Institute of Maritime and Ports of Angola
Ministry of Transport
Republic of Angola

BASIC DESIGN STUDY REPORT

ON

THE URGENT REHABILITATION PROJECT

OF PORT FACILITIES

AT THE PORT OF LOBITO AND THE PORT OF NAMIBE

IN

REPUBLIC OF ANGOLA

DECEMBER 2007

JAPAN INTERNATIONAL COOPERATION AGENCY

ECOH CORPORATION

PREFACE

In response to a request from the Government of Republic of Angola, the Government of the Japan decided to conduct a basic design study on the Urgent Rehabilitation Project of Port Facilities at the Port of Lobito and the Port of Namibe and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Republic of Angola a study team from January 28 to March 21, 2007.

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

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

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

December, 2007

Masafumi Kuroki
Vice-President
Japan International Cooperation Agency

December, 2007

LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on the Urgent Rehabilitation Project of Port Facilities at the Port of Lobito and the Port of Namibe in Republic of Angola.

This study was conducted by ECOH CORPORATION, under a contract to JICA, during the period from January, 2007 to December, 2007. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Angola and formulated the most appropriate basic design for the project under Japan's Grant Aid scheme.

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

Very truly yours,

Masakiyo Muraoka
Project manager,
Basic design study team on
the Urgent Rehabilitation Project of Port Facilities at the Port of Lobito and the Port of Namibe
ECOH CORPORATION

Summary

Summary

(1) Outline of Country

Republic of Angola (hereinafter referred to as "Angola") is located at South-Western area in African Continent. Land of Angola is neighboring with Namibia, Zambia and Democratic Republic of the Congo. Area of Angola is approximately 1,250,000 km^2 which is nearly 3.3 times larger than the land of Japan. Weather of Angola is belonging to tropical savanna climate. Depending on records in 2004, population is 15.5 million and GNI per capita is 930 US dollar. African races such as Ovibundos (37%) and Quimbundos (25%) are major in Angola. Christian such as Catholicism (38%) and Protestant (15%) are reached to 53% of population in Angola. Common language is Portuguese and 90% of people in Angola can speak Bantu language.

Civil war between MPLA and UNITA was occurred in Angola after independence in 1975. It had been continued for 27 years when it made a truce in April 2002. Although past economy had been exhausted by civil war, potential of present economy is strong because there are rich natural resources such as more than 8 billion barrel oil at shore, diamond and valuable metal in land. Especially, present economy in Angola will be developed by production of oil which capability is largest in oil producing country located in sub-Sahara area. On the other hand, agriculture and fishery in Angola will have rich capabilities, too. The Government of Angola aims to develop agriculture, forestry, fishery and industry to mitigate the economy from dependence with oil industry.

(2) Background, History and Outline of the Project

Serious damaged transport infrastructure network in Angola during civil war has been generated difficulties of development of the country. Angolan Government adopted the poverty reduction strategic paper (PRSP) in January 2004. PRSP runs from 2003 to 2007 aiming at both objectives which are post-war restoration and mid-term economic growth with budget of 3.17 billion US$. The Government authorized the Priority Phase Multisector Rehabilitation and Reconstruction Program (PPMRRP2003-07) giving priority to restoring the transport infrastructures including major ports and harbors in the country. Ports in Angola have important roles to maintain the suitable logistic supporting to the economy and restoration of the country, because most of crops, building material and industrial goods are imported in the ports. Unfortunately, major 4 ports, Port of Luanda, Lobito, Namibe and Cabinda have not been maintain suitably during civil war, therefore, their facilities could not be utilized effectually.

In order to improve current condition of those ports, the Government of Angola has requested the Government of Japan to undertake the study on the urgent rehabilitation program (hereinafter referred to as "Development Study") which is comprised of three important items, namely 1) Urgent rehabilitation program of major ports, 2) Long-term port development plan all over the country and 3) Establishment of an organization and operation system in the ports. According to this request, the study has been carried out by Japan International Cooperation Agency (hereinafter referred to as "JICA") from January 2005 to August 2006. Principal objectives of the study were urgent rehabilitation of port function.

Short-term rehabilitation plan which will rehabilitate these ports facilities was established by Development Study to meet demand forecast showed that cargo throughput in 2010 would reach more than twice of its quantity in 2004. Especially, urgent rehabilitation program has been planned for urgent restoration to the serious damaged facilities. The urgent rehabilitation program intended to Ports of Lobito and Namibe among four major ports in Angola. The program selected the poor conditioned and well

utilized quays and yards as the project sites. Accordingly, rehabilitation of quays, yards, restoration of water and oil supply systems and procurement of cargo handling equipment were recommended.

Depending on the recommendations, the Government of Angola has requested the Government of Japan to execute rehabilitation works by the Grant Aid Cooperation.

(3) Outline of Result by Basic Design Study and Contents of the Project

According to request of the Government of Angola, the Government of Japan decided to conduct Basic Design Study and JICA dispatched the study team to Angola from January 28, 2007 to March 21, 2007 to execute the field surveys.

Planning, designing and analyzing of Basic Design Study have been executed based on the above mentioned field surveys. With the result of above domestic study in Japan, 1st explanation team of draft final report was dispatched to Angola from July 16, 2007 to August 11, 2007. The team achieved the agreement with Angolan side for obligations of recipient country and project's contents. Also the team executed economic assessment to determine the inflation of building costs in Angola. 2nd explanation team of draft final report was dispatched to Angola from October 10, 2007 to October 20, 2007. The team achieved the agreement with Angolan side for obligations of recipient country again and estimated project's cost.

