be undertaken at not only South pier but also North pier after 2015. The 72% of total volume will be handled at South pier by the R/S including additional units in this plan. The balance of 28% will be handled at North pier and RTG yard newly built. Therefore, the forecasted real move volume includes the volume of the quay operation at North pier and is estimated except the handling volume at RTG yard.

The required number of equipment is calculated below:

・Throughput Forecast (Box):	Demand Forecast (TEU) x TEU factor (1.2) (Refer to TEU factor in F/S)
・Throughput at South pier (Box):	2012 Throughput Forecast (only at South Wharf) (2015 Throughput Forecast) x 72% (2017 Throughput Forecast) x 72%
・Throughput at North pier (Box)::	(2015 Throughput Forecast) x 28% (2017 Throughput Forecast) x 28%

・Real Move at South pier:: (Throughput at South) x (Re-handling Ratio (5.0))

・Real Move at North pier: (Throughput at North) x (Re-handling Ratio (2.0))
No yard operation by reach stackers but only for the quay operation. Re-handling ratio is specified as 2.0.

・The required Move: Real Move at South and North Wharves

Table2.2.2-10 Required Move of Equipment

	2012	2015	2017
Throughput F'cast（TEU)	90,000	144,000	170,000
TEU Factor	1.2	1.2	1.2
Throughput F'cast（BOX)	75,000	120,000	142,000
Throughput at South Pier（BOX)	75,000	86,000	102,000
Rehandling ratio	5.5	5.5	5.5
Real Move at South Pier	412,500	473,000	561,000
Real Move at North Pier	0	68,000	80,000
Real Move required	412,500	541,000	641,000

(Source: Study Team)

At next, the equipment handling capacity is calculated based on the current operating conditions by CDN. The operating ratio is referred to the equipment operating condition mentioned and specified at 40% except the standstill unit with defects. The handling capacity based on “Move (Box)” is calculated in the cases of the operating units for 10~12 and summarized for comparison.

The calculation formula is shown below:

・Operating Hours: (364 days x 24 hours) x (Operating Ratio (%))

・Handling Capacity (Move): (No of Operating Units) x (Operating Hours) x (Productivity)

Table 2.2.2-11 Handling capacity of equipment

Case	No. of Operating Units	Operating Ratio（%）	Operating Hours (hours/year）	Productivity (Move/hour)	Hnadling Capacity (Move)
Current	7	32	19,600	16	314,000
1	10	40	34,900	16	558,400
2	11	40	38,400	16	614,400
3	12	40	41,900	16	670,400

(Source: Study Team)

It is apparent that the terminal has short capacity on the equipment and that the number of the current working units has difficulty to cope with the required move forecasted in 2012. Under the situation, current defect and standstill units are required to be restored immediately for daily operation in order to increase the handling capacity. After 2015, it is expected that the required move will increase at level of 500,000, which require the units more than 10. In 2017, it is confirmed that the R/S more than 11 units should be provided to hold the handling capacity to cope with the forecasted throughput in comparison with Table 2.2.2-10 and 2.2.2-11.

b) Operational Study

In view of operational tasks of the R/S, it is divided into 3 major operations consisting of the quay operation, yard operation to correspond the quay operation and yard work/marshalling to handle the external trailers. In this section, the requirement of allocation based on operational demand is reviewed and prepared with necessary number of units. It is also considered that the yard work to handle the external trailers has become very busy during a day time due to the gate operating time of only 12hours. So, the study should be proceeded to provide the sufficient number of units to enable to cope with the yard work and quay operation in parallel at peak time.

Until installation of the quay gantry cranes in 2017, the current quay operating method with the ships' cranes and R/Ss will be continued. The current berth productivity is confirmed at 10-16 containers/hour. The terminal currently has operated 2 berths but it will be increased to 3 berths including the north pier.

The operating conditions are set out as follows;

I) TEU factor:	1.2
II) Working days per year:	364 days
III) Working hours per day:	22.5 hours (the quay operation) 12 hours (yard operation to cope with gate operation)
IV) R/S Productivity:	10 boxes / h (the quay operation) 12 boxes / h (yard operation to support the quay operation) 16 boxes/h (yard operation to cope with gate operation)
V) A factor of Required R/Ss for Corresponding quay operation:	0.83 = (Productivity in Quay operation)/ (Support quay operation)
VI) Peak factor (gate processing):	2.1 (Based on the data of gate processing for the peak period in Dec.2011~Jan.2012)

[Allocation of Equipment at Quay]

It is suggested that the productivity of the R/S or toplifter for quay operation is set out at the same figure of ships crane productivity. Currently, one R/S has been capable to handle the quay operation by 2 ships cranes per vessel. It is a basic plan that 2 units are allocated at the south pier in view of 2 vessels alongside the berth in the same time. 3 units are allocated at the south and north piers as the north pier starts cargo operation in 2015 onward.

[Number of Required Equipment at Yard for Corresponding Quay Operation]

A number of the allocated equipment are given by the following formula. In 2015 onward, new RTG yard will be built at the north pier yard and in operation. The working load required for this study is realized as the handling volume by 2 R/Ss allocated at the south pier yard.

Required number = (Allocated number at Quay) x
(A factor of Required R/Ss for corresponding 0.83)

[Number of Required Equipment at Yard for yard work/for the external trailers]

A number of the allocated equipment is given with the following calculation steps.

As recognized that the workload of the required yard operation is equivalent to the processing volume (box) of the gate, the daily volume of the gate processing is calculated based on the throughput forecast.

Yard workload = (Throughput forecast (box))x (Working hours) / year (364 days) x
(Peak factor 2.1)

A number of the required equipment is calculated by the yard workload, productivity and working hours.

A number of the required equipment = (Yard workload)/(Equipment productivity IV)/
(Terminal working hours III)

It is assumed that the yard operation of R/Ss or toplifters is required only at the south pier yard after 2015 as the cargoes handled at the north pier are stored at new RTG yard. Therefore, the handling volume at the south pier yard is suggested to be the cargo volume handled at the south pier which is 72% of the terminal throughput.

As mentioned in the equipment working condition, the allocated equipment is technically unavailable due to maintenance and repair and standstill at the ratio of 32% in average for total hours. Therefore, total number of the units provided under this study is calculated with consideration of the balance of 68% as the technically available ratio for operation.

Table 2.2.2-12 A number of required reach stackers

Year	2012	2015	2017
Throughput Forecast（TEU)	90,000	144,000	170,000
Throughput Forecast（Box)	75,000	120,000	141,700
Throughput Forecast at South Pier（Box)	54,000	86,400	102,000
Allocation of R/S at North/South Piers (Unit) (1)	2	3	3
Allocation at Yard for Quay Operation (Unit)	1.7	1.7	1.7
Number of Units required （2）	2	2	2
Allocation at Yard for Handling External Trailers (Unit)	2.08	2.4	2.83
Number of Units required （3）	3	3	3
Total (1)+(2)+(3)	7	8	8
Technical Available Ratio except maintenance/repair（%)	68	68	68
Total Number of Unit required	-	12	12

(Source: Study Team)

It is confirmed that the operational study derives 12 units in 2017 for the required number of equipment, which is similar to the outcome of the study of equipment handling volume.

c) Determination of a number of equipment

As a result of the above 2 kinds of the study i.e. equipment handling volume and operation, it is suggested that 12 units of the R/Ss should be provided in order to handle the throughput forecast in 2017. In respect of the equipment type, the R/S is recommendable in view of operational mobility and flexibility and is able to perform the various operation requirements of the terminal.

As the current terminal has operated 8 units, additional 4 units of the R/Ss are required for meeting the demand of handled containers. Since the shortage of handling capacity is expected to be revealed until the completion of the project, it is recommended that CDN purchases two reach stackers in advance for smooth operation of containers. As a result, the remaining two reach stackers will be provided in the project.

2) Equipment Specifications Required

The terminal currently has operated the equipment manufactured by European makers of Kalmar and Konecranes-SMV. Additional equipment supplied by this project should have similar specification with the lifting capacity 45ton / 5 high stacking.

Required Specification		
1	Handling Capacity	
	(1) Lifting Capacity (1st/2nd/3rd Row)	45,000kg / 27,000kg / 14,000kg
	(2) The load center distance from tire face	1,965mm / 3,810mm / 6,300mm ±
	(3) Stacking Capacity (height)	5-high: 15,000mm ± /4-high: 13,300mm ± 3-high: 10,500mm ±
2	Service Weight	Less than 71,000kg
3	Overall Length (Boom retracted)	Less than 12,500mm
4	Height to Top of boom	Less than 19,000mm
5	Width	less than 4,500mm
6	Lifting speed (load / No load)	230mm/s, 380mm/s or higher
7	Travel Speed (Max.)(load / No load)	25km/h(No load) / 20km/h (Load) or higher
8	Turn Radius outer (20')	9,150mm or less
9	Wheelbase	More than 6,000mm
10	Tread (Front/Rear)	3,030-3,500mm/2,600-3000mm
11	Min.Height from ground	More than 250mm
12	Engine	
	(1)Type	Diesel/4-stroke, water-cooled, Turbocharger
	(2)Rated Power	More than 240kW
	(3)Cooling System (brake, engine)	Special cooling system for heat area with Brake oil cooler, additional water cooling system
13	Electric system	24VDC
14	Fuel Tank	More than 500L
15	Transmission	Torque convertor / Powershift with Forward/Reverse 4/4
16	Steering/Braking System	Servo assisted. Wet disc brakes system
17	Cabin	Air conditioned
18	Wheels (Front / Rear)	4×18.00-25-40PR/2×18.00-25-40PR as standard
19	Spreader	
	(1) Max. Side shift	±800mm
	(2) Attachment Rotation (CW/CCW)	CW 185° /CCW 95～105°
	(3) Width(20'/40')	6.050mm + /12,150mm +
20	Safety Device	Engine/Hydraulic overload alarming/cut-off system, Defect/fault warning System
21	Accessories	
	(1) Seat	Adjustable suspension system with a seat belt
	(2) Key	Same key for door and engine
	(3) Instrument/Display	Operating information incl.Fuel,Temparature,unning Hours, Back alarm, warning message with error code, Hours meter etc.
	(4) Light	Head Front, Rear, Working lights at Boom, Spreader and each side
	(5) Rearview Mirror	Right and left
	(6) Operating Manual	5 each of English / Portuguese versions
	(7) Maintenance Manual	5 each of English / Portuguese versions
	(8) Spare Parts Catalogue	5 each of English / Portuguese versions

(Source: Study Team)

3) Maintenance Management of New Equipment

In introduction of new equipment, there are some key items to enable to process maintenance properly without unnecessary standstill and theses should be in consideration after review.

* Prior to delivery, the responsible chief of operators and mechanic to update the equipment knowledge/ technical information and to improve the skill through the training organized by the manufacturer so that the possible causes of the standstill can be minimized. Unsafe and overload operation to be prevented in operation definitely.

* The guarantee engineer to be arranged to station at the terminal for 3 months after delivery for ensuring commissioning.

* The sufficient spare parts to be supplied in delivery to prevent stoppage of operation due to current shortage of necessary parts for replacement/repair. The spare parts supplied to include the following items.

- Fuel pump assembly	1 full set
- Battery	1 set
- Alternator assembly	1 set
- Twist-lock pin set (4 twist locks)	2 sets
- Accumulator assembly	1 set
- Hydraulic pump assembly	1 set
- Hydraulic horse (full set)	1 set

* For procurement of spare parts after delivery, the special price and stocking at the nearest supply point to be negotiated based on direct purchase from the manufacturer so that the immediate delivery of spare parts should be prepared for replacement when necessary.
* The lead time of procurement for necessary parts to be shortened for payment approval process in CDN.

(6) Basic Plan for RTG

1) Determination of Number of equipment

It is confirmed that the RTG yard is designed newly at the north pier yard in order to maximize the stacking height and increase the storage capacity. After the quay operation for container ships starts in 2015, all containers discharged/loaded at the north pier will be stored at the north pier yard in view of new yard capacity. The allocation of RTG will be determined based on the throughput in the throughput forecast at the north pier.

The required number of equipment is calculated in the following formula.

Throughput Forecast (Box):	Throughput forecast (TEU) x TEU factor (1.2) (TEU factor given by F/S)
Throughput Forecast at South pier (Box):	(2015 Throughput Forecast) x 28% (2017Throughput Forecast) x 28%
Required Handling Volume (Box):	(Throughput Forecast at South pier) x (Rehandling Ratio (2.4)[1])

1 European Journal of Operation Research 124, 2000"Deriving Decision to Locate Export Containers in **Container** Yard"

Table 2.2.2-13 The required move of equipment

	2012	2015	2017
Throughput F'cast（TEU）	90,000	144,000	170,000
TEU Factor	1.2	1.2	1.2
Throughput F'cast（BOX）	75,000	120,000	142,000
RTG Yard Handling Volume	0	34,000	40,000
Rehandling ratio	2.4	2.4	2.4
RTG Real move required	0	81,600	96,000

(Source: Study Team)

At next, the handling capacity of equipment is calculated in refer to the working condition as per Chapter 2. There is first introduction of RTG at this terminal and no record on the operating ratio but the study is proceeded with the current operating ratio for the reachstackers for the cases for delivery of 1~2 units.

Table 2.2.2-14 Handling capacity of equipment

Case	No. of RTG in operation	Operating Ratio（%）	Operarting Hours (Hours/year)	Productivity (Move/hour)	Handling capacity (Move)
1	1	40	3,500	15	52,500
2	2	40	7,000	15	105,000

(Source: Study Team)

It is obvious in the above calculation that 2 units of RTG are required to be allocated in the new RTG yard for planning to handle the throughput forecast in 2017.

2) Equipment Specification Required

The RTG in principle has to equip the specifications covering 6 rows with 5-high stacking at SWL 40.5 tons and the details are shown as follows:

	Required Specification	
1	Design Criteria	
1.1	Structure	
	(1) Wind load	
	Operating condition	16 m/s or over
	Stowed condition	40 m/s or over
1.2	Main dimensions	Span 1+6 row and 1 over 5 stacking condition
1.3	Climate condition	
	(1)Ambient temperature	-10℃～40℃ or higher
	(2)Humidity	Max. 95%
2	Major dimensions and performance	
2.1	Rated load as minimum	40.5 tons or higher
2.2	Dimensions (indicative standard)	
	(1)Lift under spreader	18 m +
	(2)Span	23.47 m ±
	(3)Traverse	18.9 m +
	(4)Length	13.65 m or less
	(5)No. of Tire / size	8 wheels tire 16～18.0 x 25
2.3	Speed (as minimum)	
	(1)Hoisting and lowering	
	(No load / Rated load)	52 m/min・23 m/min
	(2)Traverse	70 m/min
	(3)Travel	90 m/min
3	Steering system	90 degree turning electric steering
4	Control system	AC inverter control (digital control by PLC)
5	Spreader	20'/40'/45' Telescopic type. BROMMA(preferable) or manufacturer's standard with the flipper.
6	Diesel generator	
	(1)Diesel engine	4cycle, water-cooled diesel engine with turbocharger.
	(2)Fuel tank	900L +
	(3)Rated power	450 kw or higher
	(4)AC generator output	500 kva or higher
7	Mechanical	
	(1)Anti-sway device	Electric controlled
	(2)Skew device	Skew range ±5°
8	Safety and warning device	
	(1)Alarm /Buzzer	Anti-collision, travel, spreader etc. Warning Loudspeaker with alarm siren
	(2)Emergency stop system	Drivers Cabin, sill beam, electric room etc.
9	Lighting (Crane/driver cabin underneath, travel lane etc.)	Floodlight and 24VDC emergency lights
10	Document and drawing	
	(1)Full set of Completed drawings	5 each of English / Portuguese versions
	(2)Operation manual	5 each of English / Portuguese versions
	(3)Maintenance manual	5 each of English / Portuguese versions
	(4)Parts catalogue	5 each of English / Portuguese versions

3) Preliminary Study for Electric and Hybrid RTG for Comparison

In recent years, the container terminals are required to contribute to reduction of the environment loads for the issues of reduction of CO2 gas possibly causing the climate change and of energy-saving. On the determination of the type of RTG, the Electric RTG and Hybrid RTG are studied preliminarily in comparison with the standard RTG driven by diesel engine generator.

Table 2.2.2-15 Comparison for Electric RTG/Hybrid RTG/Standard RTG

Type	Initial Investment		Fuel	Mobility	Environment	Running Cost
	RTG	Facility				
RTG	○	○	Diesel	○	▲	▲
Hybrid RTG	△ (1)	○	Diesel	○	○	▲
Electric RTG	▲ (1)	▲ (2)	Electric (3)	▲	◎	○ (4)

(Source: the study team)

a) The approximate unit prices for Hybrid and Elect RTGs are increasing by about 10~20% for Hybrid type (including the capacitor) and 10% for Electric type (including emergency diesel generator), comparing with the standard RTG price.

b) No special facility at the yard is required for Hybrid and standard RTGs but in case of Electric type, the electric supply facility must be provided in addition by installing the bus-bar and transformer substation at each block of the stacking yard. The increase of the capacity of terminal substation needs modification or grading up of the current power supply facility. In reference with the costing at Nagoya TCB terminal, the installation cost of the bus-bars and substation at 2 blocks (145m in length for 1 block) planned in this study is roughly estimated at Japanese yen 100million per block.

c) It is essential to ensure supply of the high voltage electricity safely and consistently in order to feed to the bus-bar for driving Electric RTG without fail. The blackout or failure on supply is directly causing stoppage of the yard operation for short or longer period. So, it is suggested that the electric RTG with emergency diesel generator would be definitely required for back-up.

The maintenance cost for Electric RTG is lower than the other 2 types due to no maintenance required for the diesel generator but it will have less benefit if the emergency diesel generator is fitted. The advantage of running cost is depending upon the local price of electricity and diesel oil but the local electricity price at Nacala is comparatively higher and the further study may be required in order to define the contribution of running cost.

For the study of determination, the deployment of Electric RTG is subject to the unit equipped with emergency diesel generator for consideration in order to ensure the electric supply in case of defect and possible black out. However, it is suggested that the adoption of Electric RTG has less advantage to the standard RTG in view of the high initial investment cost. There are some terminals having reformed the present yard with modification and additionally retrofitted the bus-bar facilities of electricity supply for introduction of the electric RTG. Therefore, it is considered that the introduction of the Electric RTG can be reviewed after the stable electric supply

and RTG operation are ensured in future and that the standard type RTGs should be delivered in this project.

4) Key Items for Maintenance Management of New Equipment

It is significantly important that the responsible chief of the drivers and mechanics should provide the knowledge/skill for operation and maintenance of RTG in advance and ensure preparation for delivery of the units. It is concerned in case of possible breakdown that the operational stoppage may happen due to no back-up equipment at the yard. In maintenance viewpoints, the employment of the electric engineers and training for the control system are indispensable as the recent RTG have been developed with the control system engineering.

Under the above viewpoints, the following preparation items are to be considered.

- The responsible chief of drivers and mechanics should be appointed especially for the delivered RTG and to be trained at the manufacturer's training center for more than 1 month to ensure the knowledge/skill for driving and maintenance. The training on RTG operation at the other terminal in Mozambique may be helpful.
- The manufacture guarantee engineer for initial commissioning in delivery to be stationed at least for 3 months in the terminal under the agreement which should be included in the purchase contract. Also, it is ensured that the manufacture should prepare immediate acceptance/dispatch of the service engineer whenever necessary.
- The spare parts to be purchased at discount rate with stocking at the nearest supply points for direct purchase in negotiation with the manufacture.
- It is practical that the annual service/inspection of the manufacturer or service agent can examine the condition of RTGs properly with proper advice on maintenance and operation. Necessary schedule and budget should be arranged by CDN.

(7) Firefighting Facilities

New firefighting facilities are planned in order to enhance the existing firefighting system and bring them up to the same level of specification as its facilities at Matola area in Maputo. Contents of the facilities are described below.

1) Basic Specifications for Firefighting Facilities

・Firefighting pump(Output of vertical pump：6,000ℓ/min、pressure：0.9MPa)

・Foam mixing facilities (Capacity of main tank：4,500ℓ、pressure:1.37MPa, capacity of test tank：200ℓ, pressure:1.37MPa）

・Foam monitoring facilities(Outdoor explosion-proof type, height: 6m、spray volume:1,900ℓ/min, pressure:0.49MPa、rotation:360 degree)

・Outdoor foam fire hydrant（spray volume:400ℓ/min, pressure:0.35MPa, hose：size:65A, length:20m-4 numbers）

・Outdoor water fire hydrant（spray volume:450ℓ/min, pressure:0.35MPa, hose：size:65A,

legth:20m-4 numbers）

・Portable fire extinguisher (chemical weight：6kg, number：2 units)

2) Layout of firefighting facilities

Layout of firefighting facilities and diagram of firefighting facilities are shown Figure 2.2.2-8 and 2.2.2-9 respectively.

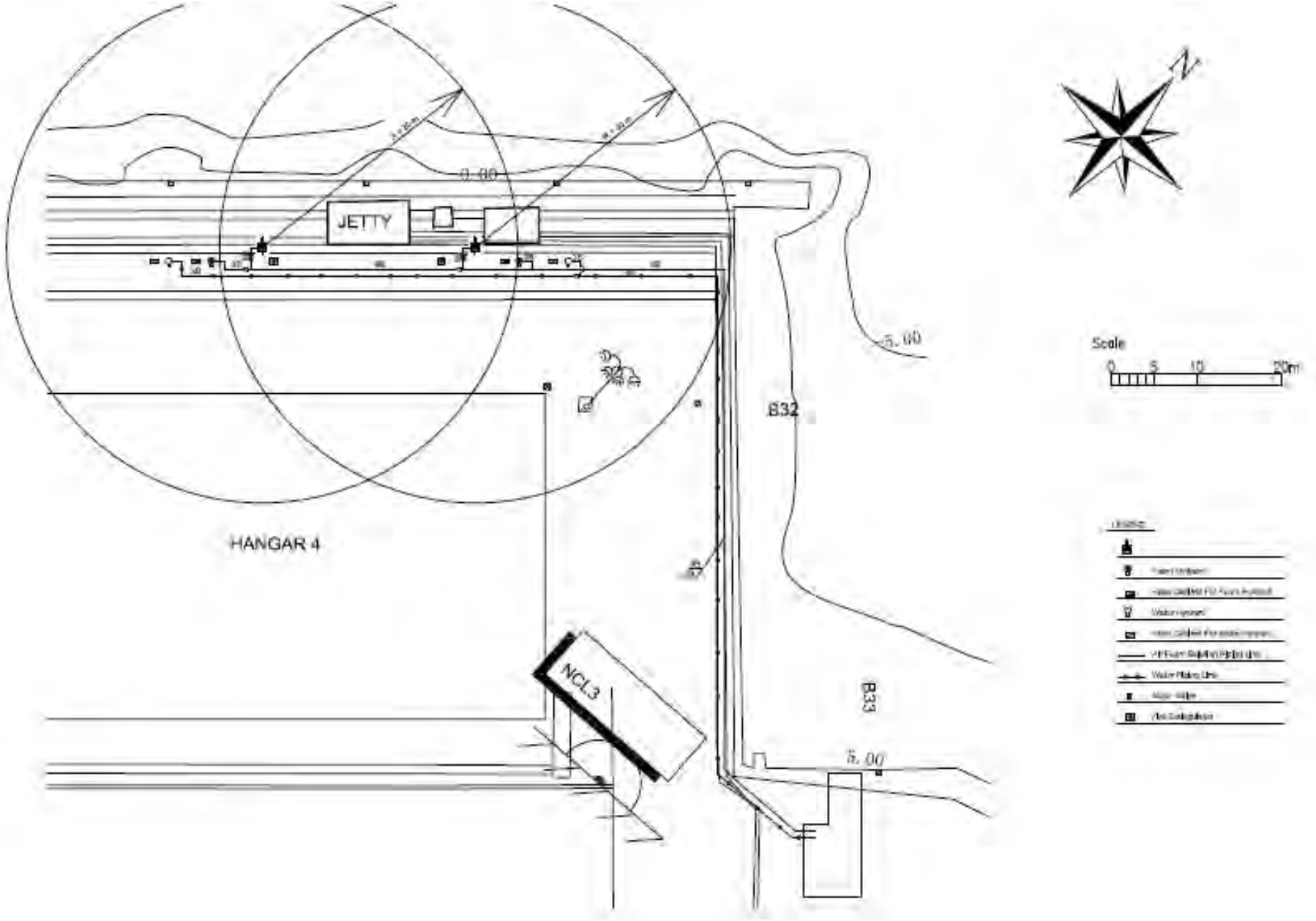


Figure 2.2.2-8 Layout of Fire Fighting facilities

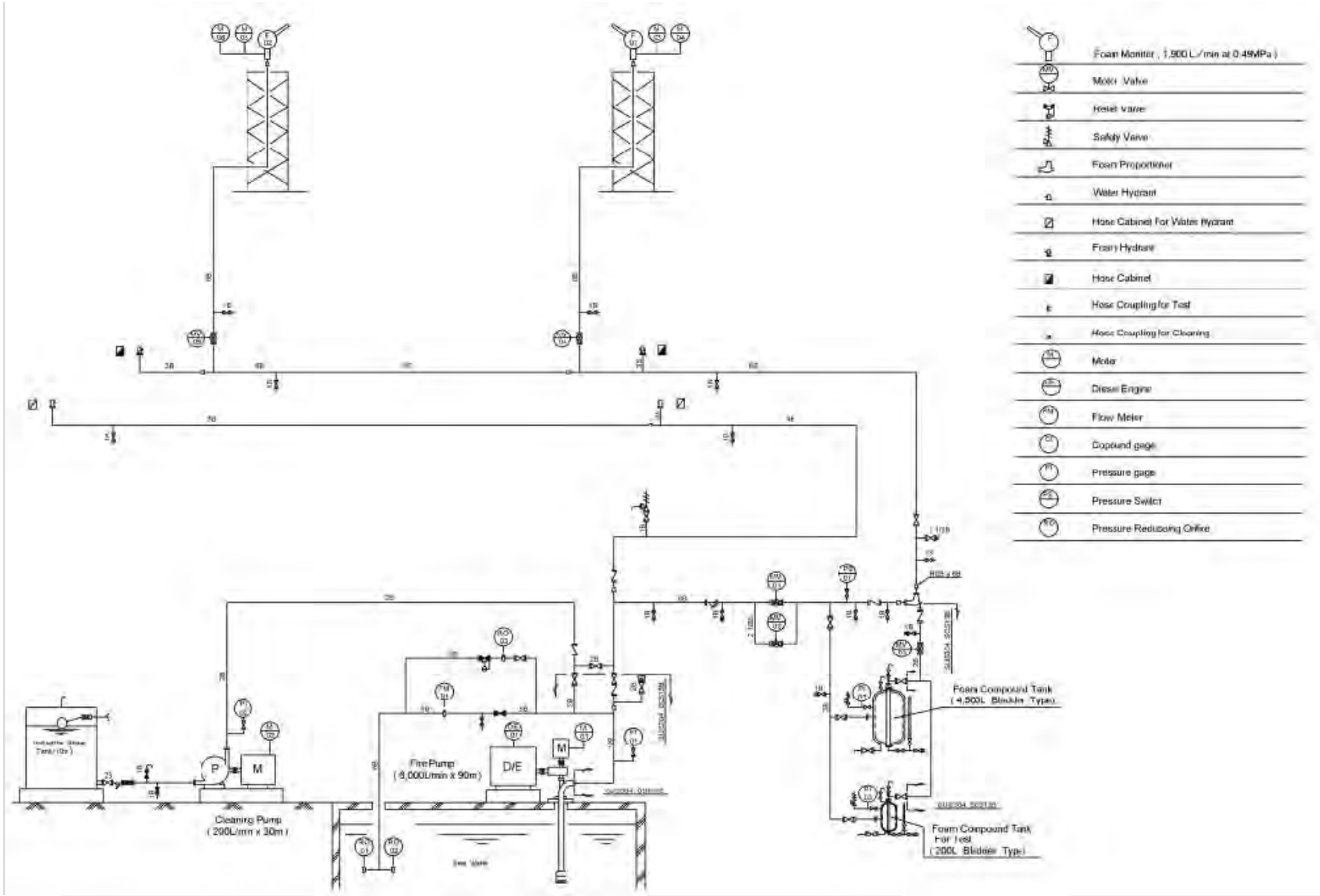


Figure 2.2.2-9 Diagram of Fire Fighting Facilities

(8) Loading/unloading Arms for Liquid Bulk Cargos

The loading/unloading method for gasoline, jet fuel and diesel oil is by manually connecting a rubber hose to the manifold of the tanker at present. A loading/unloading arm is planned to improve loading/unloading efficiency and environmental impacts. Design condition of loading arm is described below.

1) Target vessel and others

① Berth	Crown height	+ 5.80 m
	Design depth	-10.0 m
② Vessel	Maximum size（Tanker）	LOA：209m
		Maximum draft：12.0 m(berthing at high tide)
		DWT：50,000 tons
	Minimum size（Tanker）	LOA：63m
		Maximum draft：4.0m
		DWT：1,000 tons
③ Natural condition	Tide	HWL:+4.40m, LWL:+0.25m

(Source：Study Team)

2) Loading/ unloading Conditions

・Loading and unloading product：gasoline, jet fuel and diesel oil

・Size of pipeline：all 8 inches

・Characteristics of liquid bulk

Viscosity	Specific Gravity	Pressure		Temperature		Flow rate (m^3/h)
		Max	Operation	Working	Design	
Not specified	0.74	10 bar	7 bar	natural	natural	1,200
2.0 to 5.0 at 40 C°	0.84	10 bar	7 bar	natural	natural	1,200
max 8.0 at -20 C°	0.79	10 bar	7 bar	natural	natural	1,200

3) General plan of loading arm

Figure 2.2.2-10 shows the details of the loading arm.

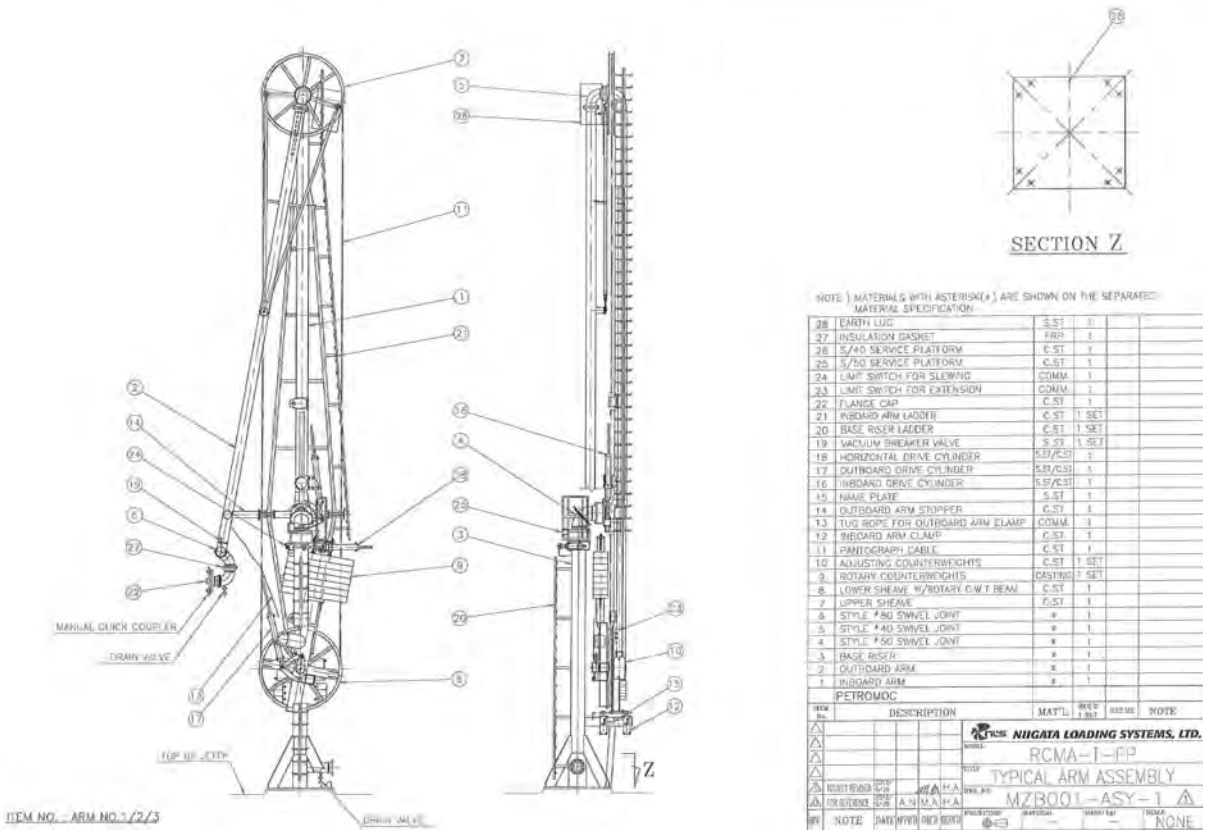


Figure2.2.2-10 General Plan of Loading Arm

2-2-3 Outline Design Drawings

The drawings of the facilities are shown as follows:

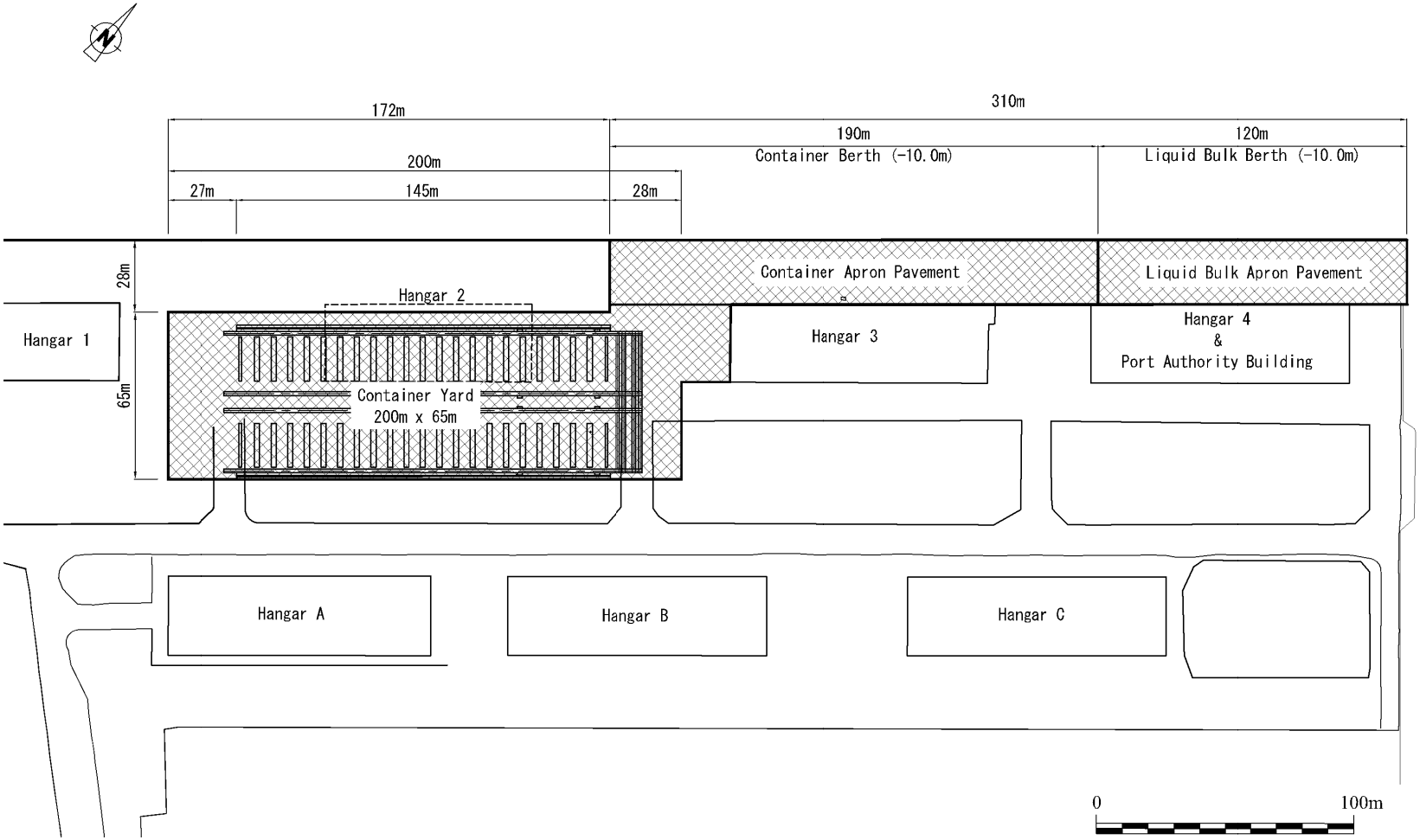
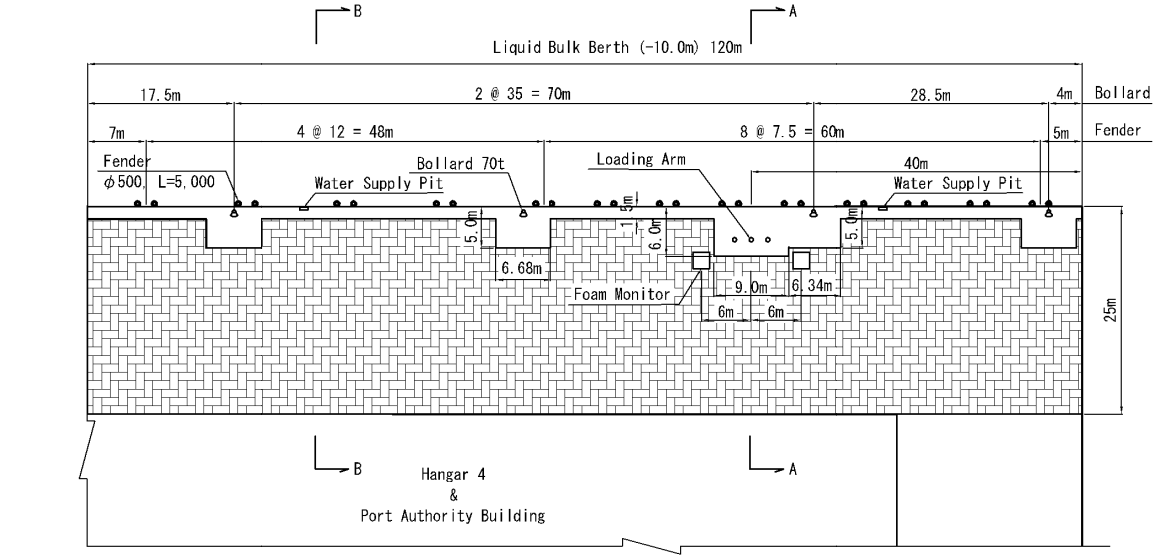
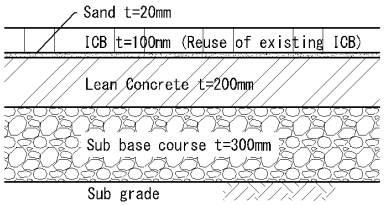


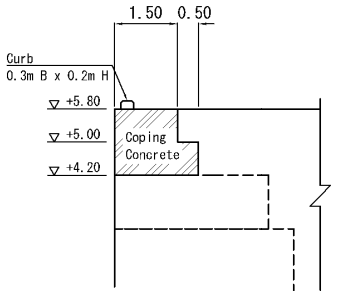
Figure 2.2.3-1 General Layout of Plan



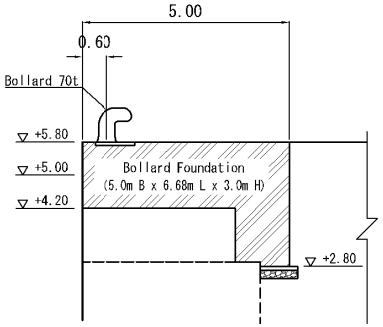
Layout Plan S=1/750



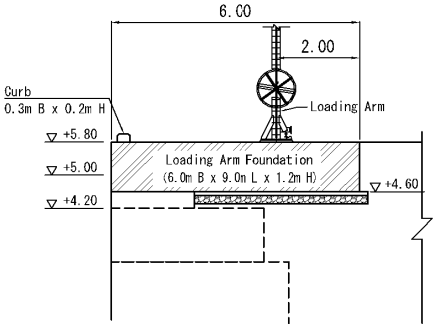
Cross Section of
Liquid Bulk Berth Pavement
S=1/25



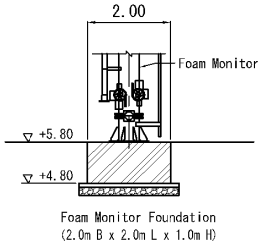
Cross Section of Coping Concrete



Cross Section of Bollard Foundation

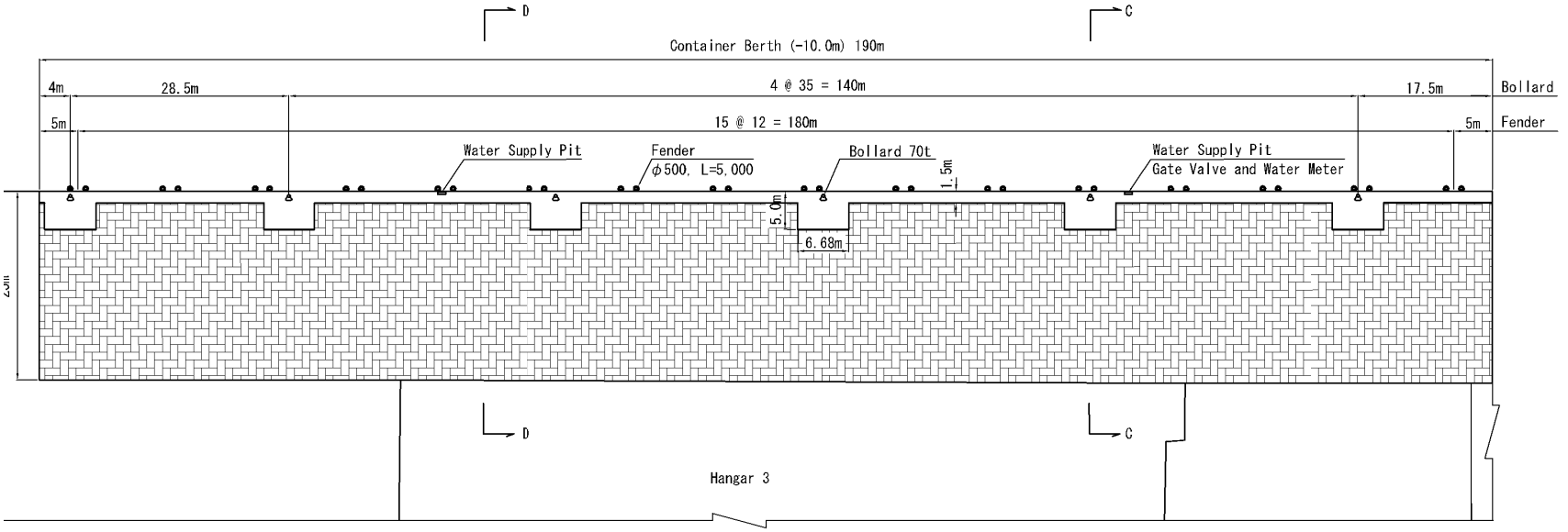


Cross Section of Loading Arm Foundation

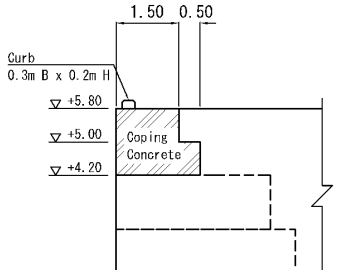


Foam Monitor Foundation

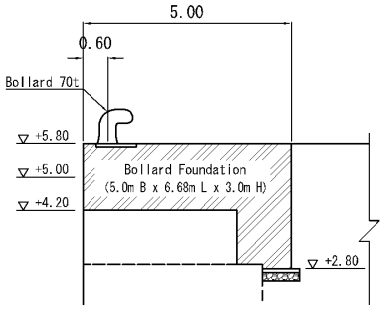
Figure 2.2.3-2 Plan and Cross Section of Liquid Bulk Berth



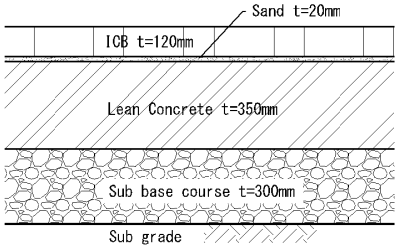
Layout Plan S=1/750



Cross Section of New Coping Concrete



Cross Section of Bollard Foundation



Cross Section of
Container Berth Pavement

Figure 2.2.3-3 Plan and Cross Section of Container Berth

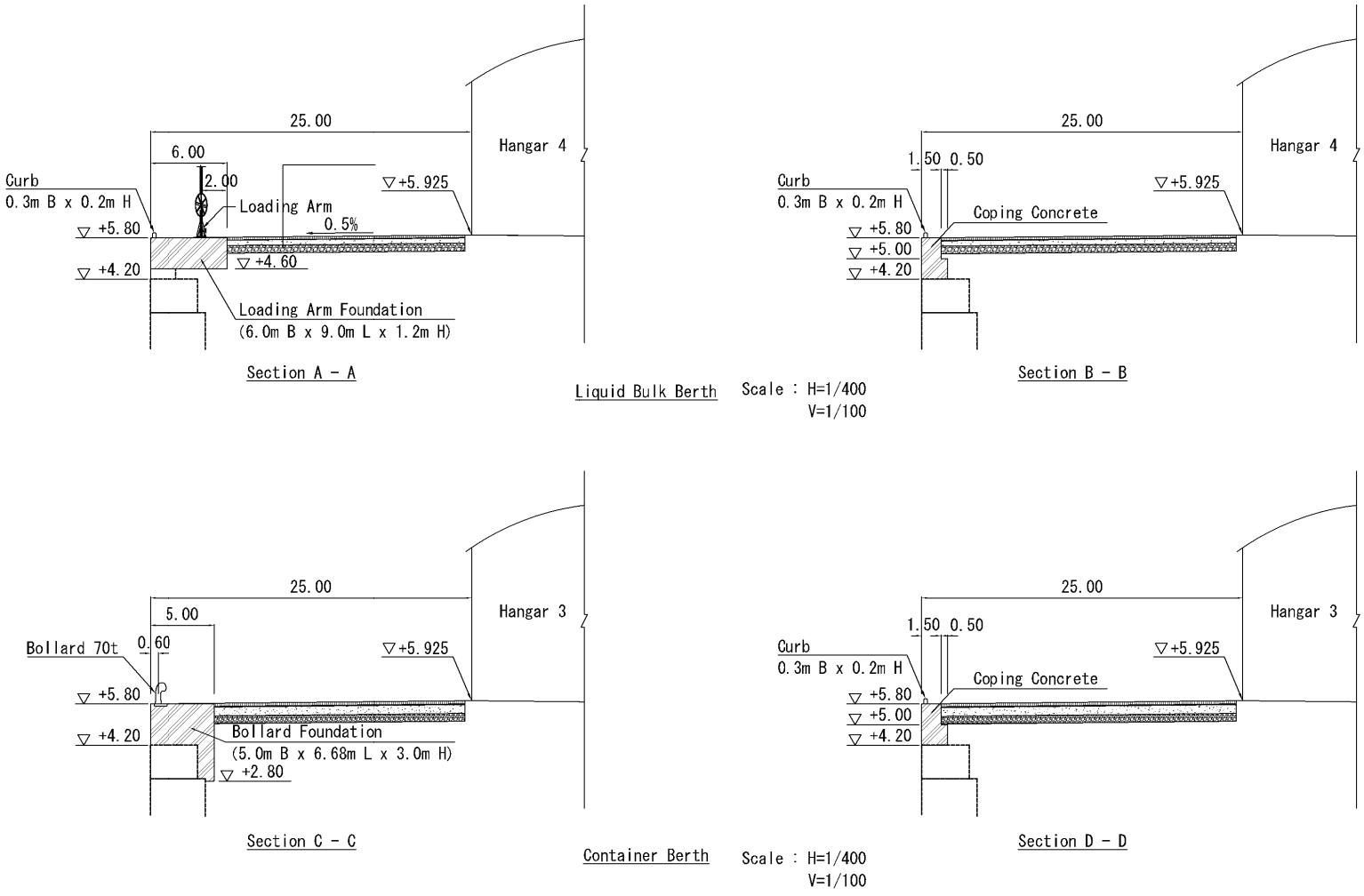
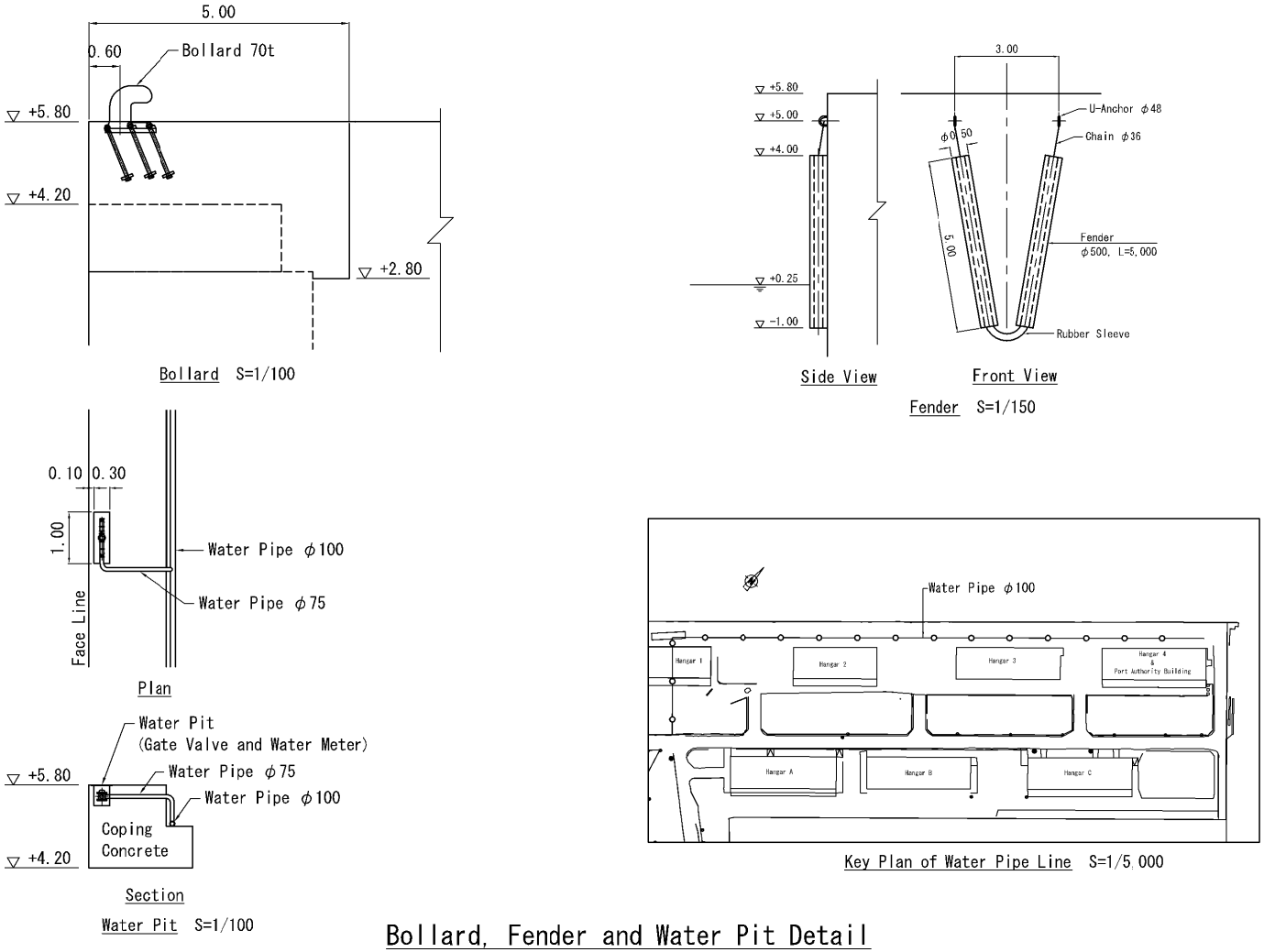