Existing apron and container yard will be rehabilitated by concrete pavement due to a lot of cargo handling with heavy cargo handling equipment. Rehabilitating area of container yard has been designed to secure the necessary scale which would be enough extent for container demand in 2010 based on the cargo demand prospecting results of the Development Study and its review. Lighting towers with necessary brightness in Namibe Port have been designed to improve the safeties and efficiency of cargo handling at night and under bad weather condition.

Most of requested items for water and oil supply systems, reefer plugs and power generators are excluded to the project's component because water supply facility in Lobito Port has been built, oil supply facilities in the ports have alternatives and some equipment in the ports has been procured. Minimum necessary numbers of cargo handling equipment will be procured considering future cargo demand, even some equipment has been procured by the Ports.

Accordingly, final planned components of the project are described in Table -1 and 2.

Table-1 Port of Lobito

Category	Facilities /Equipments	Items of Request	Planned Items
Facility	Rehabilitation of quay	Rehabilitation of quay no. 8 and a part of no.7 (240m)	Width of coping at quay 3.0(3.15)m, reconstruction of concrete structure (240m)
			Modification of electric connecters (8 nos.), protection and modification of electric cable
			Protection of water valves and pipe
			Restoration of pits for electric and water supply (16 nos.)
		Instillation of car stoppers（240m）	Instillation of Car Stoppers（208m）
		Installation of mooring bollards （8 nos.）	Installation of mooring bollards （8 nos.）
		Installation of fenders（20 nos.）	Installation of fenders (16 nos.）, installation of maintenance ladders （2nos.）
		Re-installation of rails for quay cranes (1 rail with 240m length)	Re-installation of rails for quay cranes (1 rail with 240m length)
Facility	Pavement on apron and yard	Removal of existing pavement and new pavement (46,600m^2)	Removal of existing pavement and base-course and new concrete pavement (43,074m^2; pavement on apron 3,384m^2, pavement in yard 39,400m^2, sloping between existing and new pavement 290m^2） End revetment 275m(55 m^2)
			Concrete drain with 5m width at sloping area between existing and new pavement (1,646m^2), Concrete drain1with 1m width (204m^2)
			Protection of existing structure (13 places)
			Soaking pit (11 nos.), drain pit (7 nos.), drain pipe (117m)
		Re-installation of rails for quay cranes (1 rail with 240m length)	Re-installation of rails for quay cranes (1 rail with 240m length, 288 m^2)
		Re-installation of rails for inner port railways on apron (2 set with 240m length each) (additional request on Draft Report Explanation 1)	Re-installation of rails for inner port railways on apron (2 set with 240m length each)
		Re-installation of rails for inner port railways in yard (3 set)	Re-installation of rails for inner port railways in yard (3 set with 190m length each)
Facility	Installation of water and oil supply pipes	Installation of water and oil supply pipes in quay no.8 and a part of no.7	Not providing Protection of existing water pipe
Facility	Installation of reefer facilities	Installation of reefer plugs (64 nos.) and power generator	Not providing
Equipment	Cargo handling equipment	Procurement of reach stocker (1 unit), top lifter (1 unit)	Procurement of reach stocker (1 unit)

Table-2 Port of Namibe

Category	Facilities/Equipment	Items requested	Planned Items
Facility	Rehabilitation of quay	Rehabilitation of quay (240m)	Crown of quay wall width(2.6m), Reconstruction of concrete structure (240m), Partial rehabilitation (204m), Reconstruction of upper block (36m)
			Modification of electric connectors (8nos.), Protection and modification of electric cable
			Repair damaged manholes, hand holes and water tapped boxes (16 nos.)
		Installation of car stoppers（240m）	Installation of car stoppers (208m)
		Installation of mooring bollards (8 nos.)	Installation of mooring bollards（8 nos.）
		Installation of fenders（20 nos.）	Installation of fenders (16 nos.), Installation of maintenance ladders (2 nos.)
		Re-installation of rails for quay cranes (240m)	Re-installation of rails for quay cranes (240m)
Facility	Pavement on apron and yard	Removal of existing pavement and new pavement（24,000m^2）	Removal of existing pavement and new pavement (about 18,210m^2) (Apron:3,312m^2, Yard:14,800m^2, Transition:98m^2) End revetment 274m (55 m^2)
			Concrete drain with 5m width at sloping area between existing and new pavement (about 1,480m^2)
			Protection of existing structures (3 places)
			Drain works: infiltration inlet (14 nos.)
		Removal of warehouse	Not providing
		Re-installation of rails for quay crane on apron	Re-installation of rails for quay crane on apron : 240m (288 m^2)
		Re-installation of rails for inner port railways in apron	Re-installation of rails for inner port railways in apron 2 sets: 240m long x 2sets (1200 m^2)
Facility	Repair of port road	Length 620m(+ extent of the impact)	Concrete pavement (including crossings and extent of the impact): length about 666m×width 10.0m +4 crossings + Entrance gate area totaling 7,965m^2
			Road portion about 6,660m^2 by concrete pavement
			Crossing portion 4 nos. (except main roads)1200m^2: Concrete pavement
			Entrance gate portion 105m^2 Concrete pavement Recovery of crossing rails 26 m^2
			0.5m width L-type side ditch:1,112 m, infiltration inlet: 45nos.