Figure 2.2.3-4 Cross Section of Pavement Structure in North Wharf



Bollard, Fender and Water Pit Detail

Figure 2.2.3-5 Bollards, Fenders and Water Pit Details

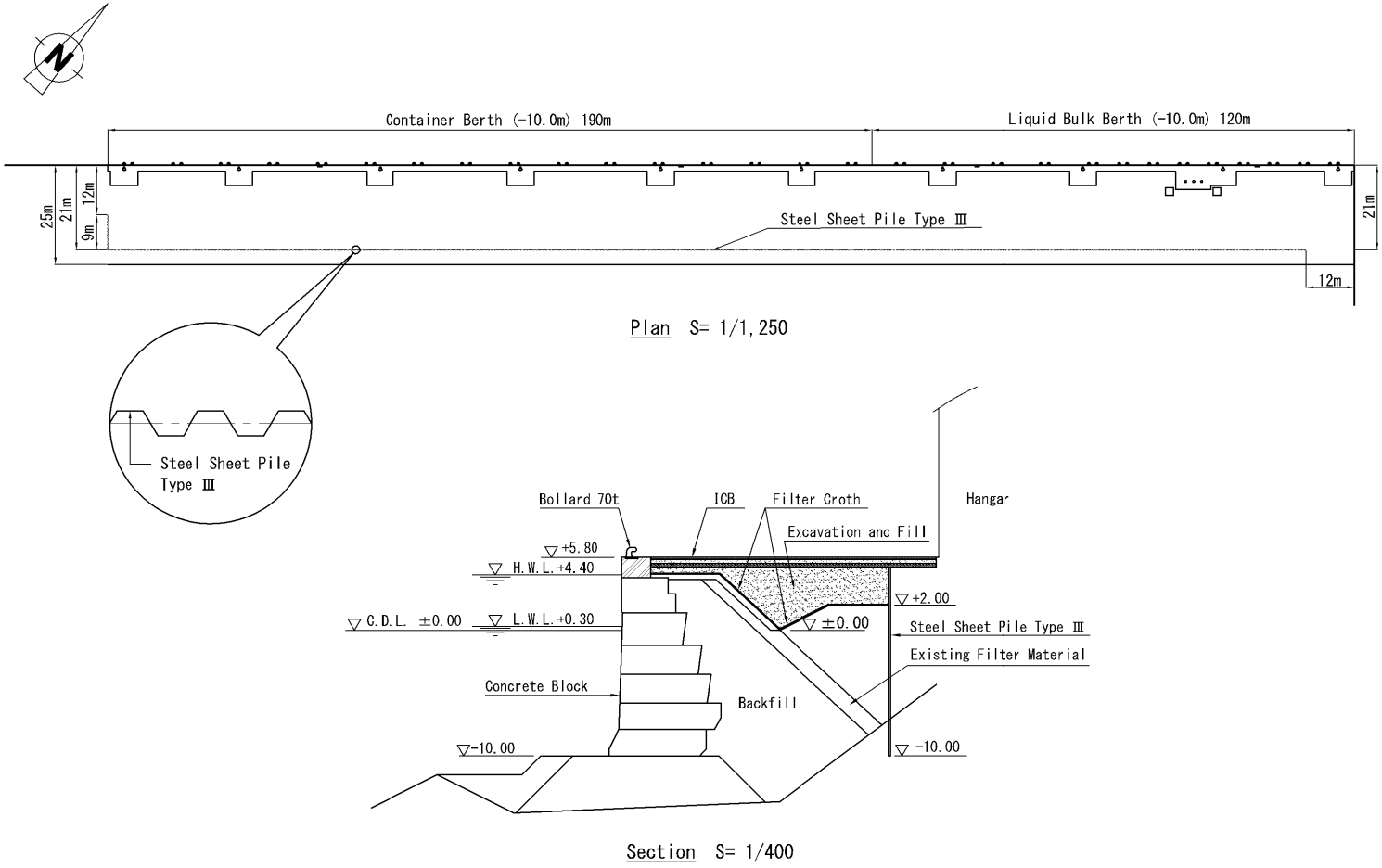


Figure 2.2.3-6 Improvement of Apron pavement

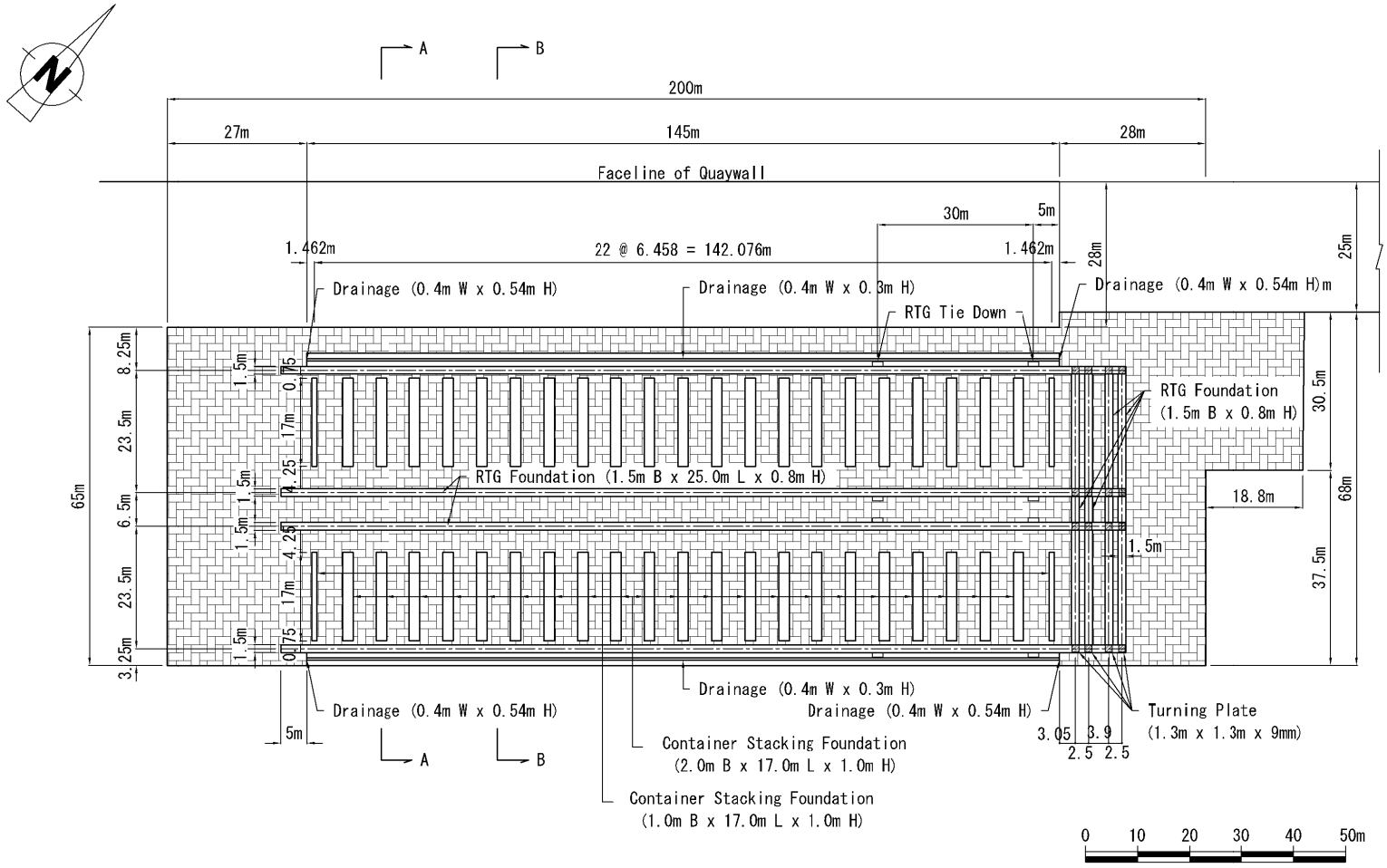


Figure 2.2.3-7 Container Yard Layout Plan

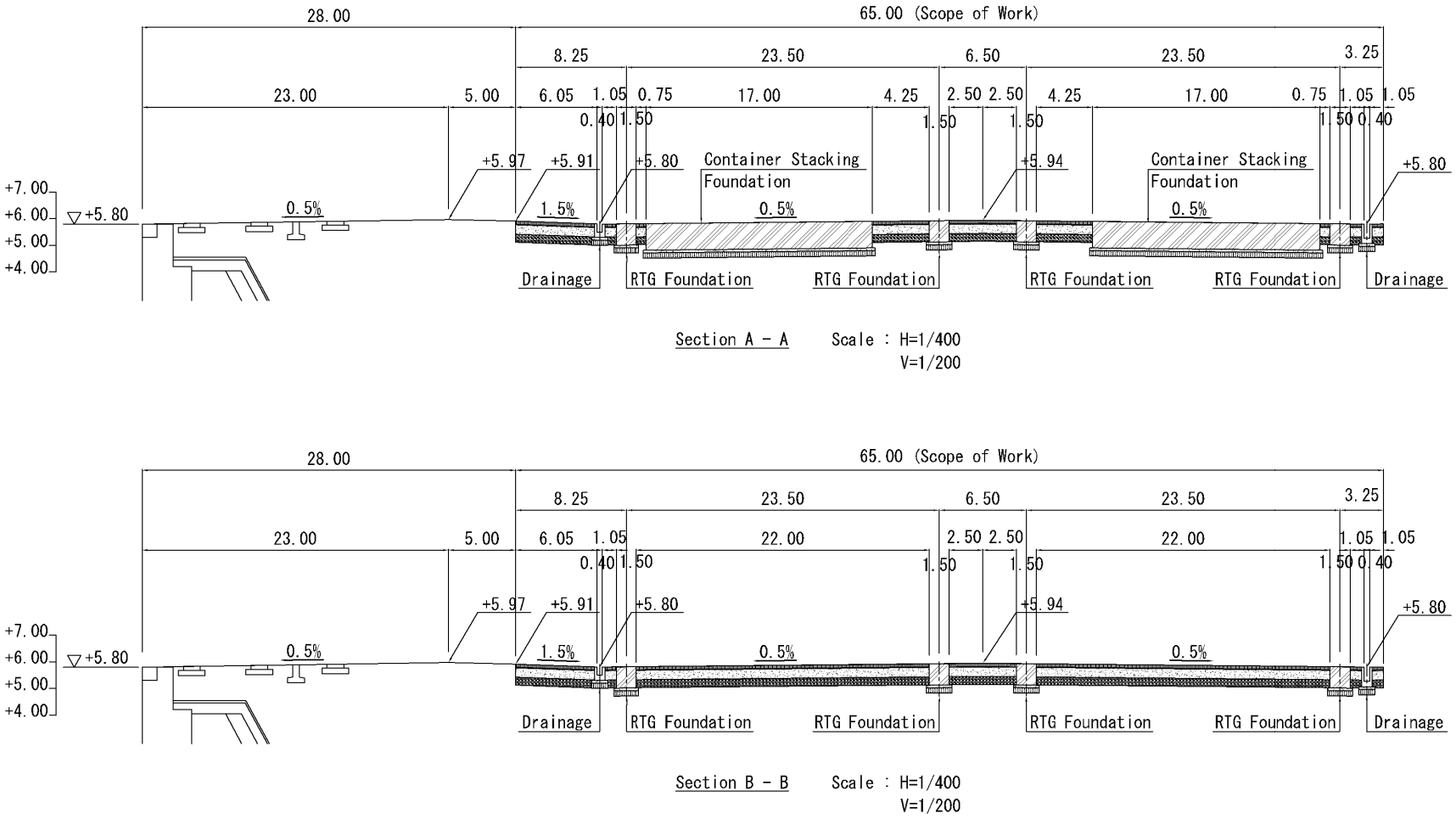


Figure 2.2.3-8 Typical Cross Section of Container Yard

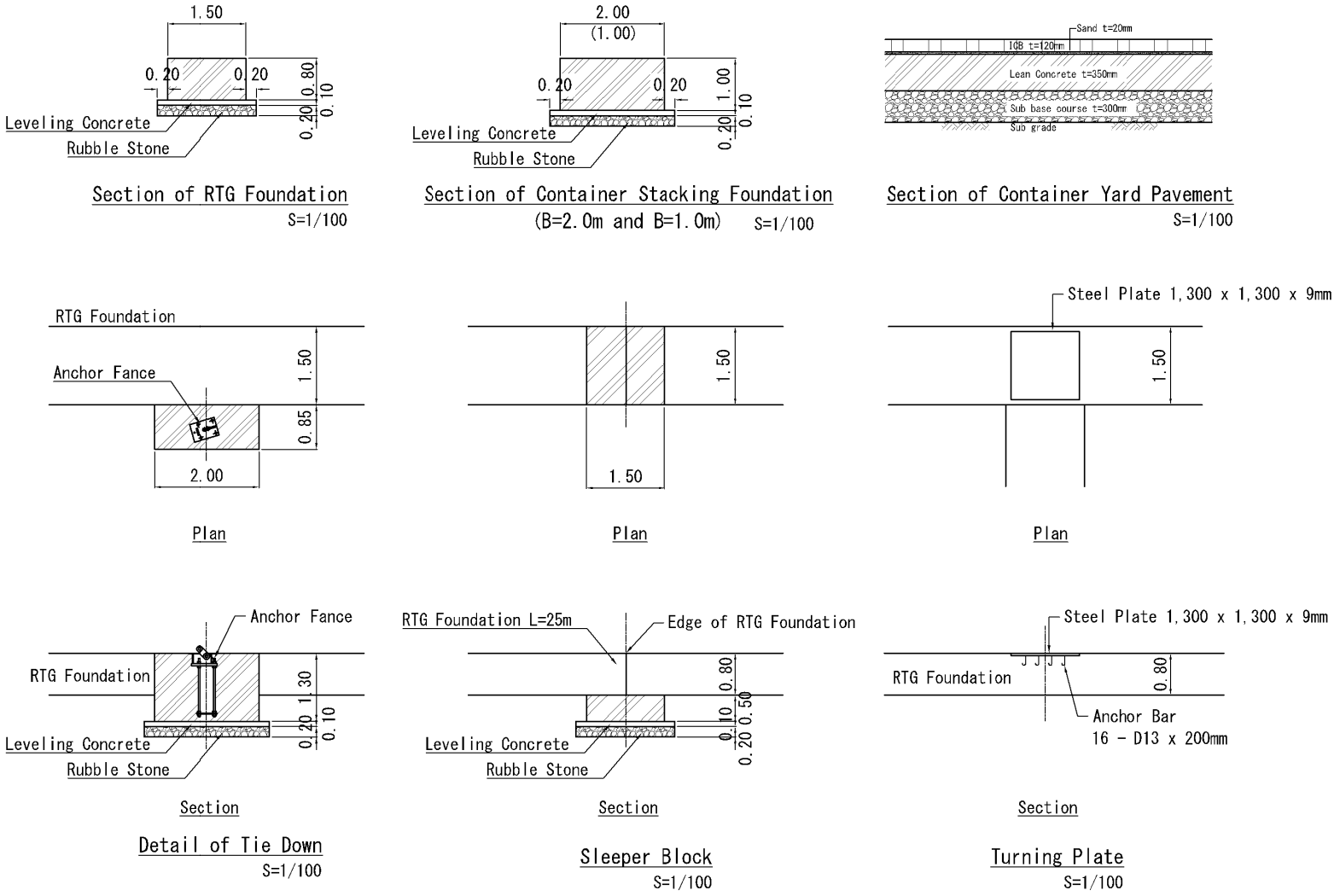
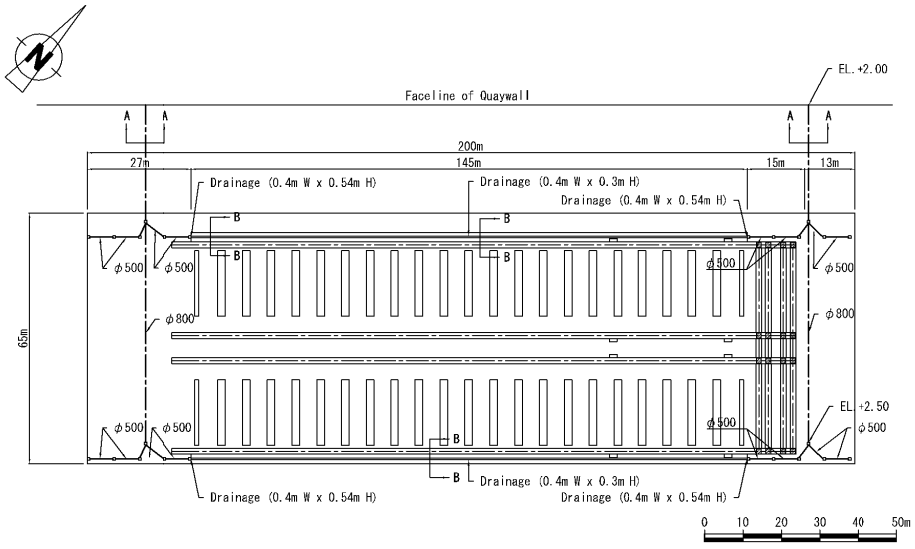
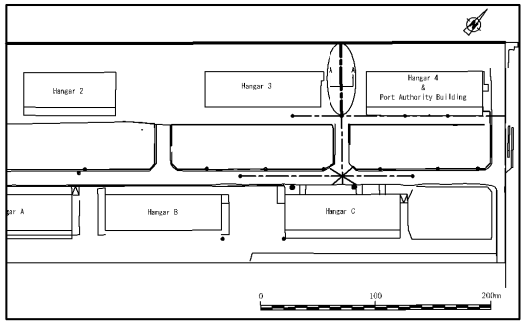


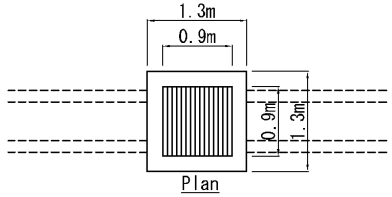
Figure 2.2.3-9 Details of Pavement in Container Yard



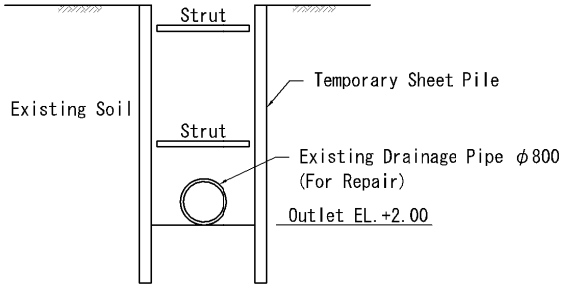
Plan of Drainage System S = 1/1,500



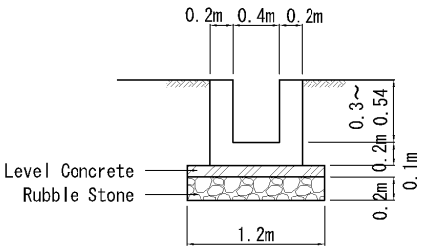
Key Plan of Drainage System (For Repair)
S=1/5,000



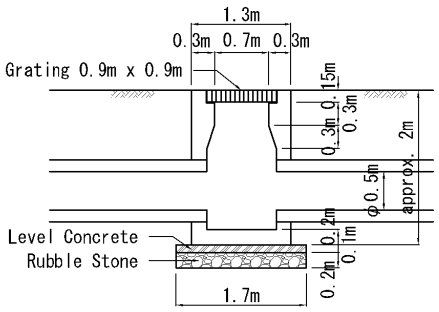
Plan



Section A - A
Typical Section of Drainage Pipe (For Repair) S = 1/100

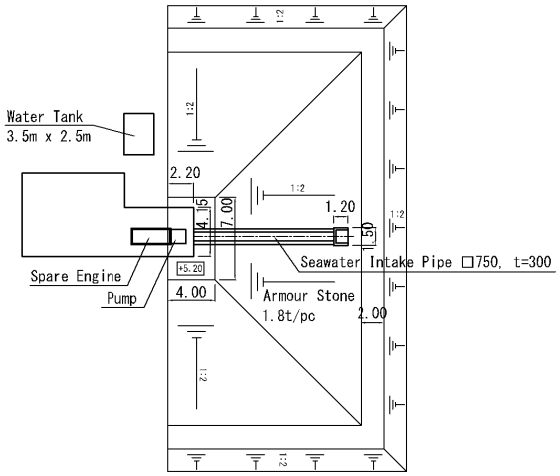


Section B - B
Typical Section of Drainage S = 1/50

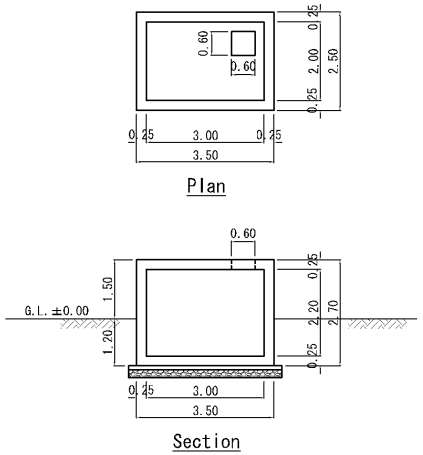


Typical Section of Manhole S = 1/75

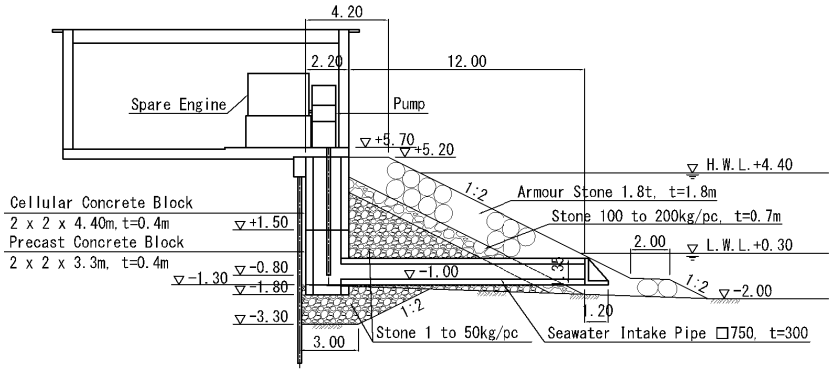
Figure 2.2.3-10 Drainage System in Container Yard



Plan S=1/500

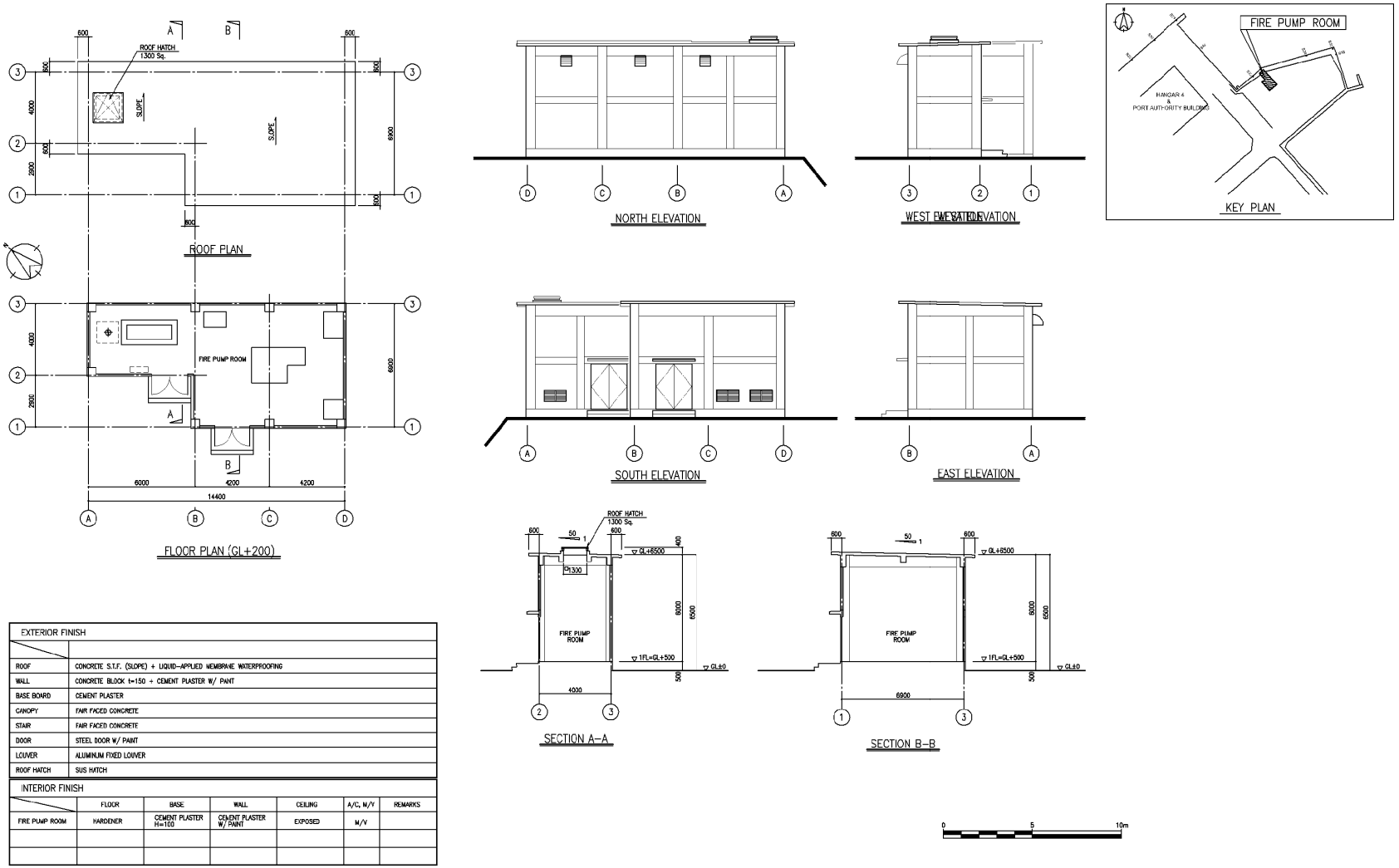


Water Tank S=1/150



Section S=1/300

Figure 2.2.3-11 Seawater Intake for Firefighting facility



EXTERIOR FINISH	
ROOF	CONCRETE S.T.F. (SLOPE) + LIQUID-APPLIED MEMBRANE WATERPROOFING
WALL	CONCRETE BLOCK t=150 + CEMENT PLASTER W/ PAINT
BASE BOARD	CEMENT PLASTER
CANOPY	FAIR FACED CONCRETE
STAIR	FAIR FACED CONCRETE
DOOR	STEEL DOOR W/ PAINT
LOUVER	ALUMINUM FIXED LOUVER
ROOF HATCH	SUS HATCH

INTERIOR FINISH	FLOOR	BASE	WALL	CEILING	A/C, M/V	REMARKS
FIRE PUMP ROOM	HARDENER	CEMENT PLASTER H=100	CEMENT PLASTER W/ PAINT	EXPOSED	M/V	

Figure 2.2.3-12 Building for Form Tank, etc.

2-2-4 Construction Plan/ Procurement Plan

2-2-4-1 Construction Policy/Procurement Policy

(1) Basic concepts

1) Implementing this project, concluding Exchange of Notes (E/N) between the Government of Japan and the Government of Mozambique and after concluding Grant Agreement (G/A),Consultant Service Agreement shall be concluded between the Consultant who has a Japanese nationality and the Government of Mozambique for the design and the construction supervision.
2) The Consultant shall produce drawings and specifications being necessary for the construction and necessary documents for contractor's tender and the contract and get the approval from the Government of Mozambique. Going through the procedures of preliminary evaluation of tenderers and tender documents and the Consultant shall hold the tender and select construction company who has a Japanese nationality.
3) The Consultant shall produce drawings and specifications being necessary for the construction and necessary documents for contractor's tender and the contract and get the approval from the Government of Mozambique. Going through the procedures of preliminary evaluation of tenderers and tender documents and the Consultant shall hold the tender and select construction company who has a Japanese nationality.
4) Construction works shall be implemented in accordance with the construction contract concluded between the Government of Mozambique and the Construction Company.
5) Regarding the total construction period for the project, 6 months will be required for detailed designs and 18 months for construction works.

(2) Construction Policy/Procurement Policy

1) Port facilities to be rehabilitated in this project shall be the rehabilitation of north wharf, container yard and Firefighting system as civil works and reach stacker, RTG, loading/unloading arm as cargo handling machine.
2) This project is the rehabilitation works of operating port, the construction works shall be implemented under the difficult situation to secure enough construction area and temporary yard. During construction period, although, it is unavoidable to have an influence on the existing port functions the construction and work execution plan so as to mitigate the influence as much as possible shall be made in addition to the safety consideration.
3) The quality and supply ability of material and equipment that can be procured locally shall be studied well and the local procurement shall be taken priority as much as possible.
4) Concerning material and equipment that are difficult to purchase locally, considering the maintenance, cost and etc. are evaluated in a comprehensive manner and decide the procurement source from neighboring countries and Japan.

2-2-4-2 Considerations of construction and procurement

(1) Alternative method of oil handling

The rehabilitation of north wharf in this project is for the berth actually operated. Especially, the oil tanker uses berth many times and the cargoes have to be handled with care. Therefore, in this project, it is divided by two sections and one is the oil berth portion (120m) and the other one is container berth portion (190m).Before rehabilitating the existing oil berth, the equal cargo handling facility with the existing facility shall be temporary made at the container berth portion and the rehabilitation works of existing oil berth shall be made safely. After the rehabilitation, it is placed in service at the safe time of cargo handling and commenced to rehabilitate the container berth portion.

(2) Inflation

Private sectors relating with coal, LNG industries and etc. in Mozambique have been grown a lot and construction field as well has been in construction boom. Hotel room charges and the food prices have been also increased in comparison with the time of F/S. Monthly CPI data is shown in Table 2.2.4-1 as the general economic index. According to this, about 6 points has been increased in comparison with December, 2010. Concerning construction sector, as the result of hearing from each construction company or material suppliers, the prices have been increased 20 to 30% in comparison with the estimated time (January, 2011) in the F/S report. Concerning labor cost, the increase of minimum wage has been decided by the cabinet in May, 2012 and about 21% has been increased in the construction sector comparing with the one before the revision.

In conclusion, high price hike can be observed in Mozambique as a whole and procurement plan shall be necessary to set considering these situation.

Table 2.2.4-1 Consumer Price Index (CPI) in Mozambique (December, 2010 =100)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2010	87.45	89.35	90.40	91.38	92.65	93.86	94.05	93.96	94.61	95.11	96.41	100.00
2011	101.62	102.96	102.86	103.05	103.60	103.25	103.68	104.14	104.06	104.15	104.70	106.14
2012	106.82	106.56	106.78	106.52	105.96							

（Source:Instituto Nacional de Estatística）

(3) Construction Circumstances

1) Construction Company

There are no local consultant and construction company who are able to correspond to quality control, survey, construction supervision around Nacala Port. Construction companies have offices as the local corporation or branches of Portugal or South Africa in capital city, Maputo and these companies can be employed without any technical problem as sub-contractors of Japanese Construction Company.

2) Labor

According to the hearing from a construction company in Maputo, skilled workers and general workers are possible to employ in Mozambique. Engineers or foremen are employed from

South Africa or Portugal. In this project, under water work is partly necessary for the rehabilitation works of north wharf and these works require skilled technician (diver) who knows the port construction works to be dispatched.

3) Construction Machine

Certain construction machineries are owned by Truck Transportation Company and etc. around Nacala Port but their capacities are not enough to be used in its quantity and the functions in this project. It is common for the construction companies in Maputo to procure necessary construction machines when each project requires although they have general construction machines. It is also necessary to study the procurement from neighboring countries or Japan upon the price or the use frequency.

4) Construction Material

a) Ready mixed concrete

There is no commercial ready-mixed concrete plant around Nacala Port and the installation of such concrete plant shall be inevitable for this project. And as this area is generally short of water, a desalination plant shall be installed for the stable supply of ready-mixed concrete. Cement in bag is possible to purchase around Nacala Port since there are two cement factories in production. There is a quarry in production for the aggregate located around 100km from Nacala. Transportation cost is required due to the distance but the road condition is good and the supply will have no problem. As there is no other quarry in production around here, the procurement from this quarry shall be the base.

b) Steel reinforcing Bars and Steel Material

It is scheduled to construct a stock yard for steel bars near Nacala Port within this year by the supplier who owns a steel bar factory in Beira. Cheaper steel bars shall be procured in comparison with the price procured from Japan including the transportation cost. Steel sheet pile for the protection of water outflow shall be procured from Japan considering the easy procurement.

c) Interlocking Blocks

Good quality inter-locking block for the pavement of berth apron and container yard can be procured from the supplier in Nacala. Considering the maintenance, the local supplier can be utilized.

d) Port Accessories

Accessories for wharves such as fenders and bollards shall be procured from Japan considering the procurement merit and the quality.

e) Disposal Area

As the separation of general waste and industrial waste is not done, both wastes shall be disposed in the disposal area designated by Nacala Municipal, which is located 20km from Nacala Port

(4) Checking points on procurement

There are no marine liner services from Japan neither by container vessel nor general cargo ship. About 45 days is considered to be necessary as the transportation period needed in marine transportation from Japan. Items to be procured around Nacala port are very limited and it is necessary to consider the transportation cost to Nacala Port when procurement is made in Maputo.

As the assembly work of RTG cannot be made at the project site, it shall be factory assembly. And, it is necessary to carry it by ship equipped with adequate gear to unload the RTG due to the non-availability of berth crane in Nacala Port.

2-2-4-3 Responsibilities for Construction/Procurement& Installation

(1) Obligation of Japan side

1) Consultant services for Detailed Design, Support to Tender, Construction Supervision and etc.
2) Provision of all necessary construction materials and labors needed for Japanese side construction works in this project.
3) Provision of marine and inland transportation including the transportation insurance being necessary for Japanese side construction works and procurement of equipment in this project.
4) Necessary quality inspection on Japanese side construction works and procurement of equipment in this project.
5) Concerning related infrastructure, the entire portion after lead-in work from the electric pole being nearest to the project site as responsive boarder point for electricity, the entire portion after water supply pipe being inside of project site boarder line for water supply and the entire portion of discharging water works shall be the basic scopes.

(2) Obligation of Mozambique side

1) Acquisition of land for construction area in this project (displacement of existing berth crane and containers and demolition of existing buildings in the project site such as the existing warehouse, substation and etc. and removal of obstacles.)
2) Water supply lead-in works from main water supply pipe near the project site to the project site in this project.
3) Electricity lead-in works to the electric pole nearest to the border line of project site in this project.
4) Securing of temporary yard and disposal area.
5) Tax payment assessed for import and purchase of material and equipment

2-2-4-4 Construction Supervision Plan & Procurement Plan

Based on the policy of Grant Aid Cooperation by the Government of Japan, consistent and smooth detailed design works and construction supervision works for the project shall be done by the Consultant who well understood the effect of cooperation study. At the time of construction supervision, the Consultant shall dispatch resident engineer who has enough experiences of work site and supervise the construction works and make contacts to related organizations in addition, dispatch a professional engineer and support inspection and instruct construction works when needed.

(1) Policy of Construction Supervision

1) Project completion based on the work execution plan without delay shall be aimed by close contact and report to the pertinent organizations of Mozambique and Japan.
2) Prompt and proper instructions and advises to the contractor shall be made for the facilities construction met with the design drawings.
3) Taking the approach that technical transfer for construction method and technique shall be made and produce an effect as the project under the scheme of Grant Aid Cooperation.
4) Proper advises and instructions shall be made and persuade smooth management for the maintenance after handing over the facilities.

(2) Construction Supervision Works

1) Service for Construction Contract

The Consultant shall make services for selection of Construction Company, decision of construction contract method, producing draft of contract document, checking detailed construction works and witness for construction contract.

2) Checking and confirmation of shop drawings and etc.

The Consultant shall check the shop drawings and inspect the construction material, finish samples, facility material submitted from the Contractor.

3) Instruction of Construction Works

The Consultant shall study the construction plan and work execution schedule and instruct the Contractor and report the work progress to the Client.

4) Cooperation to payment procedure

The Consultant shall check invoices and etc. including the procedures for the construction cost to be paid during and after the construction works.

5) Inspection

The Consultant shall inspect each progress during construction period upon needs and instruct the Contractor. The Consultant shall witness the handing over the facilities upon confirming the completion of construction and accomplish the content of contract and finish the works obtaining the confirmation of receipt from the Client. And, The Consultant shall report necessary

matters related with progress during construction, payment procedures and handing over after completion to the concerned officials, the Government of Japan.

(3) Procurement

Following matters shall be taken care concerning the procurement of cargo handling machine.

1. The execution of procurement control by the Consultant
2. The execution of pre-shipment inspection by the third party inspection company
3. The execution of handing over after operation training of cargo handling machine

2-2-4-5 Quality Control Plan

Controlled item, controlled content, controlled method, quality standard, measuring frequency and the method of record on the quality of materials to be used in this project shall be in accordance with the specifications (tender documents, drawings, and question and answer) and "Quality Control Standard for Port and Harbor Construction" described in Port and Harbor Construction Work Common Specifications.

Quality control item and the test method of main items are shown in Table2.2.4-2.

Table 2.2.4-2 Quality Control item and the test method of main items

Main Item	Detailed item/Main material	Quality Control Item	Test Method
Pavement work	Base course work	Material	Grain size, Specific gravity, Absorption test, Material shape & size measurement
		Compaction density	Moisture content, Plate loading test, Site density test
Concrete work	Steel Reinforcing Bar	Material	Chemical analysis, Mechanical test, Size measuring
	Concrete production	Material constituent	Quality test for cement, water and aggregate
		Body quality	Tests for slump, air content, compressive strength and chloride ion density, Temperature measure
Fender installation work	Fender	Material	Rubber physical test, Size measurement
Bollard installation work	Bollard	Material	Chemical test, Mechanical test, Size measurement

2-2-4-6 Procurement Plan for Material, Equipment and etc.

Especially, following points shall be taken care for the procurement of necessary material and equipment in this project.

(1) Procurement Policy

Material and equipment that can be supplied locally shall be taken priority to procure as much as possible studying the quality and the supply capacity. The items that are difficult to procure locally shall be procured from the third countries or Japan.

(2) Thought on guaranty

Granted facilities shall be guaranteed for one year from the completion to the one year inspection after completion except man-caused damage like rough handling on the facilities and equipment.

(3) Spare parts component

The content of spare parts shall be selected mainly from periodic replacement parts and consumables in view of keeping equipment function and preventing malfunction before happens. It shall be the base to procure necessary parts for two years operation.

(4) Procurement from the third countries and Japan

Procurement and transportation plan shall be necessary to make for the material and equipment procured from Japan and the third countries considering the period for order, production, packing and shipment in case the material and equipment needed jobbing work or domestic fabrication. And, In case of procurement from Japan and the third countries, it is necessary to pay attention to packing, transportation, insurance, port charges and the tax exemption.

(5) Procurement Item

Procurement sources of main construction materials studied previously is shown in 2.2.4-3(1) and the one of main construction machines is shown in Table 2.2.4-3(2) and the one of cargo handling machines is shown in Table 2.2.4-3 (3).

Table 2.2.4-3(1) Procurement source of main construction materials

Construction Material		Procurement Source		
		Local	Japan	3rd Countries
Civil Facility	Cement	X		
	Sand	X		
	Aggregate, Stone material	X		
	Interlocking block	X		
	Steel reinforcing bar		X	X
	Steel sheet pile		X	
	Port material (Fender, bollard and etc.)		X	
	Material for Firefighting facilities		X	

Table 2.2.4-3(2) Procurement source of main construction machines

Construction Machines		Procurement Source		
		Local	Japan	3rd Countries
Crawler Crane	80t lifting capacity	X		
Bulldozer	15t	X		
Backhoe	0.8（0.6）m3	X		
Backhoe	1.4（1.0）m3	X		
Dump truck	10t	X		
Truck Crane	25t lifting capacity	X		
Hydraulic pile jacking extractor	Jacking force: 800kN, Extract force: 900kN		X	
Concrete Plant	$30m^3/h$	X		
Motor Grader	3.1m	X		
Road Roller	10-12t	X		
Tire Roller	8-20t	X		

Table 2.2.4-3(3) Procurement Source of Cargo Handling Machine

Cargo handling machine		Procurement Source		
		Local	Japan	3rd Countries
Reach Stacker	45t			X
RTG	6+1 wide/1-over-5 high		X	X
Loading/unloading arm	8”		X	

2-2-4-7 Training Plan for Initial Driving and Operation Guidance on New Equipment

(1) Driving Guidance

It is confirmed that the reach stackers are operated in the terminal and the drivers maintain skills for driving reach stackers. However, it is significant for the drivers to update the technical information and ask advice of manufacturers or their agents in order to improve the operational skills and to ensure the effective operation. The main considerations are as follows. In addition, the periodical safety training should be held for the drivers in view of high risks on the danger by operation of the heavy equipment and possible accidents caused by increase of the equipment working at the yard and.

- Specification/particulars and initial setting for new equipment

- Improvement and change on operation/driving method in comparison with the current equipment
- Safety devices and unsafe driving
- Eco-driving for low fuel consumption
- Driving failure cases and measures

For RTGs which will be deployed newly for operation, it should be well prepared in advance to delivery that the training for the drivers is programmed and performed with the following items proposed.

- Driving/Operation training to be held at the manufacture for 2-4 weeks program to learn the driving skill and technical knowledge.
- Training program at the other terminal with RTG operation in Mozambique

In parallel with the training with the drivers currently working at the site, it is suggested that the driving expert for RTG should be newly employed after review on necessity. It is considered that it is essential to need the experience and technical skill of the expert to perform safety operation and operational continuity without stoppage. In addition, it is understood that the hiring of expert can contribute to the training at the site to improve the driving skill of the other drivers.

(2) Operational Guidance

1) Maintenance Management

It is assumed that the new equipment will be allocated properly in the yard operational plan and perform their operations with the standardized workload effectively. It is practical to increase the working performance with decrease of defect ratio by ensuring the maintenance properly under the manufacturer's program. For this objective, it is necessary that the mechanics should be supported technically by the continuous training as the technical training is recognized as significant for daily maintenance/repair. Especially for RTG, it is concerned in case of possible breakdown that the operational stoppage will occur as only 2 units are installed without spare unit. The terminal mechanics should ensure learning on various unit functions from the manufacture's engineers at the commissioning in delivery and prepare for prevention of the initial trouble and the measures taken for possible troubles. The training of the maintenance specialist for RTG should be programmed and performed in the similar manner as the drivers' training as mentioned below. In parallel, as same as employment of the driving expert, it is suggested that the maintenance expert for RTG (crane/electric/electronic engineer) should be newly employed after review on necessity. It is understood that the RTGs have the troubles on the electronic control system in many cases. So, the hiring of the engineer should be subject to evaluation of the carrier and knowledge on it.

- Guarantee engineer(s) to be stationed for driving and operation guidance in introduction of equipment during three months
- Maintenance training to be held at the manufacture for 2 weeks program to learn the maintenance skill and technical knowledge.
- Training program at the other terminal with RTG operation in Mozambique

After delivery of the equipment, the terminal maintenance team is required to review necessary parts items in stock and place the orders for the periodical maintenance and repair. Also, for preparing the request of the service engineer when necessary, it is important that the service network and information on availability of the spare parts should be checked in advance.

2) Yard Operation

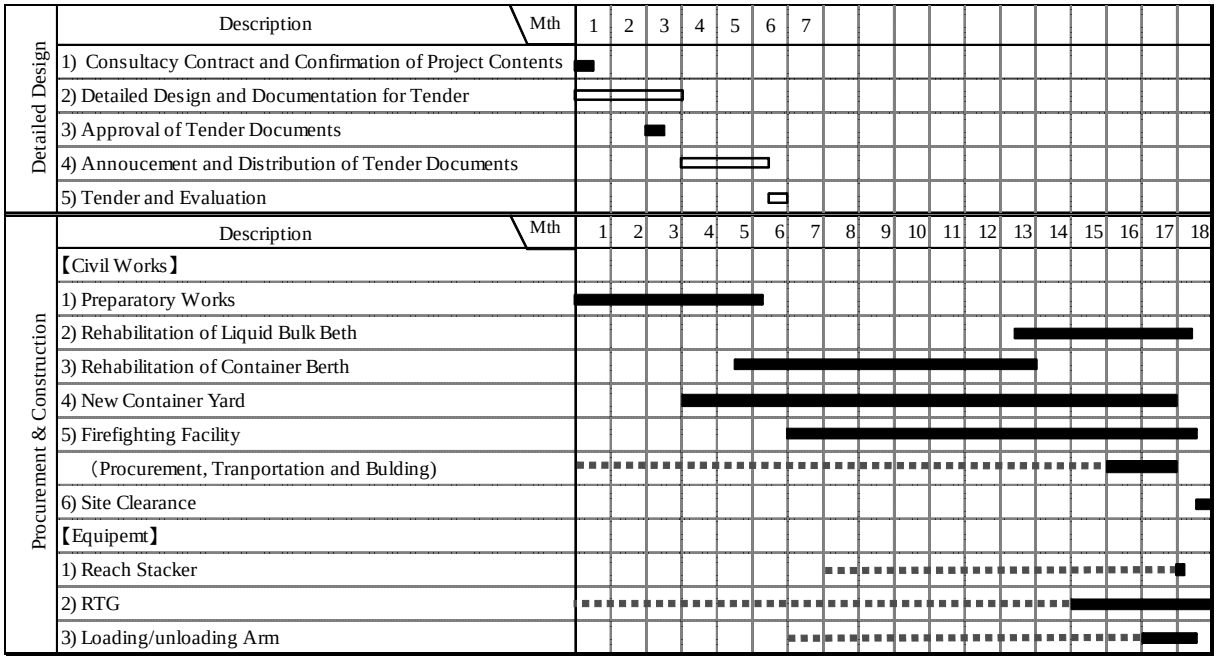
The responsible operation staff is required to arrange for daily allocation and layout of the equipment in consideration with the cargo volumes of the quay operation for the vessels and yard operation. They should discuss the maintenance and repair schedule with the maintenance team and ensure the equipment allocation with an equal workload on daily and monthly basis. For RTG operation at the new North Wharf yard, the operation staff should be familiar with the particulars of RTG and operate the equipment effectively.

Containers will be stacked from three to five high controlled by each yard block in the RTG yard. It is suggested that the yard management system, which be established with direct involvement of CDN, will induce effective operation in the yard with minimizing a number of re-handlings.

2-2-4-8 Execution Schedule

In implementing this project under the Grant Aid scheme by the Government of Japan, after conclusion of E/N between two countries and Grant Agreement, an agreement for consulting services shall be concluded between the Government of Mozambique and the Consultant who has a Japanese nationality. Based on this agreement, detailed design and tender documents shall be executed. In terms of selection of a contractor, a Japanese construction firm will be appointed as a successful tender through tendering with the support of the Consultant. The construction contract shall be concluded between the Government of Mozambique and the Japanese firm. The project shall be completed through the construction works based on the construction contract. Project Execution Schedule (draft) is shown in Table 2.2.4-4.

Table 2.2.4-4 Execution Schedule of the Project



2-3 Obligations of Recipient Country

The obligations of the recipient country that was confirmed by Minutes or others during the period of this study are as follows,

1) To secure the project Site
2) To take necessary measures to give environmental and social consideration and to obtain a license of implementation of the project
3) To secure land (Project site, Temporary Yard)
4) To demolish Warehouses No.2 and No.3 and to relocate transformer substation in the project site
5) To purchase two reach stackers
6) To provide fenders along the South Wharf
7) To reimburse customs duties, internal taxes, and other fiscal levies which may be imposed in Mozambique with respect to the purchase of the products and services. The necessary budget for the reimbursement should be prepared by MTC.
8) To issue the necessary documents such as TITULO for customs clearance of the products that may be imported for implementation of the project.
9) To accord Japanese nationals and/or nationals of third countries whose services may be required in connection with the supply of the products and services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.
10) To bear all the expenses, other than those covered by the Grant Aid, necessary for the implementation of the project.
11) To bear commission for banking arrangement and advising commission of A/P
12) To use facilities constructed under the scheme of Grant Aid Cooperation of Japan properly

2-4 Operation and Maintenance Plan

2-4-1 Operation and Maintenance Structure

(1) Implementation and Operation Agency

On the basis of the concession agreement on Nacala Port, CDN exclusively exercises the right of port operation and acts as port authority. CDN is furnished with the right of development and operation in the port area covering the whole Nacala Bay and Ferno Veloso Bay. Imperfection of the agreement and unsuccessful achievements, however, are veiled, amendment of the concession agreement is being made as the recommendation of the feasibility study team. The amendment stands ready for the approval by the cabinet of the Mozambique Government.

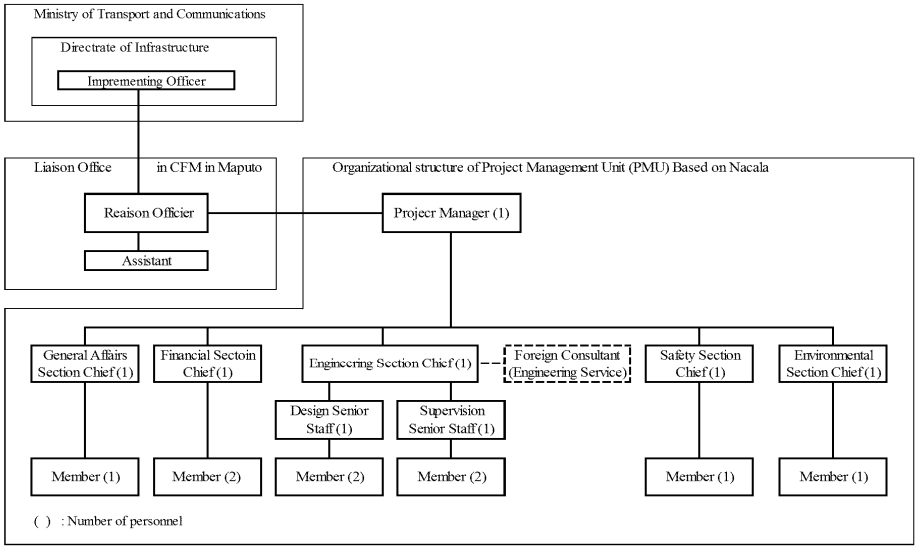
With the amendment the role of the government (MTC and CFM) is expected to be enhanced and the governmental organization is urged to establish the port acts that stipulate basic principles on administration, management, development and planning of ports, and to establish the comprehensive port policy for intensifying competitiveness of own ports.