Category	Facilities/Equipment	Items requested	Planned Items
Facility	Installation of water supply facility	Installation to Berth No.3A	Water supply facility: facilities to supply water to vessels, water tank ($300m^3$)。
			Extension of water supply pipe:1,043m、supply valve(7 nos.), stop tap and repair branch pipes: 5 places, water tank, booster pump station
Facility	Installation of fuel supply facility	Installation to Berth No.3A	Not providing
Facility	Construction of lighting tower	2, in the corner of the yard behind berth No. 3A	Construction of lighting facilities at yard behind berth No. 3A
			Lighting Tower(6,000W)×2nos.
Facility	Facilities for reefer container	Reefer plug 64nos. +Power Generator	Not providing
Equipment	Cargo handling machine	Reach stacker: 1 unit, Forklift: 1 unit, Mobile crane: 1 unit	Reach stacker(40t)1unit, Forklift (40t) 1 unit, Mobile crane (60t) 1 unit

(4) Project Cost Estimation

In the case of implementation of this project by Japan's Grant Aid Cooperation, Project cost estimation is 20 million Japanese Yen for Angola's burden.

Total period of the project will be approximately 23 months including detailed design and tender preparation. As the breakdown of the period, detailed design and tender preparation will be 7 months and construction, procurement and consultant's supervision will be 16 months.

(5) Implementation of the Project and Operation and Maintenance Organization in Angola

Implementation agency of the Project is Institute of Maritime and Ports in Angola, Ministry of Transport. And the operation, maintenance and operation of project site should be executed by Port of Lobito and Namibe Enterprises which are capitalized by the Government of Angola.

Items as the obligation of Angola of the project are the preparation of temporary yard and its clearance, preparation of dumping site, removal of existing rails, removal of quay cranes and others. The amount is nearly 8% of the total annual balance in both ports. These cost burdens will not be difficult for both ports.

Necessary costs of operation, maintenance and management of the ports after handover of the project components will be the repair cost of pavement, operation and maintenance cost of equipment. Operation, maintenance and management of new facilities in the ports are relatively easy in the aspects of budget and technique, because maintenance of pavement shall be mainly for simple repairing of the cracks. Besides, the ports will not have serious difficulty in budget and technique for operation, maintenance and management of new equipment because new cargo handling equipment has been decided with the same types and the similar specifications of existing equipment in the ports. Cost of operation, maintenance and management for new facilities and equipment was estimated to 11 % of the budgetary balance in Port of Lobito and 10 % of the budgetary balance in Port of Namibe. Observing that the budget and balance of the ports are sound and calling vessels are increasing, the necessary cost of operation, maintenance and management of new facilities and equipment in the ports could be born to them without serious difficulties.

(6) Feasibility of the Project

The project will realize following great effects. Beneficiaries of direct effects will be the port operators ship-owners and shippers. Besides, as indirect effects it will benefit of 45.8 million people in Southern Africa including Angola as total. The breakdown will be 15.5 million people in Angola and 30.0 million people in neighboring countries such as Democratic Republic of the Congo, Zambia, Botswana and Zimbabwe where Benguela and Mocamedes Railways will be linked.

<Direct Effects>

1) Safety of cargo handling from vessel to berth will be improved. Contact between vessel and berth will be prevented.
2) Dust generated days in paved apron and yard during cargo handling activity will be reduced.
3) Improving cargo handling efficiency, time of cargo handling cycle from vessel to apron and to yard will be decreased.

<In-direct Effects>

1) Construction of facilities and procurement of cargo handling equipment in these ports enhance the transportation capability for international life lines for Benguela and Namibe States where major logistics depend on maritime transportation.
2) Increasing of cargo will vitalize the economies in Benguela, Namibe and other in-land states
3) Improvement of safety and efficiency for cargo handling works will contribute to smooth transportation to inland area and reduce transportation cost of cargo.
4) Connecting with the ports to Benguela and Mocamedes Railways will contribute to economic activities of inland neighboring countries where no oceans have.

The project will realize following great effects. Firstly, the issues of cargo handling in the ports by aging facilities and equipment will be settled. Secondary, the safety and efficient port activity will be secured. Finally, the efficiency of logistic in Angola and neighboring countries where most of goods are imported will be improved. Therefore, its urgency and necessity of the project are fulfilled to meet with Japan's Grant Aid Cooperation.

(7) Point of Concern and Recommendation

The project is designed for commercial port where a lot of cargo is handled with heavy equipment. Also it is partial rehabilitation project of existing commercial port. Therefore following recommendations will be understood and executed by the ports for operation, maintenance and management of new facilities and equipment.

1) Limitation of Heavy Vehicle Parking and Working on Structure and Pavement

There are some pits and service ducts for water and electric supplying facilities. Also, there are some structures such as rails, covers and others which are damaged by heavy vehicle. To avoid generating the damages to them, heavier traffic over design loads should be limited onto the coping concrete and apron .And storing containers and cargos, parking heavy vehicles and works on them should be prohibited by the Ports.

2) Adjusting Construction in the Border of Project Sites

There will be elevation gaps generated by the differences of bearing capacity of foundations and standing waters by them in the border of project sites. These unsuitable phenomena should be repaired by ordinal maintenance works by the Ports.

Apenas para referência

Sumário Executivo

Apenas para referência

Sumário Executivo

(1) Perfil do País

A República de Angola (doravante a ser referida como Angola) localiza-se na região Sudoeste do continente Africano e faz fronteira com Namíbia ao Sul, Zâmbia a Este e Congo Democrático ao Norte. A área do seu território é de cerca de 1.250.000 km^2, o que significa ser aproximadamente 3,3 vezes maior do que o Japão. O seu clima pertencente ao de savana. Sua população é de 15,5 milhões de habitantes (2004), que conta com o RNB (Rendimento Nacional Bruto = GNI [em Inglês]) de USD 930. Quanto à etnia, esta consiste primordialmente de grupos étnicos Africanos, tais como ovibundos (37%), quimbundos (25%) entre outros. Quanto à religião, a que predomina é a cristã, tendo como adeptos 53% da população (38% católicos e 15% protestantes). A língua oficial de Angola é Português e mais de 90% da população falam línguas nativas bantas.

Após a independência de Portugal em 1975, eclodiu a guerra civil entre as forças do Governo (MPLA: Movimento Popular de Libertação de Angola) e da oposição (UNITA: União Nacional para a Independência Total de Angola), a qual perdurou durante 27 anos até que foi firmado o Memorando de Cessar-fogo em Abril de 2002. Como consequência, a economia do país retraiu-se gravemente, mas o país apresenta um grande potencial económico, graças à abundância de recursos minerais, representados primordialmente pelo petróleo, explorado na zona costeira e cuja reserva é estimada em 8 mil milhões de barris, e o diamante, que é explorado nas regiões do interior do país. No sector petrolífero, sobretudo, é estimado que ainda em 2007 Angola venha a tornar-se o maior produtor ao lado de Nigéria, o que faz crer que o desenvolvimento económico continuará a girar centrado neste ramo ainda por algum tempo. Além disso, o país conta também com alto potencial agrícola e pesqueiro e o Governo está a promover os sectores agrícola, pesqueiro e industrial, com vistas a transpor a actual situação de dependência económica ao petróleo.

(2) Antecedente, Processo e Perfil do Projecto Solicitado

A malha de transportes, seriamente danificada durante a guerra civil, está hoje a constituir entrave para a promoção da reabilitação e o desenvolvimento do país. Angola, para transpor tal situação, elaborou em Janeiro de 2004 sua "Estratégia de Combate à Pobreza (ECP)", no intuito de conjugar a reconstrução nacional pós-conflicto com o crescimento económico de médio prazo, orçando a mesma em USD 3,17 mil milhões, a serem empregues em 5 anos, de 2003 a 2007. Paralelamente, a "Fase Prioritária do Programa Multi-sectorial de Reabilitação e Reconstrução" (PPMRRP2003-07) traz como um dos desafios prioritários a equipamentação de infra-estruturas de transporte, inclusive portuárias. Angola depende da importação de muitos dos cereais, materiais de construção e produtos industrializados, motivo pelo qual os portos jogam um importante papel de infra-estrutura de suporte à reconstrução e à actividade económica do país. Contudo, os quatro principais portos do país, nomeadamente os de Luanda, Lobito, Namibe e Cabinda, apresentam dificuldades de desempenharem suas funções com eficiência, por terem carecido de manutenções durante a guerra civil.

Para transpor tal situação, o Governo de Angola solicitou ao Governo do Japão a realização de um Estudo de Desenvolvimento com os seguintes objectivos: 1) Elaboração de um plano de reabilitação urgente dos quatro principais portos do país; 2) Elaboração de um plano de equipamentação portuária de longo prazo para todo o território nacional; e 3) Estruturação organizacional e institucional do sistema de gestão portuária. Em resposta a esta solicitação, a Agência de Cooperação Internacional do Japão

(doravante a ser referida como “a JICA”) realizou o “Estudo para o Programa de Reabilitação Urgente dos Portos de Angola”, no período de Janeiro de 2005 a Agosto de 2006, focalizando a reabilitação urgente das funções portuárias.

No Estudo de Desenvolvimento, foi elaborado um “Plano de Reabilitação de Curto Prazo”, de restabelecimento das funções portuárias através da reabilitação das instalações existentes com o horizonte em 2010, e, a partir do mesmo, foi também compilado o “Plano de Reabilitação Urgente” através da selecção dos componentes do primeiro que demandavam maior urgência para atender à demanda de carga estimada em duplicar entre 2004 e 2010. O “Plano de Reabilitação Urgente” seleccionou como alvos os dois dos quatro principais portos, nomeadamente os do Lobito e do Namibe, e propôs a reabilitação dos cais e parques dos respectivos portos com maior frequência de uso e com danos maiores, respectivas instalações de abastecimento de combustível e de água, além do fornecimento de equipamentos de carga.

O Governo de Angola solicitou ao Governo do Japão a Cooperação Financeira Não-Reembolsável para a concretização das propostas deste “Plano de Reabilitação Urgente”.