In addition to the above, the amendment is expected to be properly made for promoting the followings.

- Revision of the scheme of owner ship and operation of Nacala Port which will encourage competition among private operators and securing the public interests
- Ensuring the public investment in port development projects

The amendment will clarify involvement of MTC and CFM for promoting the port development and operation in Nacala Port and the organizations will legally and directly involve in the projects under Grant Aide and loan schemes.

For promotion of the Urgent Rehabilitation Project, the F/S report recommends establishment of Project Management Unit (PMU) as shown in Figure2.4.1-1.



(Source: F/S Report)

Figure 2.4.1-1 Organization of PMU Recommended in F/S Report

PMU should be a government organization with the legal power and should perform the responsible to supervise and monitor the progress of the project, safety control of the works, impacts to the environment and society.

With keeping close connection with MTC and CFM, recommendation by the F/S report urges the organization located at Nacala to be composed of 17 officers plus the project manager as shown in Figure2.4.1-1.

MTC expresses establishment of the internal section named Project Coordination Unit (PCU), while PMU is not established in the study of the project. PMU and/or PCU are/is expected to be established for meeting the occasion for implementing the project or the Urgent Rehabilitation Project under the loans. Under this situation, MTC naturally plays a role of the implementation agency and CFM support the ministry in the technical field.

MTC includes 613 million Mt for the project in the government budget for fiscal year 2012 and registers the official project number. Based on the registration number, MTC will make application of the necessary internal procedures such as reimbursement of taxes and duties, issue of TITULO visas to Japanese nationals, etc.

CDN will be responsible for operation and maintenance of the port as the present and future concessionaire of the Nacala Port.

Responsibility will be shared among the following organization:

- Implementation Agency: MTC and CFM
- Operation and Maintenance: CDN and CFM

Actual operation and maintenance for the facilities and equipment provided under the Grant Aid scheme will be made as follows:

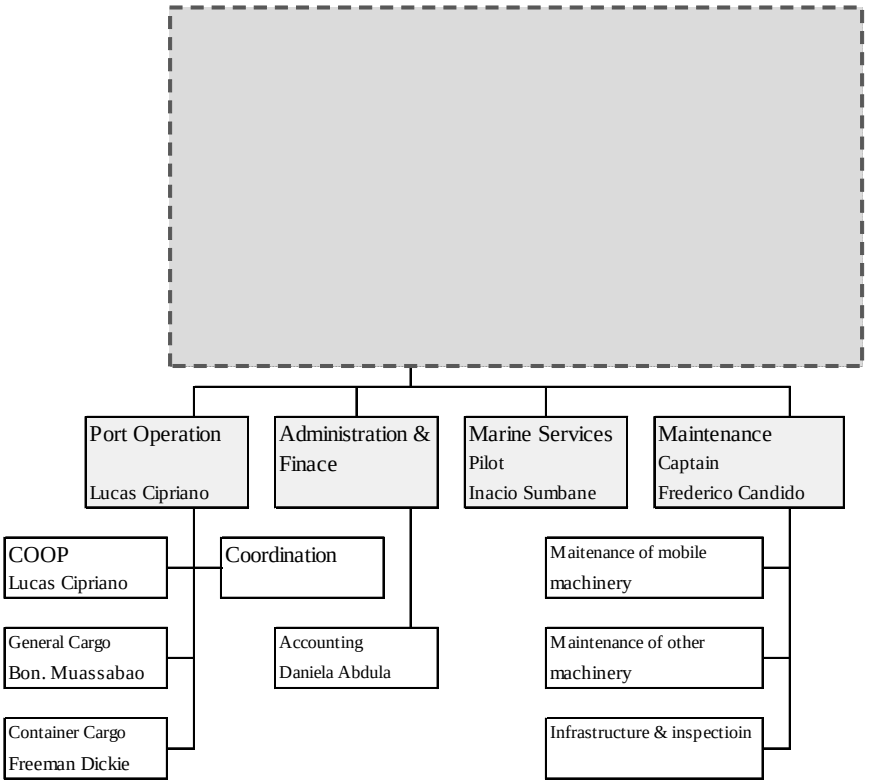
- North Wharf, Container Yard, Reach stackers and RTG: CDN
- Liquid Bulk Cargo Handling Equipment and Firefighting System: CFM

(2) Operator

1) Organization

CDN is furnished with right of operation and management of Nacala Port based on the concession agreement, which is scheduled to be modified in this year., and the modified agreement will be concluded with CDN.

CDN Nacala Port is responsible for the operation and management of Nacal Port, while its headquarters is located in Maputo. As shown in the following figure, the site organization is composed of the sections of Port Operation, Administration and Finance, Marine Services and Maintenance, which are controlled by the Management Staff headed by Executive Director. The total employees are 228 in 2011.



(Source: CDN)

Figure 2.4.1-2 Organization of CDN Nacala Port

2) Financial Situation

The balance of port operation business by CDN is fundamentally in black; the balance in 2011 records 237 million Mt in black with 25% profitability. It shows the port operation business in Nacal Port is sound situation/

Table 2.4.1-1 Balance of CDN in Port Business

	2010（thousand Mt）	2011（thousand Mt）
Income	754,129	975,758
Expenditure	614,274	738,732
Balance	139,855	237,026

(Source: CDN)

2-4-2 Maintenance and Repair

As stated above, CDN, the concessionaire, has responsibility of maintenance of the port facilities, while CFM has its responsibility of maintaining the liquid bulk cargo handling facility and firefighting facility.

Civil structures such as North Wharf, its apron and container Yard should be maintained by CDN under the control of the in-house Civil Engineer. Cargo handling machinery should be maintained by Workshop Manager of CDN maintenance section.

The facilities and equipment should be maintained based on the following or equivalent measures; cargo handling equipment including RTGs should be maintained and repaired on the basis of the manufacturer's maintenance check list, considering proper maintenance and repair of the cargo handling equipment by CDN.

(1) North Wharf

1) Cap concrete

Item	Method	Measures for maintenance	Frequency	Person in charge（CDN）
Concrete	Visual inspection	Partial repair with concrete when needed	Once every 2 months	Civil Engineer

2) Fender and bollard

Item	Method	Measures for maintenance	Frequency	Person in charge（CDN）
Fender	Visual inspection	Replaced when seriously damaged	Once a month	Civil Engineer, Port Captain
Bollard	Visual inspection	Re-paint	Once a month	Civil Engineer Port Captain

3) Apron

Item	Method	Measures for maintenance	Frequency	Person in charge（CDN）
Interlocking concrete block	Visual inspection	Replace of Damaged blocks and/or partial settlement of blocks	Once every 2 months	Civil Engineer

(2) Container Yard

Item	Method	Measures for maintenance	Frequency	Person in charge（CDN）
Interlocking concrete block	Visual inspection	Replace of Damaged blocks and/or partial settlement of blocks	Once every 2 months	Civil Engineer
RTG lanes	Visual inspection	Injection of chemical bond into small cracks	Once every 2 months	Civil Engineer

(3) Cargo Handling Equipment (Inspection based on Manufacturer's manual

Item	Method	Measures for maintenance	Frequency	Person in charge (CDN)
RTG	Visual inspection of appearance of equipment & meters	・Paint（when needed） ・Replacement of parts(when needed) ・Repair (when needed)	Every day	Driver, Workshop Manager
	Inspection based on manufacturer's manual	・Paint（when needed） ・Replacement of parts(when needed) ・Repair (when needed	Manufacturer's recommendation	Driver, Workshop Manager
Reach stacker	Visual inspection of appearance of equipment & meters	・Paint（when needed） ・Replacement of parts(when needed) ・Repair (when needed)	Every day	Driver, Workshop Manager
	Inspection based on manufacturer's manual	・Paint（when needed） ・Replacement of parts(when needed) ・Repair (when needed	Manufacturer's recommendation	Driver, Workshop Manager

(4) Firefighting System

Item	Method	Measures for maintenance	Frequency	Person in charge (CFM)
All system	Confirmation of operation with discharge	・Replacement of parts (when needed) ・Repair (when needed)	Once a year	Officer in charge
Pump	Capacity tests	・Replacement (when needed)	Once a week	Officer in charge
Appearance	Visual inspection	・Re-paint (when needed） ・Replacement of parts (when needed) ・Repair (when needed)	Once a month	Officer in charge
Form	Sampling undiluted form from the tank	・Check of quality	Once a year	Officer in charge
		・Replacement of form (when needed)	Once every 5 year	Officer in charge

(5) Liquid Bulk Cargo Handling Facility

Item	Method	Measures for maintenance	Frequency	Person in charge (CFM)
Abrasion parts	Visual inspection	Replacement of rubber gasket, filter elements, etc.	Once a year	Officer in charge
Overall system	Overhaul	・Paint（when needed） ・Replacement of parts(when needed) ・Repair (when needed)	Once every 5 year	Officer in charge

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Estimated Project Cost under the Grant Aid Scheme

The project cost defrayed by the Government of Mozambique is estimated as shown below, according to the conditions indicated (2).

Table 2.5.1-1 Cost to be Borne by the Government of Mozambique

Items	Amount(thousand Mt)	Yen equivalent(million yen)
1. Demolition of warehouse No.2	9,800	28.9
2. Relocation of the transformer substation	170	0.5
3. Commissions for Banking Arrangement	915	2.7
TOTAL	10,885	32.1

In implementing the project, taxes and duties imposed on material and machinery purchased in Mozambique plus import duties will be reimbursed to the contractor. MTC will include the following approximate amount of 49 million Mt in the government budget for each year.

Table 2.5.1-2 Amount to be Reimbursed in the Project

Item	1st year(thousand Mt)	2nd year(thousand Mt)	TOTAL(thousand Mt)
IVA imposed on material and machinery	5,776	23,100	28,876
Import duties and IVA	8,001	12,001	20,002
TOTAL	13,777	35,101	48,878

(2) Conditions for Cost Estimation

1) Estimation Time: May 2012
2) Exchange Rate: 1US$ = 80.17 Yen, 1EUR = 106.07 Yen, 1Mt = 2.95 Yen
3) Construction Period: as indicated in Figure 2.2.4-4
4) Others: the cost estimation conducted in conformity with the requirements for the scheme of the Japan's Grant Aid

2-5-2 Operation and Maintenance Cost

CDN will be responsible for operation and management of Nacala Port after completion of the project and necessary cost for maintenance of the facilities and equipment will not cost so much except the maintenance cost for RTGs.

Since no RTG, new large cargo handling equipment, is operated in the existing yard, skilled

driver(s) and mechanic(s) will be indispensable for proper operation of the equipment. Moreover, sufficient stock of spare parts will be required and an engineer/ mechanic form the manufacturer might be required in serious breakdown. The cost for the maintenance of the new equipment will be necessary for appropriate operation and maintenance.

Some damages of rubber fenders set along the North Wharf may occur due to their deterioration and improper berthing; the cost should be prepared.

The cost for maintenance of the pavement of the apron and the container yard should be prepared against small breakage and slight settlement of the interlocking concrete blocks, and the cost is equivalent with 0.5% of the construction cost.

Total maintenance cost is summarized in the following table.

Facilities and Equipment	Description	Amount(thousand Mt)
Cargo Handling Equipment	Maintenance, Employment of a driver and a mechanic for RTG, Fuel, Insurance	8,429
North Wharf	Fender	678
North Wharf Apron and Container Yard	Replacement of interlocking concrete blocks	457
TOTAL		9,564

As indicated in the table, maintenance cost for the facilities and equipment is estimated to be about 9.6 million Mt.

CDN will afford to prepare the above amount for the maintenance, considering the balance in the port business.

Chapter 3 Project Evaluation

Chapter 3 Project Evaluation

3-1 Preconditions

(1) Securing the land such as Project Site, Temporary Yard, Disposal Area, etc.)

(2) Taking the necessary measures to complete whole process for facilitating the EIA certification process

(3) Removing/relocating existing utilities (Warehouse No.2, transformer substation facility in the container yard pavement)

(4) Procuring additional two(2) reach stackers other than those covered by the Grant

(5) Providing rubber fenders along the South Wharf

(6)Reimbursing customs duties, internal taxes, and other fiscal levies that may imposed in Mozambique with respect to the purchase of the products and services, and preparing the necessary budget for the reimbursement by MTC

(7) Issuing the necessary documents such as TITULO for customs clearance of the products that may be imported for implementation of the project

(8) To accord Japanese nationals and/or nationals of third countries whose services may be required in connection with the supply of the products and services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(9) Bearing commissions for the banking services based upon Banking Arrangement and the advising commissions of the Authorization to Pay

(10) Bearing all the expenses, other than those covered by the Grant Aid, Necessary for the implementation of the project

(11) Assisting, if necessary, to issue licenses, permissions and other procedures for the commencement of the project.

3-2 Necessary Inputs by Recipient Country

Table 3.2-1 and 3.2-2 shows the items that the Mozambican side should undertake in order to accomplish and maintain the project effects.

Table 3.2-1 Necessary Inputs by the Mozambican side (1)

Stage	Items
(1) Before construction	1. Completion of EIA procedures 2. Clearance of the project site 3. Installation of fenders along the South Wharf 4. Issue of work permit and other necessary permits or licenses for the Japanese and the third countries' firms that may involve the project 5. Preparation of the budget for reimbursement of customs duties, internal taxes and other fiscal levies that may imposed on the products and services for the project 6. Banking Arrangement (B/A) and issue of Authorization to Pay (A/P)

Table 3.2-2 Necessary Inputs by the Mozambican side (2)

Stage	Items
(2) During construction	1. Arrangement and coordination of control of in-port traffic 2. Coordination among the relevant organs for relocation of fuel facility 3. Notice to the shipping firms/agents on berth congestion due to construction 4. Purchase of two reach stackers 5. Training for driving technique and maintenance of RTGs 6. Verification of payment in accordance with A/P and the Contract
(3) After construction	1. Proper and effective utilization of the project facilities constructed under the Grant Aid 2. Periodical checkup and maintenance of the quay facility, apron and container yard 3. Effective operation of the container yard with introduction of a yard management system 4. Continuous training for drivers and mechanics of RTGs and employment of skilled engineer(s) 5. Request to the manufacturer or its agent for reserve of important spare parts for maintenance of RTGs and reach stackers, and establishment of a systematic channel for promptly purchasing spare parts at a moderate price 6. Contract with a RTG manufacturer or service agent for annual service/inspection, and budgetary for the contract

3-3 Important Assumption

The external conditions to develop and maintain the effects of the project after completion of the facilities are listed below.

1) Proper utilization of the quay facility and apron of the North Wharf and the container yard
2) Proper maintenance of the above facilities with necessary budgetary
3) Installation of proper rubber fenders along the South Wharf for container and larger bulk cargo ships
4) Prolongation of the structural life of the South Wharf with reduction of berthing forces by ships and with control of surcharges on the deck of the structure
5) Proper operation of RTGs based on sufficient training of driving and maintenance of the equipment
6) Effective operation of the container yard with introduction of a yard management system that should be set up with direct involvement of the yard operator, which is expected to be Porto do Norte
7) Termination of the preferential use of the South Wharf by Vale Lda as scheduled
8) Implementation of Urgent Rehabilitation Project under the Yen Loan Scheme as scheduled

3-4 Project Evaluation

3-4-1 Relevance

(1) Present Situation and Issues of the Sector

The major commercial ports in Mozambique are Maputo Port, Beira Port and Nacala Port. The hinterland of each port is described below:

- Maputo Port: the urban area of Maputo and South Africa
- Beira Port: the area between the urban area of Maputo and Nacala Corridor and Zimbabwe
- Nacala Port: Neighboring area of Nacala Corridor and Malawi and Zambia

Nacala Port renders services of the two deep sea berths of -15m and needs no dredging of the waterways, while other two ports need dredging of their waterways. The extensive area of the hinterland of Nacala Port has high potential of development. The Mozambique Government has established policy to promote the development of the Nacala Corridor in the field of agriculture and industry. Mining of mineral resources in Zambia and Malawi likely produces active cargo traffic between Mozambique and the countries. These economic activities are expected to increase of cargo throughput in Nacala Port. It is also expected to increase transit cargo volume due to overcapacity of handled cargo volume in Durban Port.

The above situation likely improves the position of Nacala Port in the region of the southern east Africa; the port, therefore, requires sufficient port capacity to accommodate larger carriers.

However, almost of all the port facilities in Nacala Port are deteriorated. The main concrete-piled berth of -15m is seriously damaged to impose control on surcharges on the berth deck, while inefficient operation is managed in the port. Therefore, a present concern is shown about the insufficient port capacity to meet the future demand of port cargo. It is recognized that improvement and expansion of the port facilities is required for facilitating the port function as the central port in the region.

There remain the bottlenecks in the port management stated above; however, Vale Lda obtains the preferential use of a berth in the South Wharf for exporting coral during January 2013 and early 2015. The contract is concerned that it may cause shortage of berths and handling capacity. There will remain no option except partial utilization of -10m berth in the North Wharf so long as a new container berth of 14m depth will be not constructed.

The container throughput in 2011 is 89,000TEUs, which shows the increase of 17% from the volume in 2010; it results in excess of 7 % over 10% increase presented in the Final Report on the Preparatory Survey on Nacala Port Development Project in the Republic of Mozambique (hereinafter referred to as “F/S Report”). It is understood that efficient use of the existing yard area should be made and efficiency of containers operation should be improved.

In terms of the fuel handling facility and fire fighting facility, they remain far from the requirements of IMO and they should be improved promptly.

In the view point of the above, the necessity and urgency of the project are confirmed with understanding that the project targets the improvement of capacity of Nacala Port for operation of increasing cargo volume and the maintenance of international safety standard for handling fuel.

(2) Consistency of Short-tem Development Plan and Urgent Rehabilitation Project

The study for the development plan of Nacala Port was conducted by the JICA study team, which presented the F/S Report in June 2011. The report is comprised of the Medium/ long-term Development plan, Short-term Development Plan and Urgent Rehabilitation Plan (Part-1 and Part-2). These plans are approved by the Government of Mozambique to be the development plan of Nacala Port.

The Short-term Development Plan and Urgent Rehabilitation Plan will be reviewed and re-established by the study team for the Project for Improvement of Nacala Port in Republic of Mozambique (hereinafter referred to as “Technical Cooperation”) for meeting the latest cargo traffic.

The Project under the Grant Aid is requested by the Government of Mozambique. In implementing the project, the Urgent Rehabilitation Project under the Yen Loan scheme is scheduled to be conducted for provision of the remaining components of the Urgent Rehabilitation Project (Part-1) except those of Grant Aid Project. The Urgent Rehabilitation Project (Part-2) will be implemented under the co-financing with JICA and African Development Bank.

From the implementation schedule of the above project, the Project under the Grant Aid takes the position of the first stage toward the comprehensive Urgent Rehabilitation Project and Short-term Development Plan. It requires the Project under the Grant Aid should ensure the development concept of these project and plan.

Considering the requirements and the study results on the demand forecast of cargo throughput by the study team for Technical Cooperation, the Project is formulated with matching the overall yard layout plan in Nacala Port prepared by the above team.

The Project under the Grant Aid, therefore, reserves consistency with the study results presented in the F/S Report and those for Technical Cooperation, which are established as the development policy of Nacala Port.

(3) Technical Cooperation

Introduction plan for RTGs and reach stackers are formulated to propose the training programs on operation and maintenance technique. In terms of RTGs that have never be provided in Nacala Port, the equipment requires skilled technique of operation and maintenance; a skilled trainer is indispensable for initial introduction. In implementing the Project, drivers and technicians of RTGs are scheduled to be trained in the manufacturer’s training center or in Nacala Port using the new equipment as options in introduction. Employment of a skilled engineer/ technician of RTGs is recommended in addition to the training. The employment will produce the opportunity of

on-the-job training with the skilled person and prompt upgrade of the trainers will be achieved by a skilled trainer.

In parallel with the Project under the Grant Aid, Technical Cooperation Project is scheduled to be implemented till March 2015. Technical Cooperation will make the recommendations on re-formulation of Short-term Development Plan, improvement of port management capacity, improvement of maintenance technique of port facilities and cargo handling equipment. In addition to the recommendations, capacity building for the port staff will be made on the basis of practical training and lectures.

Efficiency of yard management is expected to be improved through the several opportunities for capacity building in the program of Technical Cooperation Project, even at the construction stage of the Grant Aid Project.

(4) Beneficial Effect

The Government of Mozambique establishes the Special Economic Zone in the suburb of Nacala Municipality to promote investment from the private sector to the region of the Northern Provinces that is behind in development. The center of the SEZ is Nacala Municipality with increasing number of up-and-coming firms to the SEZ. Nacala Port plays a role of the gateway for import/export of products to the international/domestic markets. Nacala Port is connected with inland provinces and Malawi and Zambia through the roads and railways, which is called Nacala Corridor. The hinterland of the port covers the wide range of area; the population is 36 million, the total area is 1.2 million square meters and GNI is US$18.4 billion. These figures surmise the high development potential. In the region of Nacala Corridor, ProSAVANA- JBB project is commenced to target the increase of agricultural products. A production increase by the project may activate cargo traffic through the Corridor to Nacala Port, which is expected to result in increase of cargo throughput in Nacala Port.

The hinterland of Nacala Port covers the wide range of the area of the Northern Provinces, Malawi and Zambia through Nacala Corridor. Benefitted population with implementation of the Project seems to be 36 million in the hinterland. Agricultural production increase may induce the increase of cargo throughput in Nacala Port and is expected to earn foreign currency as a major anchor.

Through the comprehensive consideration as above, the Project for improvement of cargo handling efficiency and maintenance of international safety standard is appropriately evaluated based on understanding of the position of Nacala Port. Implementing a part of the Project under the Japan’s Grant Aid scheme adequately fulfills the relevance and significance in view of the scheme policy.

3-4-2 Effectiveness

(1) Quantitative Effects

The outcome of quantitative effects with implementing the Project is tabulated in Table 3.4.1.

1) Improvement of Capacity in the Container Yard

The overall stacking capacity of containers in Nacala Port increases due to provision of a container yard in the North Wharf with implementation of the Project.

2) Achievement of Safe Handling of Fuel

Fuel is unloaded through the pipes that connect manifolds on a tanker with landside valves. Leakage and dispersion of fuel in the sea is concerned in handling fuel under the existing system. Safe unloading of fuel is achieved with equipping loading/unloading arms with implementing the Project.

Target	Criterion Number (Achievement in 2011)	Target Number (in 2017)
Increase of handling volume in the yard (TEU/yr)	89,714	161,590
Achievement of safe unloading of fuel (%) *)	0	100

*) Percentage = (Number of tankers to safely unload fuel at Nacala Port)/(number of tankers calling at Nacala Port)

(2) Qualitative Effects

The followings are the outcome of qualitative effects with implementation of the Project.

1) Prolongation of Utilizing the Deteriorated Port Facilities

Quay operation is hampered due to the deteriorated apron and cap concrete of the North Wharf; however, the function of the Wharf will be recovered with rehabilitation of the facilities with implementation of the Project. A berth at the North Wharf will be renewed as a container berth, which will bring prolongation of utilization of the North Wharf.

2) Safe Berthing with Equipping Rubber Fenders

Sizes of ships mooring at the North Wharf vary in a wide range; the maximum is 50,000DWT and minimum is 1,000DWT. The wharf is equipped with insufficient rubber fenders and safe mooring is not secured at the wharf. The rubber fenders newly equipped at the wharf in the Project will be properly applied to the wide range of the ships' sizes and will make calling ships moored safely.