(3) Resumo dos Resultados do Estudo e Teor do Projecto

Com base nos resultados do Estudo de Desenvolvimento supra-citado, o Governo do Japão decidiu realizar o Estudo de Desenho Básico e a JICA delegou uma Equipa de Desenho Básico à Angola, no período de 28 de Janeiro a 21 de Março de 2007.

Após o trabalho baseado no mesmo, nomeadamente de escrutínio dos componentes alvos, definição das dimensões e especificações requeridas, ponderações sobre o plano de implementação, cálculo do custo estimativo de projecto etc. no Japão, foi delegada à Angola a Equipa de Explanação do Desenho Básico (I), no período de 16 de Julho a 11 de Agosto de 2007, quando foram levadas a cabo discussões e confirmações sobre o teor do Desenho Básico, obtido o acordo sobre o mesmo e também realizada uma avaliação económica do país, para determinar a inflação dos custos de construção em Angola. Em seguida, foi delegada a Equipa de Explanação do Desenho Básico (II), no período de 10 de Outubro a 20 de Outubro de 2007, quando foram levadas a cabo a explanação sobre o custo estimativo de projecto e refeitas as discussões e confirmações sobre as incumbências da parte Angolana e obtido uma vez mais o acordo.

Para o recapeamento do cais e parque existentes, optou-se pelo pavimento de betão, que se caracteriza pela alta resistência, levando-se em conta os pesos das cargas a serem manuseadas e das máquinas que circularão sobre os mesmos. A área do parque a pavimentar foi redimensionada, baseando-se na abrangência proposta no Estudo de Desenvolvimento, revisando-se a estimativa de demanda feita naquele estudo, procurando garantir a eficiência do manuseio de carga e a dimensão necessária para satisfazer a demanda de carga em 2010. Além disso, para garantir a viabilidade de trabalho durante a noite e nos dias de tempo ruim, foi incluído ao plano do Porto do Namibe a instalação de torres de iluminação, de forma a garantir a luminosidade necessária.

Dentre as instalações de abastecimento de combustível/água e tomadas de contentores frigoríficos, inicialmente propostas, não foram incluídas ao presente projecto aquelas que já foram instaladas pela parte Angolana antes do início do Estudo de Desenho Básico e/ou que já contam com instalações alternativas. No que tange às máquinas de carga, foi igualmente constatado que algumas já foram adquiridas pela parte Angolana por esforço próprio, mas foi mantido no plano o fornecimento das máquinas que virão logo a ser minimamente necessárias, conforme os tipos de carga e a demanda futura.

O perfil do projecto, proposto finalmente, com base no resultado acima, está mostrado nas Tabelas 1 e 2 a seguir.

Tabela 1: Teor do Projecto de Reabilitação do Porto do Lobito

Categoria	Instalação/ Equipamento	Teor Solicitado	Teor Proposto
Instalação	Reparação do Muro-Cais	Reparação do muro-cais (240 m)	Rebetonização de 3,0 (3,15) m de largura e 240 m de extensão do do muro.
			Reparação de 8 conectores de energia e proteção/reparação de seus cabos.
			Proteção/reabilitação da tubagem e dos fechos.
			Reparação dos poços de visita e outras avarias: 16 pontos (caixas de inspecção de energia e água)
		Instalação de guias p/ autos (240 m)	Instalação de guia p/ autos (208 m)
		Instalação de cabeços (8 unidades)	Instalação de cabeços (8 unidades)
		Instalação de Defensas(20 unidades)	Instalação de defensas (16 unidades)
			Instalação de escadas (2 pontos)
		Recolocação dos carris de gruas de cais (240 m)	Recolocação dos carris de gruas de cais (240 m)
Instalação	Pavimentação do cais e do parque	Remoção do pavimento existente e repavimentação (46.600 m^2)	Remoção do pavimento e base existentes e repavimentação em betão: 43.074 m^2 (Pavimento do cais: 3.384 m^2; pavimento do parque: 39.400 m^2; Acabamento da borda declinada: 290 m^2) Remate 275m(55 m^2)
			Escavação, terraplenagem e pavimentação em betão de uma vala de drenagem de 5 m de largura na borda declinada da via: cerca de 1.646 m^2. Escavação, terraplenagem e pavimentação em betão de uma sarjeta de 1 m de largura: cerca de 204m^2（180+24）.
			Protecção de 13 estruturas construídas existentes na área.
			Drenagem: 11 valas de infiltração, 7 valas colectoras e 117 m de tubos colectores
		Recolocação dos carris de gruas de cais	Recolocação dos carris de gruas de cais:Extensão240 m(288 m^2)
		Recolocação de 2 pares de carris de comboio do cais(solicitação adicional)	Recolocação de 2 pares de carris de comboio do cais: Extensão 480 m
		Recolocação de 3 pares de carris de comboio do parque	Recolocação de 3 pares de carris de comboio do parque: Extensão 570 m
Instalação	Reparação de instalações de água e combustível	Equipamentação no Posto 8 e na metade do Posto 7.	-Não será executada. Proteção das instalações de serviço de água
Instalação	Tomadas de contentores frigoríficos	64 tomadas + gerador	Não serão equipadas.
Equipamento	Máquinas de Carga	1 porta-contentor e 1 empilhadeira gigante	1 porta-contentor (40 t)