APPENDICES

APPENDICES

Appendix 1 Member List of the Survey Team

(1) Site Survey

Assignment	Name and Position
Team Leader	Mr. Yuki ARATSU Deputy Director General, and Group Director for Transportation and ICT, Economic Infrastructure Department, Japan International Cooperation Agency (JICA).
Planning Coordinator	Mr. Yutaka ARAKI Transportation and ICT Division 1, Transportation and ICT Division Group, Economic Infrastructure Department, Japan International Cooperation Agency (JICA).
Chief Consultant / Port Planning	Mr. Masafumi ITO ECOH CORPORATION
Port Facility Design / Natural Condition Survey	Mr. Isao HINO ORIENTAL CONSULTANTS CO., LTD
Cargo Handling Equipment Plan	Mr. Kazutoshi TSUCHIYA ORIENTAL CONSULTANTS CO., LTD
Construction Planning / Cost Estimate	Mr. Yuhei YAMAMOTO ECOH CORPORATION
Environmental and Social Considerations	Mr. Yuji HATAKEYAMA ECOH CORPORATION

(2) Explanation of Draft Final Report

Assignment	Name and Position
Team Leader	Mr. Taiji KAWAKAMI Executive Technical Advisor to the Director General, Economic Infrastructure Department, Japan International Cooperation Agency (JICA).
Planning Coordinator	Mr. Yutaka ARAKI Transportation and ICT Division 1, Transportation and ICT Division Group, Economic Infrastructure Department, Japan International Cooperation Agency (JICA).
Chief Consultant / Port Planning	Mr. Masafumi ITO ECOH CORPORATION
Construction Planning / Cost Estimate	Mr. Yuhei YAMAMOTO ECOH CORPORATION

Appendix 2 Study Schedule

(1) Site Survey

			JICA Member		Consultant Member					
			Mr. Yuki ARATSU	Mr. Yutaka ARAKI	Mr. Masafumi ITO	Ms. Sanae TANABE	Mr. Isao HINO	Mr. Kazutoshi TUCHIYA	Mr. Yuhei YAMAMOTO	Mr. Yuji HATAKEYAMA
			Leader	Coordinator	Chief Consultant /Port Planning	Interpreter (Portuguese)	Port Facility Design/Natural Condition Survey	Port Accessary Design/Equipment Planning	Construction and Procurement Planning /Cost Estimation	Environmental Impact Evaluation
1	2012/4/7	Sat			Tokyo→HKG					
2	2012/4/8	Sun			HKG→			Tokyo(Kansai)→HKG→		
3	2012/4/9	Mon			→JNB→Maputo, Meeting to JICA, MTC					
4	2012/4/10	Tue			Discussion with MTC and CFM					
5	2012/4/11	Wed			Discussion with MTC and CFM				Collection of data	Collection of data
6	2012/4/12	Thu			Discussion with MTC and CFM			Port of Maputo	ditto	ditto
7	2012/4/13	Fri			Discussion with MTC and CFM, Report to JICA					
8	2012/4/14	Sat			Maputo→Nampula→Nacala					
9	2012/4/15	Sun			Team Meeting					
10	2012/4/16	Mon			Site visiting with all members concerned					
11	2012/4/17	Tue	Tokyo→HKG→		Nacala→Nampula→Maputo		Site survey			
12	2012/4/18	Wed	→JNB→Maputo		Survey for other donor	attend to Chief Consultant	Ditto	Survey for cargo-handling situation	Survey for construction plan	Discussion with MICOA
13	2012/4/19	Thu	Discussion with MTC				Ditto	Ditto	Ditto	Survey for EIA
14	2012/4/20	Fri	Discussion with MTC				Ditto	Survey for cargo-handling equipment	Visit to Quarry	Discussion with MITUR
15	2012/4/21	Sat	Maputo→Nampula→Nacala, Site visiting		Discussion with related organization	attend to Chief Consultant	attend to JICA team	ditto	attend to JICA team	Site survey
16	2012/4/22	Sun	Nacala→Nampula→Maputo		Team Meeting		Team Meeting			
17	2012/4/23	Mon	Discussion with MTC and CFM				Site survey	Survey for cargo-handling equipment	Construction company	Discussion with CDN
18	2012/4/24	Tue	Discussion with MTC and CFM, Signing of M/D				Ditto	Ditto	Nacala→Nampula→Maputo	
19	2012/4/25	Wed	Report to Japan Embassy and JICA			Visiting to Matola	Ditto	Ditto	Visiting to Matola	Survey for EIA
20	2012/4/26	Thu	Maputo→JNB→		Maputo→Nampula→Nacala		Ditto	Survey for port facility	Construction situation	Meeting to University, Institute
21	2012/4/27	Fri	→HKG→Tokyo		Survey for port facility	attend to Chief Consultant	Ditto	Ditto	Ditto	Discussion with NPMA
22	2012/4/28	Sat			survey for cargo-handling equipment	attend to Chief Consultant	Ditto	Survey for maintenance of equipment	Construction equipment	Survey for EIA
23	2012/4/29	Sun			Team Meeting					
24	2012/4/30	Mon			Discussion for traffic management	attend to Chief Consultant	Site survey	Survey for maintenance of equipment	Construction material	Survey for EIA
25	2012/5/1	Tue			Discussion with PETROMOC	attend to Chief Consultant	Ditto	survey for maintenance management situation	Discussion with PETROMOC	Discussion with MICOA
26	2012/5/2	Wed			Discussion with CFM	attend to Chief Consultant	Ditto	Ditto	Construction price	Survey for EIA
27	2012/5/3	Thu			Survey for yard operation	attend to Chief Consultant	Ditto	survey for maintenance management planning	Ditto	Ditto
28	2012/5/4	Fri			Survey for yard operation	attend to Chief Consultant	Ditto	Ditto	Report to JICA	
29	2012/5/5	Sat			Nacala→Nampula→Maputo		Ditto	Nacala→Nampula→Maputo	Construction price	Survey for EIA
30	2012/5/6	Sun			Team Meeting			Maputo→JNB→		
31	2012/5/7	Mon			Discussion with MTC and CFM		Ditto	→HKG→Tokyo(Kansai)		
32	2012/5/8	Tue			Discussion with MTC and CFM		Nacala→Nampula→Maputo			
33	2012/5/9	Wed			Report to Japan Embassy and JICA					
34	2012/5/10	Thu			Maputo→JNB→					
35	2012/5/11	Fri			→HKG→Tokyo					

(2) Explanation of Draft Final Report

			JICA Member		Consultant Member		
			Mr. Taiji KAWAKAMI	Mr. Yutaka ARAKI	Mr. Masafumi ITO	Mr. Yuhei YAMAMOTO	Ms. Sanae TANABE
			Leader	Coordinator	Chief Consultant/Port Planning	Construction and Procurement Planning/Cost Estimation	Interpreter (Portuguese)
1	2012/10/13	Sat			Tokyo→HKG→		
2	2012/10/14	Sun	Tokyo→MBA	Tokyo→SIN→	→JNB→Maputo		
3	2012/10/15	Mon	MBA→Nacala, Site visiting	→JNB→maputo	Discussion with MTC		
4	2012/10/16	Tue	Nacala→Maputo	Meeting with JICA	Discussion with MTC		
5	2012/10/17	Wed	Discussion with MTC and CFM				
6	2012/10/18	Thu	Visiting to Maputo Port, Signing of M/D				
7	2012/10/19	Fri	Report to Japan Embassy and JICA		Making of final report / Collection of data		
8	2012/10/20	Sat	Maputo→MBA	Maputo→JNB→	Making of final report / Collection of data		
9	2012/10/21	Sun	MBA→Tokyo	→SIN→Tokyo	Maputo→JNB→		
10	2012/10/22	Mon			→HKG→Tokyo		

Appendix 3 List of Parties Concerned in the Recipient Country

(1) Mozambican Parties

Ministério dos Transportes e Comunicações (MTC)

Mr. Pedro Augusto Inglês	Secretário Permanente
Dr. Ana Matusse Dimande	Project Coordinator
Mr. Orlando Manhique	
Mr. Manuel Mário	DNTL
Mr. Tomás Julai	DEI
Ms. Ivone A. Pemicelo	DRH
Mr. Francisco R. Martins	Marine Engineer

Portos e Caminhos de Ferro de Moçambique (CFM)

Mr. Miguel Nhaca Guebuza	Administrador
Mr. Aníbal Manave	Assessor do Conselho de Administração
Mr. Paulo Tarmamade	Assessor do Conselho de Administração
Mr. João Mateus Mabota	Chief Engineer
Ms. Carmona Macobola	Civil Engineer
Mr. Radamês Bongece	Assessor
Mr. Paulo Tarravane	Assessor
Ms. Marilia Bene	Tecnica Ambienatlista
Mr. José Joaquim Daúde	Representante da CFM-Nacala

Corredor de Desenvolvimento do Norte (CDN)

Mr. Amado Mabasso	CEO
Mr. Luiz Martins	Director de Operações
Mr. Agostinho Langa	Director do Porto
Mr. Lucas José Cipriano	Director de Operações
Cap. António F. Cândido	Director da Manutenção Portuária
Mr. Cremildo Madeira	Coordenador do Ambiente/Segurança
Mr. Romero Justino	Director Executivo
Mr. Fabio Duarte	Assistente Executivo

Porto do Norte (PN)

Mr. João P. M. Fernandes	Portos do Norte-Assessor da Administração

Ministério da Energia

Ms. Natálie M.Teodor	Gabinete do Ministro Assessora para a Área de Combustível
Ms. Jorgina Manhengane	Gabinete do Ministro Assessora para a Área de Combustível

Gabinete das Zonas Económicas de Desenvolvimento Acelerado (GAZEDA)
Ms. Cármen Paula F.E. Quembo

PETROMOC

Mr. Danilo Laice	PETROMOC/NACALA -Superintendente

(2) Japanese Parties

Embassy of Japan Mozambique

Mr. Eiji HASHIMOTO	Ambassador of Japan
Mr. Kazuyoshi INIKUCHI	Special Researcher

JICA Mozambique Office

Mr. Ryuichi NASU	Chief Representative
Mr. Akihiro MIYAZAKI	Senior Representative
Mr. Naoki YANASE	Senior Representative
Ms. Yukiko Ohno	Project Formulation Advisor

Appendix 4 Minutes of Discussion (M/D)
(1) Minutes of Discussion (April 24th, 2012)

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON
THE PROJECT OF URGENT REHABILITATION
OF
NACALA PORT DEVELOPMENT
IN
THE REPUBLIC OF MOZAMBIQUE

In response to a request from the Government of the Republic of Mozambique (hereinafter referred to as " Mozambique ") and based on the results of the preceding Data Collection Survey in November 2011, Japan International Cooperation Agency (hereinafter referred to as "JICA") in consultation with the Government of Japan, decided to conduct a Preparatory Survey on the Project for the Urgent Rehabilitation of Nacala Port Development (hereinafter referred to as "the Project").

JICA sent the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Yuki Aratsu, Group Director for Transportation and ICT, Economic Infrastructure Department, JICA, and is scheduled to stay in the country from April 7, 2012 to May 11, 2012.

The Team held a series of discussions with the officials of the Government of Mozambique and conducted a field survey at the Project area.

In the course of discussions and the field survey, both sides confirmed the main items described on the attached sheets. The Team will continue further studies and prepare a Preparatory Survey Report.

Maputo, April 24th, 2012

Ana M. Matusse Dimande
Coordinator
Nacala Port Development Project
Ministry of Transport and Communications
Republic of Mozambique

Yuki Aratsu
Leader of the Preparatory Survey Team
Group Director for Transportation and ICT
Economic Infrastructure Department
Japan International Cooperation Agency

ATTACHMENT

1. Objective of the Project

The objective of the Project is to urgently rehabilitate deteriorated facilities of North Wharf and to provide urgently required cargo handling equipment in Nacala Port.

2. Project site

The site of the Project is shown in Annex-1.

3. Responsible and Implementing Organizations

3-1. The responsible ministry and implementing organization of the Project is the Ministry of Transport and Communications (hereinafter referred to as "MTC"). The organization chart of MTC is shown in Annex-2

4. Items requested by the Government of Mozambique

4-1. After discussions with the Team, the items described below were finally requested with priority order by the Government of Mozambique.

(1) Repair of North Wharf with installing Fenders
(2) Pavement of Apron at North Wharf
(3) Container Yard Pavement at North Wharf (Expansion of Yard)
(4) Reach Stacker: 4 units
(5) RTG 2 units
(6) Fire Fighting System
(7) Loading and Unloading Arm for Liquid Bulk Cargoes

4-2. JICA will assess the necessity, relevancy and degree of urgency of the requested items through the survey and will recommend to the Government of Japan for approval.

4-3. The outputs and results of "The Project for Improvement of Nacala Port" (Technical Cooperation) will also be considered when assessing the necessity, relevancy and degree of urgency of the Project components.

5. Japan's Grant Aid Scheme

5-1. The Mozambican side has shown a full understanding of the Japan's Grant Aid Scheme explained by the Team, as described in Annex-3 and Annex-4.

5-2. The Mozambican side will take the necessary measures, as described in Annex-5 for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.

6. Environmental and Social Considerations

6-1. The Mozambican side agreed to take necessary measures to give due consideration and social considerations in the implementation of the Survey, in accordance with the JICA

Guidelines for Environment and Social Considerations(April, 2010).

6-2. The Mozambican side informed the present status of Environment Impact Assessment (EIA) approval. The Team informed the Mozambican side that the EIA approval is prerequisite for the Project appraisal in Japan. The Mozambican side agreed to submit the report to JICA Mozambique Office by the end of June, 2012.

6-3. The Mozambican side also agreed that

1) JICA may disclose on its website the EIA report and environmental certifications
2) JICA may disclose on its website the monitoring results conducted by MTC in accordance with the Monitoring Plan for the Project, which will be described in the Preparatory Survey Report and/or will be agreed on Minutes of Meetings.

7. Schedule of the Survey

7-1. The consultants will proceed to further studies until 11 May, 2012.

7-2. JICA will submit to the Mozambican side the result on the review of the cost shown in the previous F/S report and will propose optimal components of the Project by mid-July.

7-3. JICA will prepare a draft Preparatory Survey report and dispatch a team in order to explain its contents to the Mozambican side around October, 2012.

7-4. When the contents of the draft Preparatory Survey report are accepted in principle by the Government of Mozambique, JICA will complete the final report and send it to the Government of Mozambique around November, 2012.

8. Other relevant issues

8-1. The Mozambican side strongly requested that the Team shall take into considerations the urgency of the Project and civil works shall be commenced within CY2013. The Team took notes of the request and promised to transfer the request to the concerned authorities.

8-2. The Mozambican side strongly requested the Reports stipulated above in Article 7 shall be prepared in both English and Portuguese. The Team promised to deliver the request to JICA Headquarters.

8-3. Both sides agreed that installation of fenders along the South Wharf in Nacala Port should be conducted by Corridor de Desenvolvimento do Norte SA (hereinafter referred to as "CDN"). In implementation of expansion of a new container yard in the North Wharf, CDN should demolish the Warehouse No.2 and No.3, and relocate the transformer facility located in the yard pavement area as shown in Annex-1 before commencement of the works under the Grant Aid.

8-4. The Mozambique side agreed that:

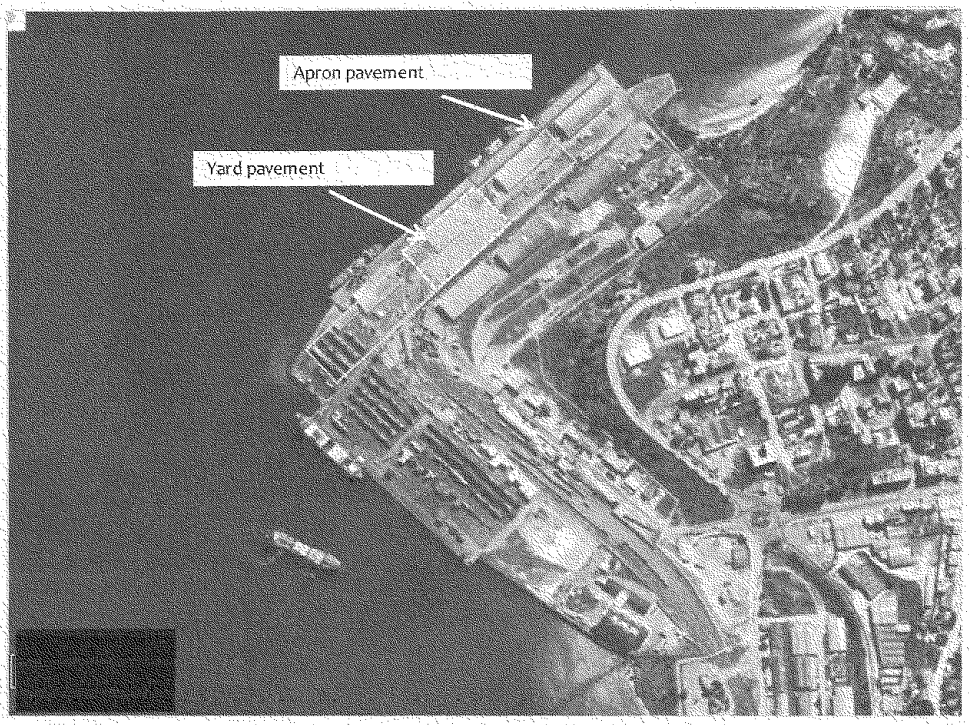
1) Customs duties, internal taxes, and other fiscal levies which may be imposed in Mozambique

with respect to the purchase of the products and the services shall be reimbursed. The budget required for the reimbursement stated above should be prepared by MTC.

2) The necessary documents such as TITULO should be issued for customs clearance of the products that may be imported for implementation of the project.

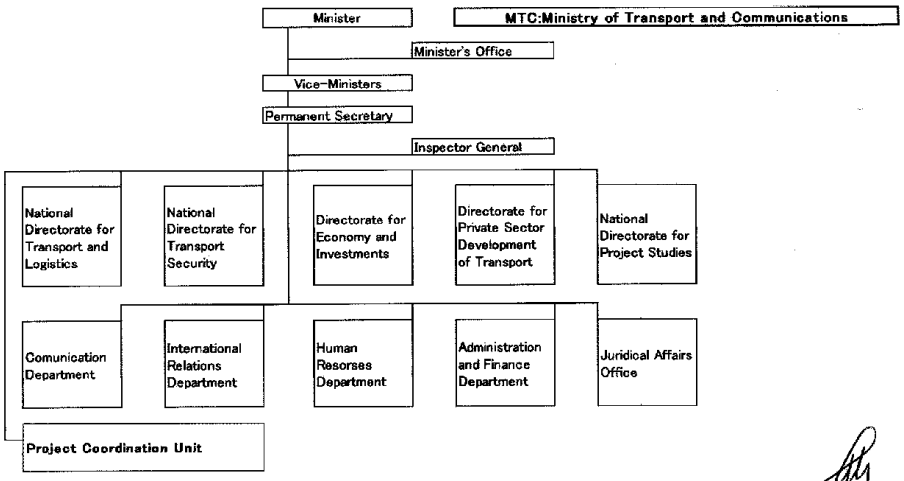
Annex-1 Project Site
Annex-2 Organization Chart of the Ministry of Transport and Communications
Annex-3 Japan's Grant Aid Scheme
Annex-4 Flow Chart of Japan's Grant Aid Procedures
Annex-5 Major Undertakings to be taken by the Government of Recipient Country

Annex-1 Project Site



Proposed Components by Grant Aid Project Team (April 2012)

Annex-2 Organization Chart(MTC)



Annex-3

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures :

·Preparatory Survey
- The Survey conducted by JICA

·Appraisal &Approval
- Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet

·Authority for Determining Implementation
- The Notes exchanged between the GOJ and a recipient country

·Grant Agreement (hereinafter referred to as "the G/A")
- Agreement concluded between JICA and a recipient country

·Implementation
- Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex-5.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

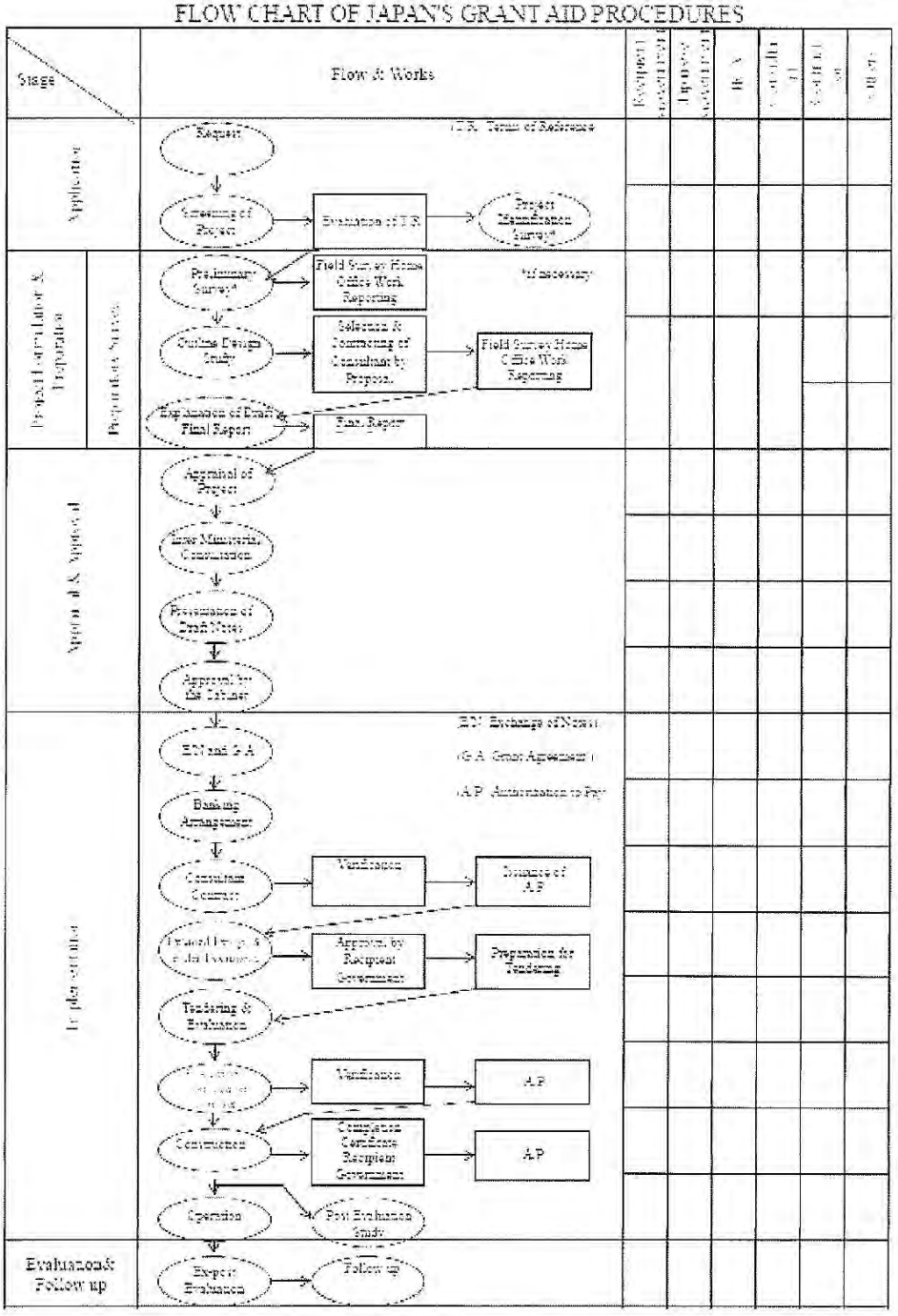
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

Annex-4

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES



Annex-5

Major Undertakings to be taken by the Government of Recipient Country

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure lots of land necessary for the implementation of the Project and to clear the sites		●
2	To ensure prompt unloading and customs clearance of the products and to assist internal transportation of the products in the recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2) Custom clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	
3	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be borne by the Government of Recipient country without using the Grant		●
4	To accord Japanese nationals and/or nationals of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
5	To ensure that the facilities and the products provided under Japan's Grant be maintained and used properly and effectively for the implementation of the Project		●
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
7	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
8	To give due environmental and social consideration in the implementation of the Project		●

(B/A : Banking Arrangement, A/P : Authorization to pay)

(2) Minutes of Discussion (October 18th, 2012)

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON THE PROJECT OF URGENT REHABILITATION
OF NACALA PORT DEVELOPMENT
IN THE REPUBLIC OF MOZAMBIQUE

In October 2012, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team (hereinafter referred to as "the Team") on the Project of Urgent Rehabilitation of Nacala port Development (hereinafter referred to as "the Project") to the Republic of Mozambique (hereinafter referred to as "Mozambique"), and through discussions, field surveys and technical examination of the results in Japan, JICA prepared a Draft Final Report of the study.

In order to explain and to consult with the concerned officials of the Government of Mozambique on the contents of the Draft Final Report, JICA sent to Mozambique the team for explaining the Draft Final Report. The team is headed by Mr. Taiji Kawakami, Executive Technical Advisor to the Director General, JICA and is scheduled to stay from October 15 to 19, 2012.

As a result of the discussions, both sides confirmed the main items described in the attached sheets.

Maputo, October 18, 2012

Ana M. Matusse Dimande
Coordinator
Nacala Port Development Project
Ministry of Transport and Communications
Republic of Mozambique

Taiji Kawakami
Leader of the Preparatory Survey Team
Executive Technical Advisor to the Director General
Economic Infrastructure Department
Japan International Cooperation Agency

ATTACHMENT

1. Project Component

1-1. After the discussion during the first Preparatory Survey mission in April 2012, the items described below were requested with priority order by the Government of Mozambique as written in the Minutes of Discussion agreed on April 24th 2012.

(1) Repair of North Wharf with installing Fenders
(2) Pavement of Apron at North Wharf
(3) Container Yard Pavement at North Wharf (Expansion of Yard)
(4) Reach Stacker: 4 units
(5) RTG 2 units
(6) Fire Fighting System
(7) Loading and Unloading Arm for Liquid Bulk Cargoes

1-2. After the discussion during the stay of the team this time, both sides confirmed that 2 Reach Stackers will be procured by Mozambican side and remaining 2 Reach Stackers will be recommended to the Government of Japan (hereinafter referred to as "GoJ") as grant aid project component.

1-3. After the discussion, both sides agreed that the items below will be recommended to GoJ for approval.

(1) Repair of North Wharf with installing Fenders, Bollards and Water pits
(2) Pavement of Apron at North Wharf
(3) Container Yard Pavement at North Wharf (Expansion of Yard)
(4) Reach Stacker: 2 units
(5) RTG 2 units
(6) Fire Fighting System
(7) Loading and Unloading Arms for Liquid Bulk Cargoes

1-4. Since the Oil supply through Nacala port is indispensable to Mozambican economy, it is necessary to maintain the function of Fuel handling during the construction period of Liquid Bulk Terminal. As an option for preservation of the function of fuel handling, both sides agreed that following countermeasure will be taken:

- The Oil loading/unloading point will be moved from Berth No.4 to the center of the North Warf (Berth No.3) temporarily

Since the depth of the Berth No.3 is slightly shallower than the Berth No.4, the depth of No.3 will be leveled to the depth of No.4 so that the same size of tanker can be moored. In addition, the some section of temporary pipeline will be installed underground not to affect the port activity.

1-5. Both sides agreed that Reach stackers should be delivered as early as possible.