Tabela 2: Teor do Projecto de Reabilitação do Porto do Namibe

Categoria	Instalação/ Equipamento	Teor Solicitado	Teor Proposto
Instalação	Reparação do Muro-Cais	Reparação do Muro-Cais (240m)	Rebetonização de 2,6 m de largura e 240 m de extensão do do muro.
			Reparação de 8 conectores de energia e proteção/reparação de seus cabos.
			Reparação dos poços de visita e outras avarias: 16 pontos (caixas de inspecção de energia e água)
		Instalação de guias p/ autos (240 m)	Instalação de guias p/ autos (208 m)
		Instalação de cabeços (8 unidades)	Instalação de cabeços (8 unidades)
		Instalação de Defensas(20 unidades)	Instalação de defensas (16 unidades) e escadas de serviço (2 pontos)
		Recolocação dos carris de gruas de cais (240m)	Recolocação dos carris de gruas de cais (240 m)
Instalação	Pavimentação do Cais e do Parque	Remoção do pavimento existente e repavimentação (24.000 m^2)	Remoção do pavimento existente e repavimentação(cerca de 18.210 m^2) (Pavimento do cais: 3.312 m^2; pavimento do parque: 14.800 m^2; acabamento da borda declinada: 98 m^2) Remate 274 m (55 m^2)
		Remoção do Armazém	Escavação, terraplenagem e pavimentação em betão de uma vala de drenagem de 5 m de largura na borda declinada da via: cerca de 1.480 m^2.
			Protecção de 3 estruturas construídas existentes na área.
			Drenagem: 14 valas de infiltração
			Não será executada.
		Recolocação dos carris de gruas de cais	Recolocação dos carris de gruas de cais : Extensão 240 m (288 m^2)
		Recolocação dos carris de comboio	Recolocação de 2 pares de valetas de carris de comboio:Extensão240m×2 (1.200 m^2)
		Extensão: 620m (＋área de influência)	Repavimentação em betão (inclusive nos pontos de cruzamento e área de influência): Extensão 666 m × largura 10,0 m ＋4 pontos de cruzamento ＋ área do portão principal: Total 7.965 m^2
Instalação	Reparação da Via de Acesso Interno do Porto	Equipamentação na Zona 3A.	Via (6.660m^2): pavimento de betão
			1.200 m^2 dos 4 pontos de cruzamento (excepto via principal): pavimentação em betão
			Área do portão (105m^2): pavimento de betão e recuperação do curso do cruzamento: 26 m^2
			Valeta de drenagem em L com largura de 0,5 m: 1.112 m; Vala de infiltração: 45 pontos
			Instalação de serviço de água: instalações para servir os navios e reservatório (300 m^3).

Categoria	Instalação/ Equipamento	Teor Solicitado	Teor Proposto
Instalação	Equipamento de instalações de serviço de água	Equipamentação na Zona 3A.	1.043 m de extensão da tubagem de água; 7 válvulas; 1 fecho geral; 5 ramais; 1 reservatório e uma estação elevatória.
			Não será equipada.
Instalação	Equipamento da instalação de combustível.	Instalação de 2 torres na Zona 3A.	Serão instaladas torres de iluminação para o trabalho noturno na Zona 3A.
Instalação	Instalação de Torres	Torres de Iluminação	Torres de Iluminação (6.000 W) × 2
Instalação	Tomadas de contentores frigoríficos	64 tomadas + gerador	Não serão equipadas.
Equipamento	Máquinas de Carga	1 porta-contentor; 1 empilhadeira e 1 grua-móvel	1 porta-contentor (40t), 1 empilhadeira (40t) e 1 grua móvel (60t)

(4) Custo Estimativo do Projecto

Supondo-se a implementação do Projecto sob o Sistema de Cooperação Financeira Não-Reembolsável do Japão, o custo a ser arcado pela parte Angolana será de 20 milhões de ienes Japoneses.

Segundo os resultados do estudo, o prazo total de implementação do presente Projecto será de 23 meses (sendo 7 meses para o Desenho Detalhado e 16 meses para a construção e aquisição sob supervisão da consultoria).

(5) Implementação do Projecto e Estrutura de Gestão/Operação/Manutenção

O órgão responsável e executor do presente Projecto é o Instituto Marítimo Portuário de Angola, do Ministério dos Transportes, sendo que a gestão/operação/manutenção dos portos de abrangência do Projecto são da responsabilidade das respectivas empresas portuárias do Lobito e do Namibe, que são entidades governamentais.

Dentre as tarefas da parte Angolana, para o presente Projecto, podem-se citar: o asseguramento e limpeza do terreno para o canteiro de obras, preparação da área de despejo de resíduos de obra; remoção dos carris existentes na área de intervenção e deslocamento das gruas da área de intervenção, ente outras. A verba necessária para a realização destas tarefas corresponde a cerca de 8% do balanço de ambos os portos, sendo portanto perfeitamente arcáveis pelas respectivas empresas portuárias.

A verba necessária para a gestão/operação/manutenção após a conclusão do Projecto consiste do: custo de reparação do pavimento; custo operacional das máquinas de carga e custo de manutenção das mesmas. O trabalho de manutenção do pavimento consistirá basicamente da reparação de rachaduras, trabalho este perfeitamente realizável sob estrutura de manutenção existente, tendo em vista que tanto a aquisição dos materiais necessários quanto a execução são fáceis. O nível técnico existente é também suficiente para a gestão/operação/manutenção das máquinas de carga, uma vez que está planeado o fornecimento de máquinas com especificações equivalentes àquelas existentes. A verba necessária para a realização destes trabalhos corresponde a 11% do balanço do Porto do Lobito, e a 10% do Porto do Namibe. Estima-se que este nível de dispêndio é realizável, tendo em vista que os dois portos têm apresentado estabilidade

financeira com superávits nos seus balanços, além do que os orçamentos e os balanços dos dois portos estão a apresentar tendências ascendentes devido ao aumento dos navios que fazem escala.