1-6. Mozambican side requested the additional training for regular maintenance especially for port infrastructure other than those included in Grant Aid.

1-7. The commencement of the Project is subject to the approval by GoJ and will be informed by GoJ.

2. Cost Estimation

Both sides agreed that the Project Cost Estimation as attached in Annex-1 should never be duplicated or disclosed to any third parties before the signing of all the contract(s) with contractor(s) for the Project.

3. Japan's Grant Aid Scheme

The Mozambican side understood the Japan's Grant Aid scheme and the necessary measures to be taken by the recipient country as explained by the Team and described in Annex-5, Annex-6 and Annex-7 of the Minutes of Discussions signed on April 24, 2012.

The Mozambican side understands that the Team is not in the position to guarantee implementation of the Project.

4. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Mozambican side, in English around December 2012 and in Portuguese around January 2013.

5. Environmental and Social Considerations

5-1. Ministry of Transport and Communications (MTC) agreed to acquire the approval of EIA report from Ministry of Coordination of Environmental Affairs (MICOA) and inform the result to JICA Mozambique office by the end of October 2012. Also, regarding the environmental license, it should be acquired before the commencement of the bidding process of contractors.

5-2. JICA mission was concerned that the construction of Fire Fighting System was not included within the scope of present EIA, however Mozambican side replied that it is already included and no additional amendment will be necessary for the project.

5-3. The Mozambican side and the JICA mission confirmed information on environmental and social considerations including major impacts and relevant mitigation measures are summarized in the Environmental Checklist attached as Annex-2. The Mozambican side confirmed they will inform JICA of any major changes which affect environmental and social considerations made for the Project by revising it in a timely manner.

5-4. The Mozambican side agreed that the results of environmental monitoring will be provided to JICA as a part of Monthly Progress Report by filling in the monitoring form attached as Annex-3 on a quarterly basis during construction. After the completion of the Project, the Mozambican side confirmed the monitoring form (Annex-3) will be submitted to JICA semiannually or annually for 2 years.

5-5. The Mozambican side agreed that monitoring for Environmental and Social considerations should be conducted by Project Management Unit (hereinafter referred to as "PMU") under MTC and Mozambique Ports and Railways (CFM) in accordance with the Monitoring Plan for the Project described in the Preparatory Survey Report and EIA report.

5-6. The Mozambican side confirmed it will take stipulated procedures for information disclosure in accordance with Regulations for the Environmental Impact Assessment Process (Decree 45/2004 of

29 September and Decree 42/2008 of 4 November. In addition, the JICA mission requested the Mozambican side to disclose the monitoring results to local project stakeholders, and the Mozambican side agreed to disclose monitoring results on their website.

5-7. The Mozambican side agreed JICA's disclosure of provided monitoring results in the monitoring form (Annex-3) on its website.

6. Other Relevant Issues

6-1. Both sides confirmed that the following undertakings should be carried out by the Mozambican side at the Mozambican expenses for the Project.

(1) To secure land (Project Site, Temporary Yard, Disposal Area)

(2) To remove/relocate existing utilities (Warehouses No.2, the transformer substation facility in the container yard pavement) by the end of June, 2013 before the bidding process starts in July, 2013.

(3) To procure additional two 2 reach stackers other than those covered by the Grant stipulated in 1-3. (4).

(4) To provide fenders along the South Wharf.

(5) To reimburse customs duties, internal taxes, and other fiscal levies that may be imposed in Mozambique with respect to the purchase of the products and services. The necessary budget for the reimbursement should be prepared by MTC.

(6) To issue the necessary documents such as TITULO for customs clearance of the products that may be imported for implementation of the project.

(7) To accord Japanese nationals and/or nationals of third countries whose services may be required in connection with the supply of the products and services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(8) To bear all the expenses, other than those covered by the Grant Aid, necessary for the implementation of the project.

(9) To assist, if necessary, to issue licenses, permission and other procedures for the commencement of the Project.

6-2. The Mozambican side shall bear the following costs as a condition for the Japan's Grant Aid to be implemented.

(1) The commissions for the banking services based upon Banking Arrangement (B/A)

(2) The advising commission of the Authorization to Pay (A/P)

6-3. The Mozambican side shall secure enough budget and personnel necessary for the operation and maintenance of the facilities and equipment either constructed or supplied by the Project.

6-4. The Mozambican side will give additional comments if any about the draft final report to JICA Mozambique office by 31th October 2012. The Team will examine them and may reflect on the final report.

Annex-1 Project Cost Estimation

Annex-2 Environmental Checklist

Annex-3 Monitoring Form

<Confidential> Annex-1

Project Cost Estimate

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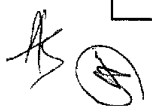
This Page is closed due to the confidentiality.

Annex-2 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) N/A (d) N	(a) The project proponent-MTC is currently in the process of preparing the EIA for "Nacala Port Short-term Development Project". (b) The EIA report will be approved around October in 2012 by MICOA. (c) Unknown (d) There are no environmental permits required other than the EIA.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a)During the preparatory survey, three stakeholder meetings were conducted to obtain their opinions about the proposed development plan. A consultation meeting was also held specifically with the local fishermen.In general, the stakeholders were fully supportive of the project. There were no objections from the fishermen as well. A public consultation meeting was also held as part of the EIA process in September, 2012. (b)No opinions were raised at the above mentioned stakeholder meetings during the preparatory survey that required any changes to the project design. The comment from the September meeting will be reflected to the design of Nacala Port Short-term Development Project.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a)Alternatives on improvement of the pier for liquid bulk cargoes were examined by taking into account aspects such as environmental impacts, project effect and cost.
	(1) Air Quality	(a) Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted from ships, vehicles and project equipments comply with the country's emission standards? Are any mitigating measures taken?	(a) Y	(a) The port will need to strengthen its environmental management to minimize air pollution from port activities, especially regarding bulk cargo handling, exhaust emissions from trucks and fugitive dust emission from stockyard. These will be considered in the EIA.

Annex-2 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
2 Pollution Control	(2) Water Quality	(a) Do effluents from the project facilities comply with the country's effluent and environmental standards? (b) Do effluents from the ships and other project equipments comply with the country's effluent and environmental standards? (c) Does the project prepare any measures to prevent leakages of oils and toxicants? (d) Does the project cause any alterations in coastal lines and disappearance/appearance of surface water to change water temperature or quality by decrease of water exchange or changes in flow regimes? (e) Does the project prepare any measures to prevent polluting surface, sea or underground water by the penetration from reclaimed lands?	(a) N/A (b) N/A (c) N (d) N (e) N	(a) In general there will be no major effluent sources from the port. (b) All ships should be required to comply with regulations and standards stipulated in the MARPOL convention. (c) There will be no major additional sources of oil and toxicant leakages. The project will also install a new oil loading/unloading arm, which should reduce the risk of oil spillage from the oil loading/unloading operation. (d) The project includes no modification of water areas, such as shoreline modifications, reduction in water areas, and creation of new water areas. (e) The project includes no land reclamation. The EIA will provide a Waste Management Plan (WMP)
	(3) Wastes	(a) Are wastes generated from the ships and other project facilities properly treated and disposed of in accordance with the country's regulations? (b) Is offshore dumping of dredged soil properly disposed in accordance with the country's regulations? (c) Does the project prepare any measures to avoid dumping or discharge toxicants?	(a) Y (b) N/A (c) N/A	(a) All wastes generated from port activities should be treated and disposed in accordance with the relevant regulations and norms.The EIA will provide a Waste Management Plan (WMP) (b) The project generates neither dredged materials nor soils. (c) There should be neither dumping nor discharge of toxicants.
2 Pollution Control	(4) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) N/A	(a) There are no noise and vibration standards for vehicle and train traffic.However, the port will need to strengthen its environmental management to minimize noise emissions, especially from cargo trucks. These will be considered in the EIA taking into consideration the WHO guidelines and SANS 10103 Code of Practice.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) There will be no extraction of groundwater.
	(6) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a) N	(a) There will be no major odor sources.
	(7) Sediment	(a) Are adequate measures taken to prevent contamination of sediments by discharges or dumping of hazardous materials from the ships and related facilities?	(a) N/A	(a) Anti-fouling paints used by ships may continue to contaminate sediments. The port should therefore encourage ships to refrain the use of harmful anti-fouling paint. Ratification of the AFS Convention is also recommended. The EIA will provide a Waste Management Plan (WMP).
	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country' s laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) There are no protected areas in the vicinity of the project site.



Annex-2 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country' s laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the project will adversely affect aquatic organisms? Are adequate measures taken to reduce negative impacts on aquatic organisms? (e) Is there a possibility that the project will adversely affect vegetation or wildlife of coastal zones? If any negative impacts are anticipated, are adequate measures taken to reduce the impacts on vegetation and wildlife?	(a) Y (b) N (c) Y (d) N (e) N	(a) There are small patches of mangrove, seagrass, small communities of corals and tidal flat near the North Wharf. (b) There are no protected habitats of endangered species in the vicinity of the North Wharf. (c) Repair and pavement of the North Wharf does not cause the impacts on the ecosystem. (d) There is no possibility that repair and pavement of the North Wharf will adversely affect aquatic organisms. (e) There is no possibility that the project will adversely affect vegetation and wildlife of coastal zones.
	(3) Hydrology	(a) Do the project facilities affect adversely flow regimes, waves, tides, currents of rivers and etc if the project facilities are constructed on/by the seas?	(a) N	(a) There is no installation of port and harbor facilities that will cause oceanographic changes.
	(4) Topography and Geology	(a) Does the project require any large scale changes of topographic/geographic features or cause disappearance of the natural seashore?	(a) N	(a) There is no installation of port and harbor facilities that will cause an alteration of topographic and geologic features.
	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) N (b) N (c) N (d) N (e) N (f) N (g) N (h) N (i) N (j) N	(a) There is no involuntary resettlement. (b) Not applicable. (c) Not applicable. (d) Not applicable. (e) Not applicable. (f) Not applicable. (g) Not applicable. (h) Not applicable. (i) Not applicable. (j) Not applicable.

Annex-2 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that changes in water uses (including fisheries and recreational uses) in the surrounding areas due to project will adversely affect the livelihoods of inhabitants? (c) Is there a possibility that port and harbor facilities will adversely affect the existing water traffic and road traffic in the surrounding areas? (d) Is there a possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are considerations given to public health, if necessary?	(a) Y (b) N (c) N (d) Y	(a) The construction vehicles that travel through the access road may cause nuisance (e.g. air pollution, noise) to the local residents. (b) The project will not adversely affect the livelihoods of inhabitants. (c) Improvement of North Wharf will not adversely affect the existing water traffic and road traffic in the surrounding areas. (d) Implementation of regular health checks and education programs are recommended to reduce the risk of spreading of infectious diseases.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There are no heritages in or near the project site.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) Impacts on the landscape are negligible as the project area lies under a designated port/industrial area.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a) There are no ethnic minorities and indigenous peoples near the project site. (b) See above.
4 Social Environment	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) N (b) Y (c) Y (d) Y	(a) The project proponent will not be violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project. (b) Tangible safety considerations will be in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials. (c) Intangible measures will be planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc. (d) Appropriate measures will be taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents. The EIA will provide an Environmental Management Plan.

Annex-2 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) Y (c) Y	(a) Various measures are planned to prevent or minimize pollution from construction activities. Following are some of the planned countermeasures: [Air pollution measures] - Use of well maintained trucks and implementation of regular vehicle maintenance. - Covering of truck loading space with sheet cover to minimize dust spills - Loading and unloading bulk construction should be in areas protected from the wind on in calm conditions. - Vehicles carrying dusty materials should be washed before leaving the site (washing facilities should be available). - Limit access to construction site to construction vehicles only - Impose vehicle speed restrictions on the construction site - Maintain high moisture content on exposed surface and roads by spraying with water [Noise pollution measures] - Use of well maintained trucks and implementation of regular vehicle maintenance - Strict abidance of speed limit and avoidance of unnecessary revving - Avoidance of night-time travelling of trucks whenever possible [Waste disposal] - Construction wastes (wastes of concrete and asphalt) are properly disposed to the damping site in the city. (b) See 3(2)(c). (c) Various pollution measures are planned to prevent or minimize impact on the local residents and local fishermen. See (a) above. The EIA will provide an Environmental Management Plan.

Annex-2 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) The proponent develops and implements monitoring program for the environmental items. (b) The monitoring in the construction and operation phases is recommended as follows respectively; - Air quality monitoring (4/year and 2/year) - Noise level measurement (4/year and 2/year) - Meeting with fishermen (2/year and 1/year) - Meeting with local residents (2/year and 1/year) (c) During the implementation stage of the project, the MTC and the CFM will establish a project management unit (PMU), and the adequate monitoring framework will be established by the PMU. (d) Will be established by the PMU. The EIA will provide an Environmental Monitoring Plan.

Annex-2 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, impacts on groundwater hydrology (groundwater level drawdown and salinization) that may be caused by alteration of topography, such as land reclamation and canal excavation should be considered, and impacts, such as land subsidence that may be caused by groundwater uses should be considered. If significant impacts are anticipated, adequate mitigation measures should be taken.	(a) N/A	(a) Not applicable.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N/A	(a) Not applicable.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards,appropriate environmental considerations are required to be made. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Annex-3

MONITORING FORM

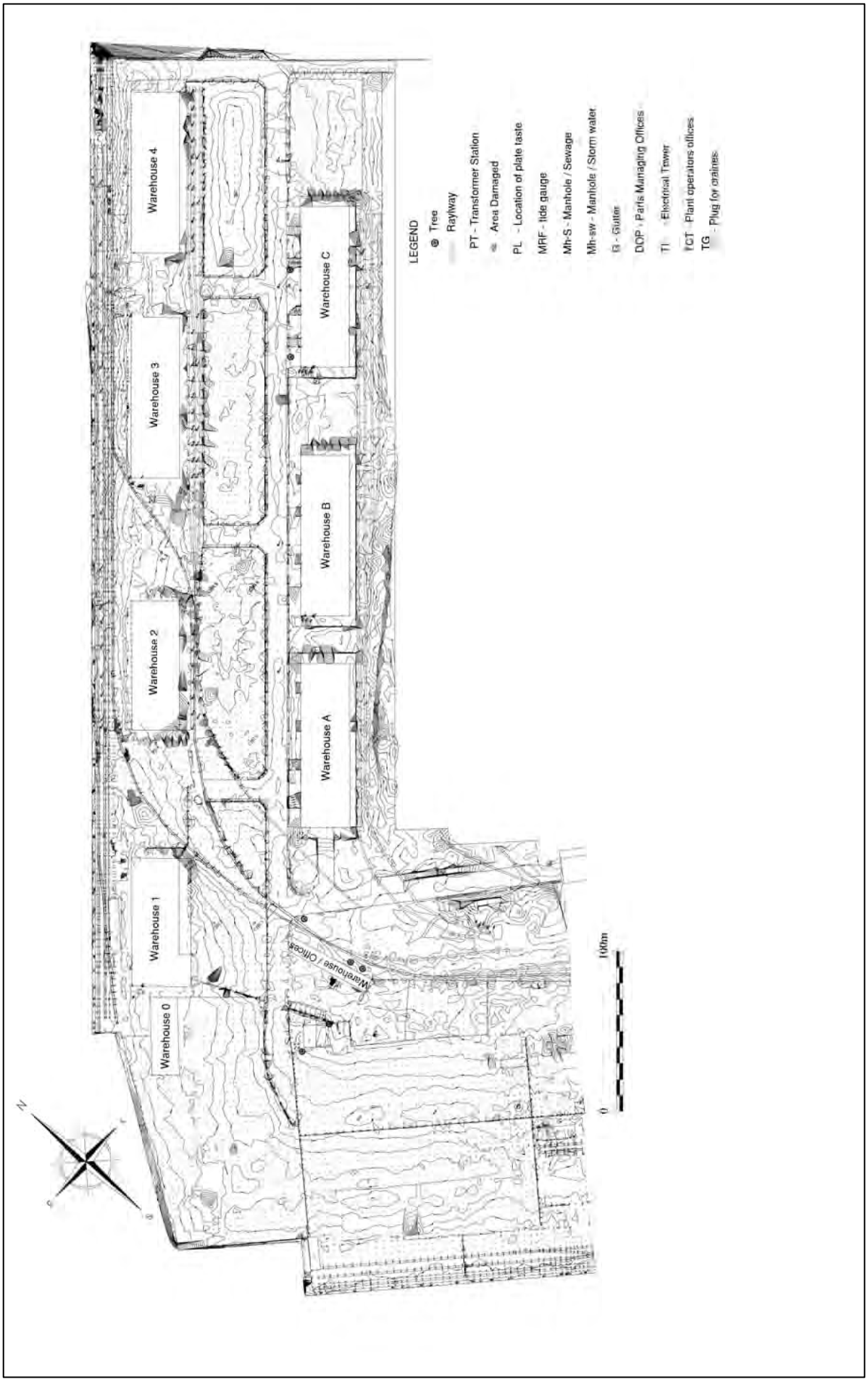
Environmental Monitoring Plan-Construction Phase

No.	Impact	Environmental Monitoring	Frequency	Implementing Entity	Responsible Entity	Monitoring Result
Social Environment						
3	Land Use and Utilization of Local Resources	Regular meetings with representatives of local fishermen	2/year	MTC	MTC/CFM	
11	Sanitation	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM	
12	Hazards (risk) Infectious Diseases such as HIV/AIDS	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM	
Pollution						
22	Air Pollution	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM	
		Measurement of air quality(PM10), 2 points along access roads to the Port	4/year	Construction contractor	MTC/CFM	
23	Water Pollution	Measurement by using a portable turbidity meter	1/week	Construction contractor	MTC/CFM	
25	Waste	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM	
26	Noise and Vibration	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM	
		Measurement of noise level, 2 points along access roads to the Port	4/year	Construction contractor	MTC/CFM	
30	Accidents	Regular meetings with representatives of local residents	2/year	MTC	MTC/CFM	

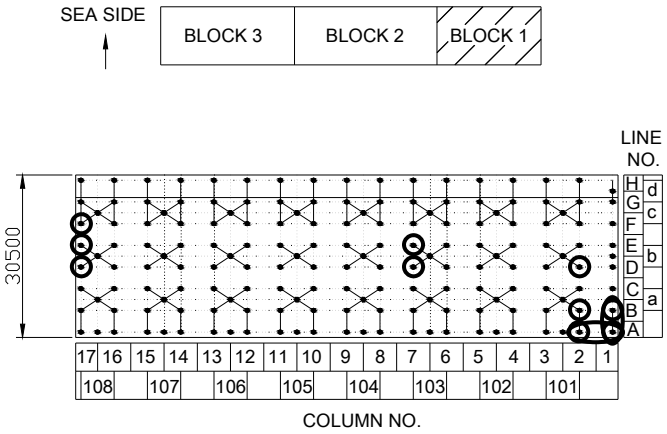
Environmental Monitoring Plan- Operation Phase

No.	Impact	Environmental Monitoring	Frequency	Implementing Entity	Responsible Entity	Monitoring Result
Pollution						
22	Air Pollution	Regular meetings with representatives of local residents	1/year	CDN	CDN	
		Measurement of air quality (PM10, SO2, NO2), 2 points along access roads to the Port	2/year	CDN	CDN	
23	Water Pollution	Regular meetings with representatives of local fishermen	1/year	CDN and Ship Owners	CDN	
26	Noise and Vibration	Regular meetings with representatives of local residents	1/year	CDN and Truck Owners	CDN	
		Measurement of noise level, 2 points along access roads to the Port	2/year	CDN	CDN	
29	Bottom Sediment	Regular meetings with representatives of local fishermen	1/year	CDN and Ship Owners	CDN	
30	Accidents	Regular meetings with representatives of local residents	1/year	CDN and Truck Owners	CDN	

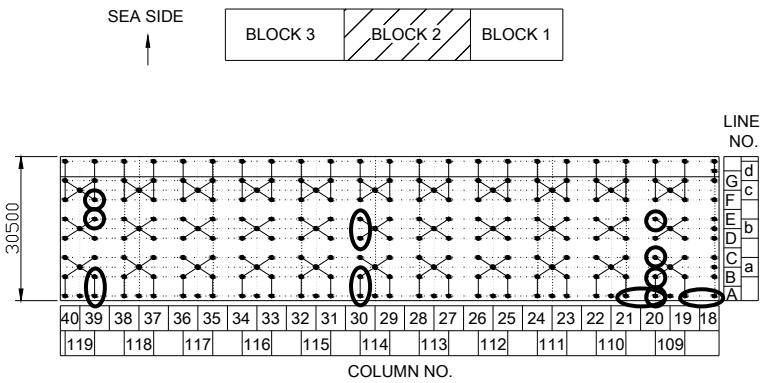
Appendix 5 Result of Topographic survey



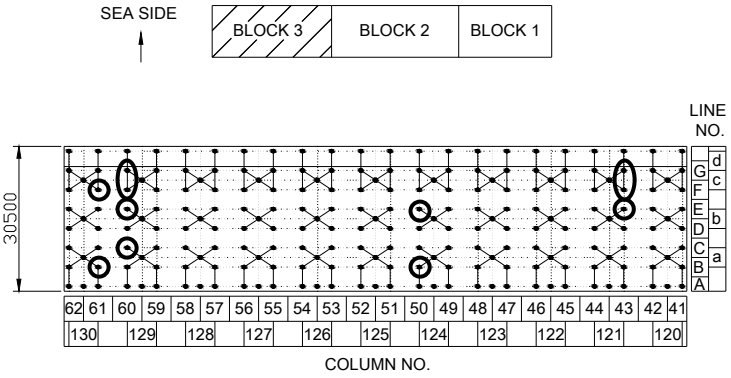
Appendix 6 Photos for Comparison of Deterioration of Pile Head under Container Terminal (South Wharf) and General Cargo Terminal (North wharf)



LOCATION OF PILES IN CONTAINER TERMINAL BLOCK 1



LOCATION OF PILES IN CONTAINER TERMINAL BLOCK 2



LOCATION OF PILES IN CONTAINER TERMINAL BLOCK 3

O : Location of Comparison of Pile Head

General layout of piles in Container Terminal (South Wharf)

Container Terminal: Block 1

Date：July 2010

Block 1
Pile 1A and Wall

Date：May 2012

Block 1
Pile 1A and Wall

Block 1
Pile 1A

Block 1
Pile 1A

Block 1
Slab bet. Pile 1A& 2A-1

Block 1
Slab bet. Pile 1A& 2A-1

Date：July 2010

Block 1

Slab bet. Pile 1A& 2A-2

Date：May 2012

Block 1

Slab bet. Pile 1A& 2A-2

Block 1

Wall bet. Pile 1A & 2A

Block 1

Wall bet. Pile 1A & 2A

Block 1

Pile 1B & 1a

Block 1

Pile 1B & 1a

Date：July 2010

Block 1
Pile 2A

Date：May 2012

Block 1
Pile 2A

→：Damage
Peel off concrete

Block 1
Pile 2B-2

Block 1
Pile 2B-2

Block 1
Pile 2D-1

Block 1
Pile 2D-1

Date：July 2010

Block 1
Pile 2D-2

Date：May 2012

Block 1
Pile 2D-2

Block 1
Pile 7D

Block 1
Pile 7D

Block 1
Pile 7E-1

Block 1
Pile 7E-1

→ : Damage
Exposed re-bar

Date：July 2010

Block 1
Pile 17D-2

Date：May 2012

Block 1
Pile 17D-2

Block 1
Pile 17E-2

Block 1
Pile 17E-2

➡ ：Damage
Exposed re-bar

Block 1
Pile 17F-3

Block 1
Pile 17F-3

Container Terminal: Block 2

Date：July 2010

Block 2

Wall bet. Pile 18A & 19A

Date：May 2012

Block 2

Wall bet. Pile 18A & 19A

Block 2

Pile 20A

Block 2

Pile 20A

Block 2

Slab bet. Pile 20A & 21A

Block 2

Slab bet. Pile 20A & 21A

Date：July 2010

Block 2
Pile 20B

Date：May 2012

Block 2
Pile 20B

Block 2
Pile 20C-1

Block 2
Pile 20C-1

Block 2
Pile 20E

Block 2
Pile 20E

Date：July 2010

Block 2

Pile 30A ~ 30B

Date：May 2012

Block 2

Pile 30A ~ 30B

➡ ：Damage

Exposed re-bar

Block 2

Pile 30D ~ 30E

Block 2

Pile 30D ~ 30E

Block 2

Pile 39A ~ 39B

Block 2

Pile 39A ~ 39B

Date：July 2010

Block 2
Pile 39E

Date：May 2012

Block 2
Pile 39E

Block 2
Pile 39F

Block 2
Pile 39F

→ ：Damage
Exposed re-bar

Container Terminal: Block 3

Date：July 2010

Block 3
Pile 43E

Date：May 2012

Block 3
Pile 43E

Block 3
Brace bet. Pile 43F & 43G

Block 3
Brace bet. Pile 43F & 43G

Block 3
Pile 50B

Block 3
Pile 50B

➡ ：Damage
Exposed re-bar

Date：July 2010

Block 3
Pile 50E-1

Date：May 2012

Block 3
Pile 50E-1

Block 3
Pile 60C

Block 3
Pile 60C

Block 3
Pile 60E

Block 3
Pile 60E

Date：July 2010

Block 3
Pile 60F ~ 60G-1

Date：May 2012

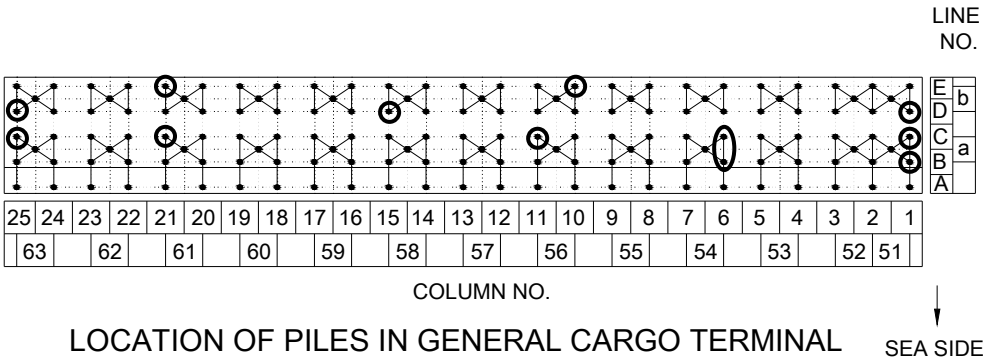
Block 3
Pile 60F ~ 60G-1

Block 3
Pile 61B

Block 3
Pile 61B

Block 3
Pile 61F

Block 3
Pile 61F



LOCATION OF PILES IN GENERAL CARGO TERMINAL

○ : Location of Comparison of Pile Head

General layout of piles in General Cargo Terminal (North Wharf)

General Cargo Terminal

Date：July 2010

Slab nearby Pile 1B

Date：May 2012

Slab nearby Pile 1B

Pile 1B

Pile 1B

Wall and Slab nearby Pile 1C

Wall and Slab nearby Pile 1C

Date：July 2010

Pile 1D

Date：May 2012

Pile 1D

Pile 6B ~ Pile 6C

Pile 6B ~ Pile 6C

Pile 10E

Pile 10E

Date：July 2010

Pile 11C-1

Date：May 2012

Pile 11C-1

Pile 15D

Pile 15D

Pile 21C

Pile 21C

Date：July 2010

Pile 21E

Date：May 2012

Pile 21E

Wall nearby Pile 25C

Wall nearby Pile 25C

Pile 25D

Pile 25D

Appendix 7 Status Quo of Container Handling Equipment

1. Summary of the equipments

The terminal currently has operated 8 units of the container handling equipments which consists of 4 Reachstackers, 3 Top Lifters and 1 Side Lifters with the major specification and present running conditions as mentioned below.

These units are owned by the stevedore company, Terminais do Norte. The maintenance and repair have been undertaken by CDN, who also send the operators.

Table 1 Summary of the container handling

No.	Equipment Name	Manufacturer	Model	Production Year	Start Operation	Weight(Kgs)	Lifting capacity (1st Row/2nd Row/3rd Row)	Working Height	Engine	Enigine Running Hours (as of 26/04/2012)	Remark
1	Reachstacker	Kalmar (05)	DFR 450-60S5	1999	1999	66,400	45 T/27 T/13 T	5th tier in 1st Row	Volvo Penta TWD1031VE	25,579	Non operative since Jan 4, 2012 due to broken Hydraulic Pump
2	Reachstacker	Kalmar (06)	DFR 450-60S5	2009	Jan-2010	66,400	45 T/27 T/13 T	5th tier in 1st Row	Volvo Penta TWD1250VE	12,576	
3	Reachstacker	Kalmar (07)	DFR 450-60S5	2009	Jan-2010	66,400	45 T/27 T/13 T	5th tier in 1st Row	Cummins QSM11	12,197	
4	Top Lifter	Konecranes SMV (1)	SL45-1200G4	2005	2005	68,500	43 T	4th tier	SCANIA DI125A4	19,006	
5	Top Lifter	Konecranes SMV (2)	SMV45-1200G4	2007	Nov-2007	68,500	43 T	4th tier	SCANIA DI125A4	14,464	
6	Top Lifter	Konecranes SMV (3)	SMV45-1200G4	2007	Nov-2007	68,500	43 T	4th tier	SCANIA DI125A4	8,365	Non operational since Aug. 22, 2011 due to broken Hydraulic Pump, defect on engine and accumurator etc
7	Side Lifter	Konecranes SMV (4)	SMV5/6ECB90	2008	2008	36,800	9 T	5th tier (9'6") / 6th tier (8'6")	SCANIA TAD722VE	10,762	For Empty Containers
8	Reach Stacker	Konecranes SMV (5)	SC4531 TA5	2003	2003	71,800	45T/31T	5th tier in 1st Row	SCANIA 6508021	7,226	Non Operatinal for Oct.,2011-Feb.,2012. Hydraulic system failed since Mar. 2,201.

Source : The study team

2. General Running Condition

At the time of visit at the terminal, 3 units of the reachstackers and top lifter are not operative and at a standstill due to the beak-down. This shortage of the equipments was supposed to be badly affecting terminal operation but could be manageable actually due to non-peak operational period. The other 5 units have run reasonably without any serious problem.

The quay operation has been continued on 24 hours basis but the terminal gates are opened for only 12 hours from 7am to 7pm basically. Under the situation, the equipments are required to run mainly in the daytime of the busy yard operation.

Fig 1 Monthly running hours of the equipments (Jul., 2011-Apr.,2012)

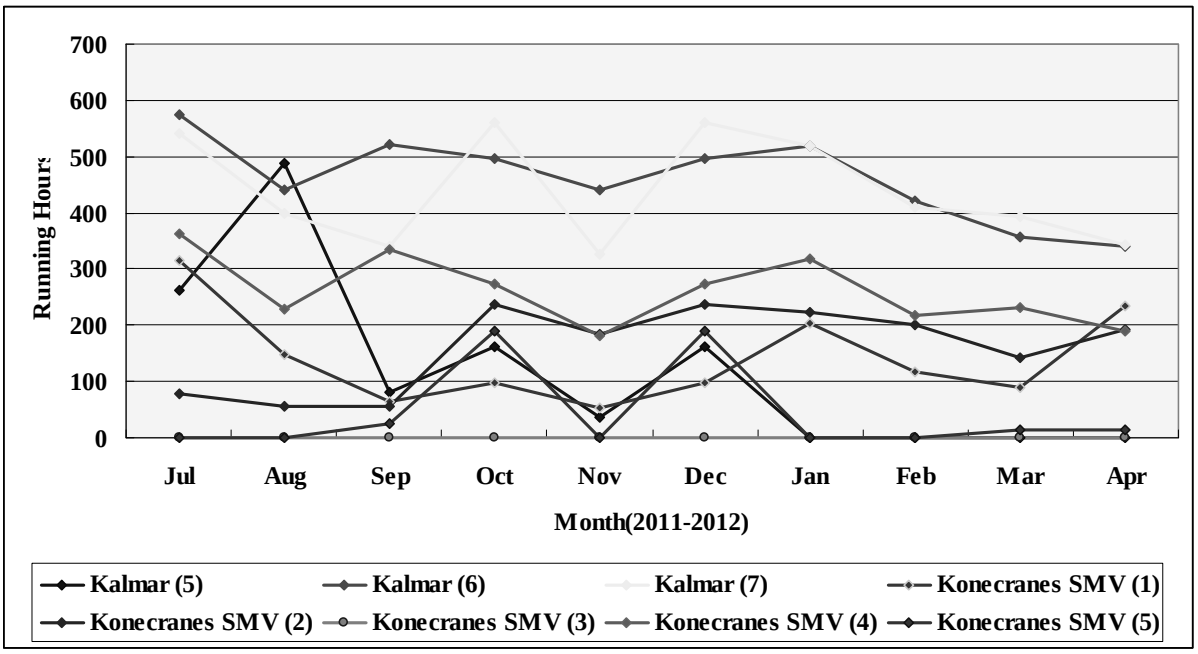
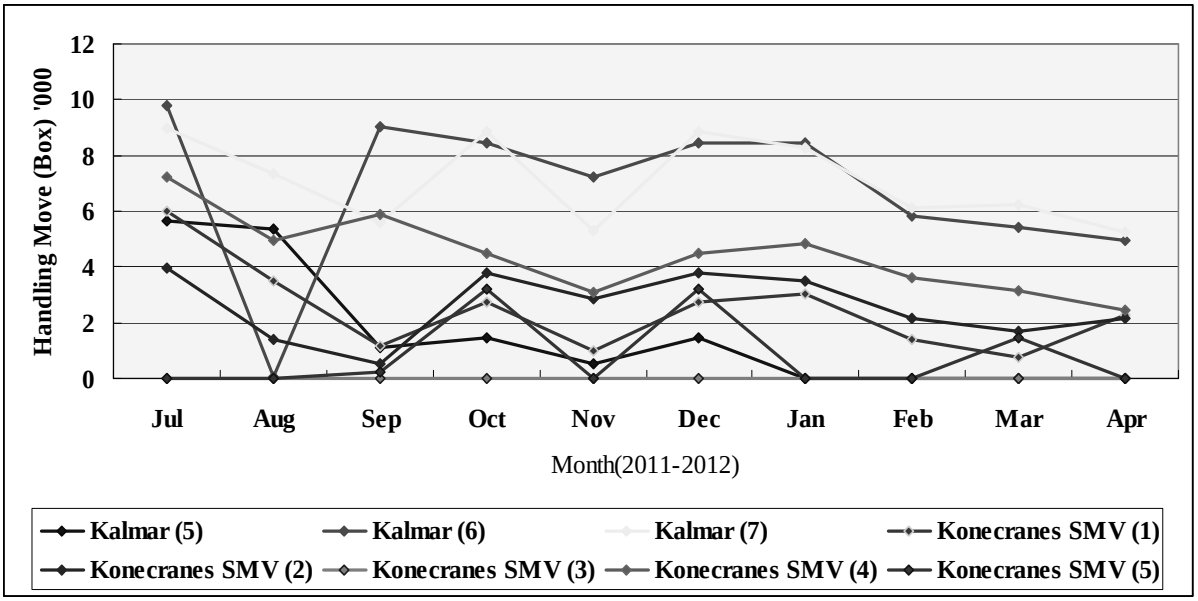


Fig 2 Monthly handling move (box) of the equipments (Jul., 2011-Apr.,2012)



Source : The study team

As shown in Table 2 and 3, it is noted that the terminal operation has heavily relied on Kalmar (6) and (7) which are working for both quay and yard operation. It is in general that the reachstacker provides the flexibility and workability in various container handlings for laden and empty containers than the top lifter, and can undertake multi-task in operation. Consequently, these 2 equipments currently have been utilized at higher ratio than others as the other 2 reachstackers have been broken down. It is suggested that the utilization of other top lifters is definitely required to share heavy load of the above 2 reachstackers and to extend their operating life by ensuring the periodical maintenance and repair which are required to prevent heavy damage.

The side lifter, Konecranes SMV (4) is exclusively used for handling the empty containers and running persistently and regularly. The top lifters and reachstackers have supported the work in case of shortage at the empty container yard.

The top lifters have been utilized mainly at the yard but they are occasionally working at the quay side in case of shortage of the reachstackers.

Table 2 Equipments operating condition (Jul., 2011 – Apr., 2012)

Equipment	Running hours (Jul2011-Apr2012)	Operating ratio	Handling volume (No. of Box)	Productivity (Move per hour)
Kalmar (5)	1,194	16%	15,560	13.0
Kalmar (6)	4,608	63%	67,658	14.7
Kalmar (7)	4,394	60%	70,723	16.1
Konecranes SMV (1)	1,415	19%	24,452	17.3
Konecranes SMV (2)	1,601	22%	25,785	16.1
Konecranes SMV (3)	0	0%	0	0.0
Konecranes SMV (4)	2,612	36%	44,110	16.9
Konecranes SMV (5)	556	8%	8,104	14.6
Total	**16,380**	**28%**	**256,392**	**16.0**
Total (excl.Kalmar 5, SMV 3/5)	**14,630**	**40%**	**232,728**	**16.0**
Total (excl. SMV 3)	**16,380**	**32%**	**256,392**	**16.0**

* Running hours were taken from the engine hoursmeter.
* Operation ratio is calculated for 10 months/304 days for Jul., 2012 – Apr., 2012 except January 1.

Source : The study team

In accordance with the above data, the operation ratio was calculated at the lower level of 28% in average against all 8 units but it is realized as 40% in case of all units being operative based on the data of the working units except Kalmar (5) and SMV (3)/(5).

The productivity (handling volume (box) per running hour) has performed with higher rate than the standard and is mainly attributed to the busy yard operation during the day time due to the limited gate opening time.

According to the maintenance record, the technically unavailable time for maintenance and repair including periodical inspection/regular replacement has been reported at 32% in average and the technical available time at 68% which includes the stand-by time considerably. The restriction of gate opening time definitely causes the busy yard operation in a day time and the stand-by at night for the equipments.

It is also observed that the rehandling ratio in the calculation based on the throughput and the hours meter of each equipments shows relatively higher than the standard terminal.

Table 3 Rehandling Ratio for the equipments

Year	Month	No. of vessels berthed	Throughput (TEU)	Throughput (Box)	Equipment Handling Volume(Move)
2011	Jul	14	8,136	6,394	41,574
	Aug	12	5,696	4,429	22,613
	Sep	14	7,758	5,924	23,525
	Oct	11	7,214	5,475	32,945
	Nov	9	3,826	3,031	19,965
	Dec	12	6,601	4,887	32,945
2012	Jan	13	7,672	5,677	28,012
	Feb	13	5,149	3,832	19,097
	Mar	12	4,906	3,449	18,707
	Apr	12	4,722	3,449	17,009
TTL		122	61,680	46,547	256,392
Rehandling Ratio (Equipment Handling Volume / Throughput)					5.5

Source : The study team

In general, this type of the operation without the yard management system tends to increase the rehandling against the actual throughput. In case of this terminal, the high ratio at this terminal is considered to be attributed to the pre-stacking work as the pre-stacking area is provided at the quay apron for efficiency of the loading/unloading operation for the vessels and to other extra yard marshalling.

As reported, 2 reachstackers and 1 top lifter among 8 equipments are currently inoperative and reported to be malfunctioned. The current progress on repair is mentioned below.

Table 4 Summary of inoperative equipments

Name of Equipment	Equipment Type	Production Year	Defect Condition	Current Progress
Konecranes SMV (3)	Top Lifter 43T	**2007**	Inoperative since Aug. 22, 2011 due to broken Hydraulic Pump, defect on engine and accumurator etc	Overhaul and complete repair of electical control system are required . Requested despatch of the service mechanic from the manufactuer's agent in Kenya last December. Finance approvanl is not available yet..
Konecranes SMV (5)	Reach Stacker 45T	**2003**	Inoperative for Oct.,2011-Feb.,2012. Brake system not workable since Mar. 2,201.	Ordered brake seals in March and expect completion of repair in May.
Kalmar (5)	Reach Stacker 45T	**1999**	Inoperative since Jan 4, 2012 due to broken Hydraulic Pump	The wrong pump for replacement was once sent due to error of the supplier. The correct pump is expected to be delivered around June.

Source : The study team

The present availability of the equipments presents the critical shortage condition which is suggested to affecting the terminal operation in view of various terminal productivities. Especially for the reach stackers, it is considered that 2 units among 4 are at standstill and negatively impacting the work planning although it is temporal. The defect units except Konecrane SMV(3) will be repaired up by June, 2012 depending upon availability of the spare parts ordered.

For the top lifter, Konecrane SMV(3), it is reported that there is no progress on repair of the engine/hydraulic system including dispatch of the service engineer from the SMV service agent, PASICO EASTERN AFRICA although the repair application was sent to CDN financial director. The subject unit has been at standstill for about a year in the past and some associated parts were removed for repair of other units. It is suggested that the terminal and CDN management should reconsider the priority of repair under the shortage condition of the equipments.

Reacstacker Konecranes SMV (5)

Reachstacker Kalmar (5)

Toplifter Konecranes SMV (3)

3. Maintenance Management of the equipments

3-1 Maintenance team

At the time of the study, the maintenance team is under control of the maintenance manager supported by 4 chief mechanics (mechanical and electric) and consisting of 23 mechanics who are working in 2 shifts a day and night. It is reported that the mechanics are employed by CDN and includes some of the ex-driver. Their mechanics have the carriers more than 5 years. Terminal do Norte as the equipments owner also employed the supervising engineer who is working for the adviser of the repair and maintenance and supporting the CDN mechanics techinically. It was reported that the maintenance manager was replaced in 2012 but the new manager has not been familiar with the past records and repair/maintenance history. The maintenance shop is a shed with a roof, has a sufficient size that can be docked 2 reachstackers at the same time. However, it has no ceiling crane for repair facilities. It is considered that the replacement and maintenance of the heavy parts needs preparation of the forklift or handling equipment.

3-2 Maintenance management

In referred to the running condition, it is confirmed that the technical downtime relating to the maintenance and repair has become less than 10% for the current running 5 units except the standstill units of Kalnar (5) and Konecranes SMV (3)/(5). This downtime ratio is considered as a standard of other terminal in comparison and means no serious repair/defect under good running condition. CDN have prepared the periodical maintenance program as shown below and carried out the inspection and maintenance under the schedule recommended by the manufacturers. The downtime has been minimized as the maintenance schedule has been discussed with the terminal operation and fixed without disturbing the operation..

The periodical inspection program

① Inspection before running and after running (To carried out between the driver's shift to shift).
② Running every 500 hours Inspection and maintenance
③ Running every 1,000 hours Inspection and maintenance
④ Running every 2,000 hours Inspection and maintenance
⑤ Running every 4,000 hours Inspection and maintenance (only for Kalmar / SMV (4)

The inspection and maintenance items are summarized in the below table.

Table 5 Equipment maintenance program

verificação de manutenção efectuada

Confirmation of maintenance work done

	P	A 500	B 1000	C 2000	D 4000
General					
Machine clean-up		x	x	x	x
Check painting situation & condition			x	x	x
Check Engine plate situation & cond. (outside metal cover)		x	x	x	x
Check glass (window) situation & condition		x	x	x	x
Check notice board and information papers		x	x	x	x
Check and tight all screws of doors, covers etc.		x	x	x	x
General check for oil leakage in all systems		x	x	x	x
Check security & condition of the cabin, tanks, counter weights,etc. .		x	x	x	x
Lubricate the machine		x	x	x	x
Change cabine's filter				x	x
Clean fuel tank					x
Check if all manometer are funcioning		x	x	x	x
Check tube and hose conditon of all systems		x	x	x	x
ENGINE					
Clean the radiator				x	x
Change radiator's liquid		x	x	x	x
Check cooling system, water level and possible leakeges		x	x	x	x
Check exhaust gas pipe			x	x	x
Check engine chain situation, pressure and condition		x	x	x	x
Check air filter indicator			x	x	x
Check engine oil level		x	x	x	x
Change engine oil		x	x	x	x
Change engine oil filter			x	x	x
Drain water separator filter			x	x	x
Change water separator filter		x	x	x	x
Change fuel filter		x	x	x	x
Clean or change air filter (external)			x	x	x
Change air filter (internal)			x	x	x
Check turbo charger			x	x	x
Check valve looseness			x	x	x
Check injection nozzles				x	x
Check injector's pump				x	x
Hydraulic System					
Check hydraulic system functions and measure hydraulic pressure		x	x	x	x
hydraulic system's oil level		x	x	x	x
Change hydraulic filters				x	x
Change hydraulic oil				x	x
Clean hydraulic tank				x	x
Check and, if necessary, change hydraulic's respirator			x	x	x
Check cooling oil level			x	x	x
Change respirator filter			x	x	x
Change respirator oil				x	x
Check and fix oil leakage in system		x	x	x	x
Gearbox, shaft, diferencial gea, tiers, brake, steering					
Check tightness of nuts (wheel)		x	x	x	x
Check tire situation, condition and pressure		x	x	x	x
Check parking brake's adjustment		x	x	x	x
Check parking and service brake's function and condition		x	x	x	x
Check steering system function		x	x	x	x
Check gearbox oil level			x	x	x
Check shaft respirator			x	x	x
Change gearbox filter				x	x
Change gearbox oil			x	x	x
Check oil level in cube and gear		x	x	x	x
Change oil in cube and gear			x	x	x
Check steering bearings and lubrificate		x	x	x	x
Check clearance of the bearings and tighten if necessary		x	x	x	x
Cabine, Electrics, Pneutatic					
Check wiper's water level		x	x	x	x
Check battery and cable connection		x	x	x	x
Check battery electrolyte level		x	x	x	x
Check electric systems function		x	x	x	x
Check and clean the starter		x	x	x	x
Check and clean AC generator			x	x	x
Lifting Equipments					
Visual check of gantry/spreader		x	x	x	x
Check the lifting mast		x	x	x	x
Check the mast chain		x	x	x	x
Maintenance on the lifting mast chain		x	x	x	x
Check for cracks on Spreader		x	x	x	
Check security and condition of lifting equipment and lifting of loads		x	x	x	x
Check condition of hoses and pipes (possible leak)		x	x	x	x
Check for any signs of welding cracks			x	x	x

(source : The study team prepared based on CDN information)

3-3 Maintenance and repair record

For maintenance and repair records, the following reports/check books are prepared and filed.

① Daily Maintenance Work Report (prepared by the mechanic working)
Description items
* Date / Time / Equipment Name and No / Running hours / Name of mechanic
* Scheduled work items and details
* Completed work items and details, review comment
* Work time by each job description (mechanical , electrical etc)
* Parts used (parts name, number, q'ty)
* Oil and grease used (name, q'ty)

② Shift Report (prepared by the driver in attendance of the mechanic)
Description items
* Name of driver/ mechanic
* Inspection items prior to running
* Fuel/Lubricant oils consumption
* Start running time and hours
* Breakdown time
* A number of containers handled.
* Running condition

③ Supervision report of operation (prepared by Operation supervisor)
Description items
* Name / Driver /Mechanic
* Equipment Name
* Running condition

The maintenance records have been filed in the form of daily reports but they have not organized by the equipment and are insufficient to use for the various purpose of the maintenance. It is suggested that they should be sorted out/classified by equipments and the maintenance database should be completed. In respect of the running conditions including the operating ratio, productivity and technical unavailable time, the data also has not been filed properly and not been managed well. It is necessary to take some steps for introducing the maintenance management system by sorting out the data, reorganizing the database, analysis and feeding back to the maintenance program. It is expected finally that the system can contribute to prevention of technical downtime and defect ratio. Based on this database completed, it is practical to include the data of the spare parts used for maintenance and develop the spare parts management including the order and stock control..

3-4 Order/stock management for spare parts

The maintenance manager has managed all purchase of the spare parts and controlled all orders. However, the orders more than MTN10,000 require the purchase authorization from the CDN finance department through the terminal manager and is handled by the CDN procurement department after authorization. It is reported that it takes a long lead time for authorization and ordering processes. The purchases of spare parts are budgeted but it

seems that the orders have not been quickly processed except the consumable items due to the possible shortage of the budget and the issue of priority.

The delivered spare parts have been under the inventory control of the storekeeper and stored at the warehouse with the lock. The parts in stock are mainly consumable items including the filters, lubricant oil, o-rings, seals and bolts etc without any components incl. hydraulic pump/pipes, electric parts, hydraulic cylinder and brake parts etc. The necessary parts for repair usually have been ordered after the defect is found. Under the situation, it is considered that the current parts in stock should are not good enough to cope with the urgent repair. It is also reported that the repair tools including hydraulic jack etc required for repair and daily maintenance are also in shortage.

Parts stock warehouse

3-5 Maintenance management system

In order to improve the operation ratio of the equipments, the current maintenance management does not cover the processes of collection /control/review of the maintenance data, which is effectively used for the maintenance program and review of progress. Some of these processes exist independently but it is necessary to integrate all process properly and build the management system. In addition, it is essential to improve the data of operating/maintenance conditions with the operation team of the terminal so that the equipments can be managed to be operated properly and safely in view of both operational and maintenance requirements.

Specially, it is considered that the building of the maintenance management system can be achievable after the following items are reviewed and the process is implemented.

Data management

① Operating data prepared by the maintenance team to be recorded as equipment-wise and shared with the terminal operator and stevedore.
② Maintenance data to include the detailed maintenance/inspection/parts used etc and be integrated as equipment-wise for record.
③ All reports to be reviewed and simplified after integration. The reported data to be analyzed to identify the cause of defect under periodical review.

④ Local repair/maintenance procedures to be recorded/filed for maintenance facilitation manual and to be shared between the mechanics.

Planning the maintenance program

① Review on the major inspection and maintenance items based on the analysis of the data.
② Review and indentify necessary spare parts and minimum quantity in stock based on the analysis of the data.
③ Conduct the immediate permanent repair plan for the defects/measures taken which are reported in the shift report prepared by the driver.
④ Annual or periodical inspection and maintenance by the manufacture service agent to identify/prevent the defects.
⑤ Improve the working condition/maneuvering of equipments in sharing the operating data with the operator and stevedore.

Improvement of maintenance skill/update the technical information

① Conduct the training of the mechanics at the service agents or private training course periodically in order to update the technical information and maintenance skill.
② Conduct annual inspection by the manufacture service agent to learn the inspection and maintenance skills for prevention of the defects.

Procurement of spare parts

① Conduct the annual purchase plan of spare parts (including consumable items) based on the maintenance program.
② Review on the major parts items for replacement and ensure the stock of them
③ Expedite and simplify the process of spare purchase orders to ensure quick delivery.

Considering the geographical disadvantage on the terminal location for procurement of the spare parts, the review of the slow procurement process, additional orders for the parts and increase of the stock level are necessary to ensure quick recovery of the defect equipments under the shortage situation of the terminal equipments. The delay of delivery on the replacement/repair parts directly cause the late recovery process and impact the productivity of the terminal and terminal performance in customer service viewpoint negatively. Apparently, this procurement issue is significantly involved to contribute to the present shortage condition that 3 units become inoperative and a standstill among all 8units.

Base on the interview and discussion with the maintenance team, the list of necessary spare parts and tools for additional stock are summarized and attached in the last page.