(6) Verificação da Viabilidade do Projecto

Através da implementação do presente Projecto, esperam-se os seguintes efeitos directos e indirectos. Além disto, enquanto que os beneficiários directos do Projecto serão os trabalhadores dos portos e dos operadores dos navios, os beneficiários indirectos incluem toda a população Angolana, de 15,5 milhões de habitantes, e a dos países da vizinhança (RDC, Zâmbia, Botsuana e Zimbabué), de 30,3 milhões de habitantes, o que somam 45,8 milhões de habitantes.

［Efeitos Directos］

1) Haverá maior segurança aos cargueiros atracados e os cascos dos mesmos não mais colidirão com o muro;
2) Haverá menor número de dias com produção de poeira no cais e no parque durante os trabalhos;
3) Haverá maior eficiência no manuseio dos contentores e cada ciclo de manuseio do contentor (navio → cais → parque) verá reduções de tempo.

［Efeitos Indirectos］

1) Com o melhoramento das instalações e equipamentos de atracação e manuseio de carga, será fortalecida a capacidade de transporte de carga ao interior de Benguela e Namibe, cuja economia social depende do transporte marítimo.
2) Com o aumento do volume da carga, as economia das províncias de Benguela, do Namibe, e do interior, será revitalizada.
3) Com o aumento da eficiência e do nível de segurança dos trabalhos de manuseio de carga, será garantido o transporte sem entraves das cargas ao interior e serão dados contributos para a redução dos custos de circulação de mercadorias.
4) Com a ligação dos portos de abrangências respectivamente com os caminhos de ferro de Benguela e de Moçâmedes, passará a ser possível o apoio da actividade económica dos países da vizinhança que não contam com litoral.

Através do presente Projecto, é esperado, nos portos do Lobito e do Namibe, que sejam garantidas a segurança e a eficiência das actividades portuárias através da solução do problema de estagnações de tais actividades devido à obsolescência das instalações, e também que seja retomada a eficiência da circulação de mercadorias não só de Angola, que depende imenso das importações, como também dos países vizinhos sem litoral. Assim sendo, pôde-se confirmar a grande validade de implementar o presente Projecto através da Cooperação Financeira Não-Reembolsável.

(7) Cuidados Necessários e Recomendações

O presente Projecto tem como alvos de intervenção as áreas do interior dos recintos portuários comerciais, onde há tráfego de veículos pesados, além do que tem como característica o facto de se tratar de uma reabilitação parcial de portos existentes. É portanto necessário que a parte Angolana tome os

seguintes cuidados ao proceder à gestão/ operação/manutenção das instalações e equipamentos, após a conclusão do Projecto.

1) Restrições do Estacionamento e Trabalho dos Veículos Pesados Sobre Estrutura e Pavimento

Sob a estrutura superficial dos muros alvos de intervenção, existem canaletas de serviço e condutas de água e energia e, nos cais e parques, existem carris de comboio, tampos de poços de drenagem e outros que não aguentam grandes pesos. Para evitar danos a estes, será necessário que os Portos venham a intervir para o controlo não só do acesso de veículos sobrecarregados, como também do tráfego, estacionamento e execução de trabalhos de veículos pesados e da colocação de contentores e outras cargas.

2) Medidas a Serem Tomadas na Área limítrofe entre Aquelas a Reabilitar e as Demais

Na área limítrofe entre a área de abrangência do presente Projecto e as demais áreas existentes, existe a probabilidade de surgimento de desníveis devido às diferenças de capacidade de carga do solo entre as mesmas e poças de água devido a chuvas. Estes transtornos devem ser transpostos através dos trabalhos de manutenção de rotina pelos Portos.

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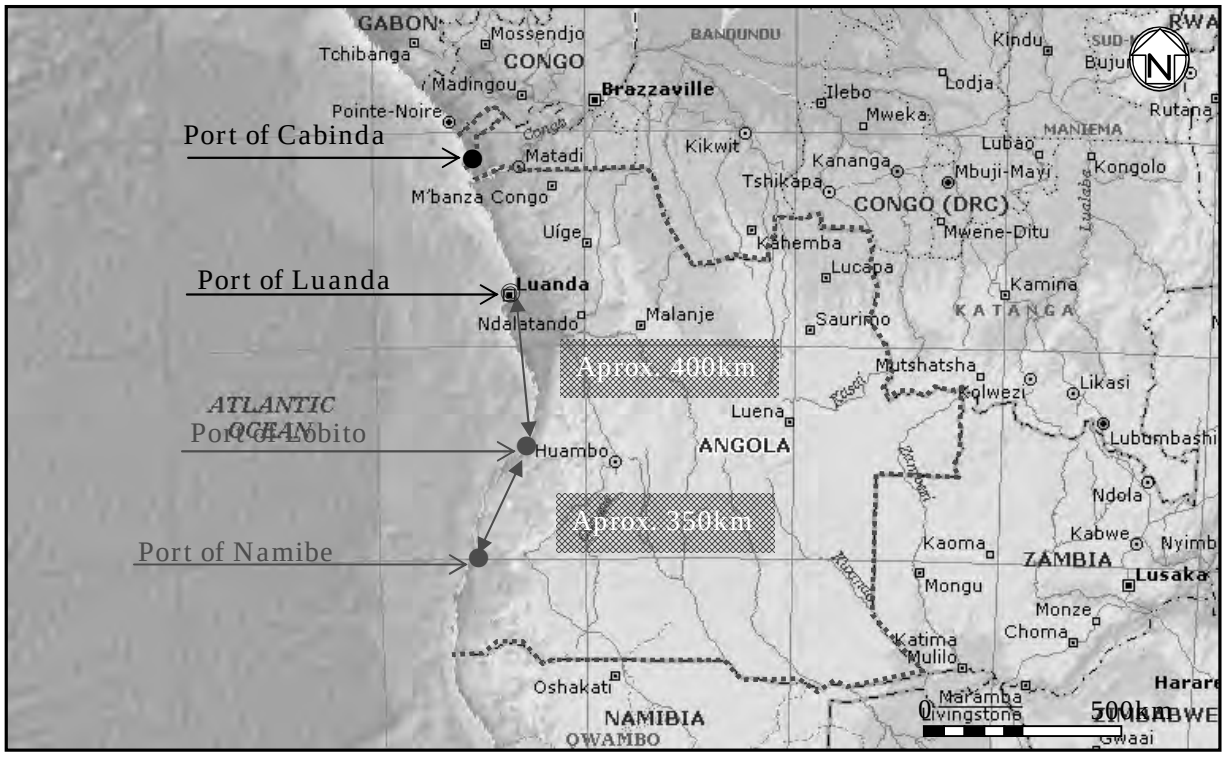
■ **Location of the Project Site**



Figurer-Title 2 Location of Main Port and Project Site

■ **Plan of Scope of Work 1: Port of Lobito**

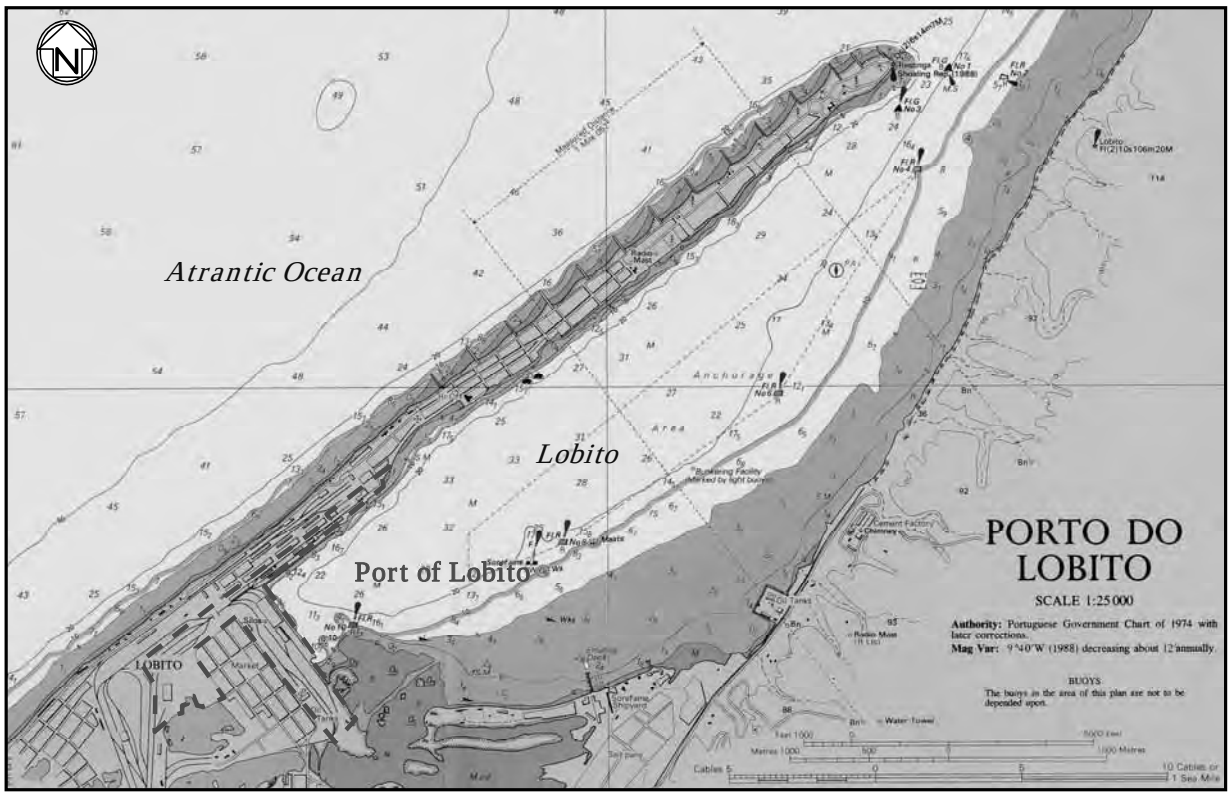
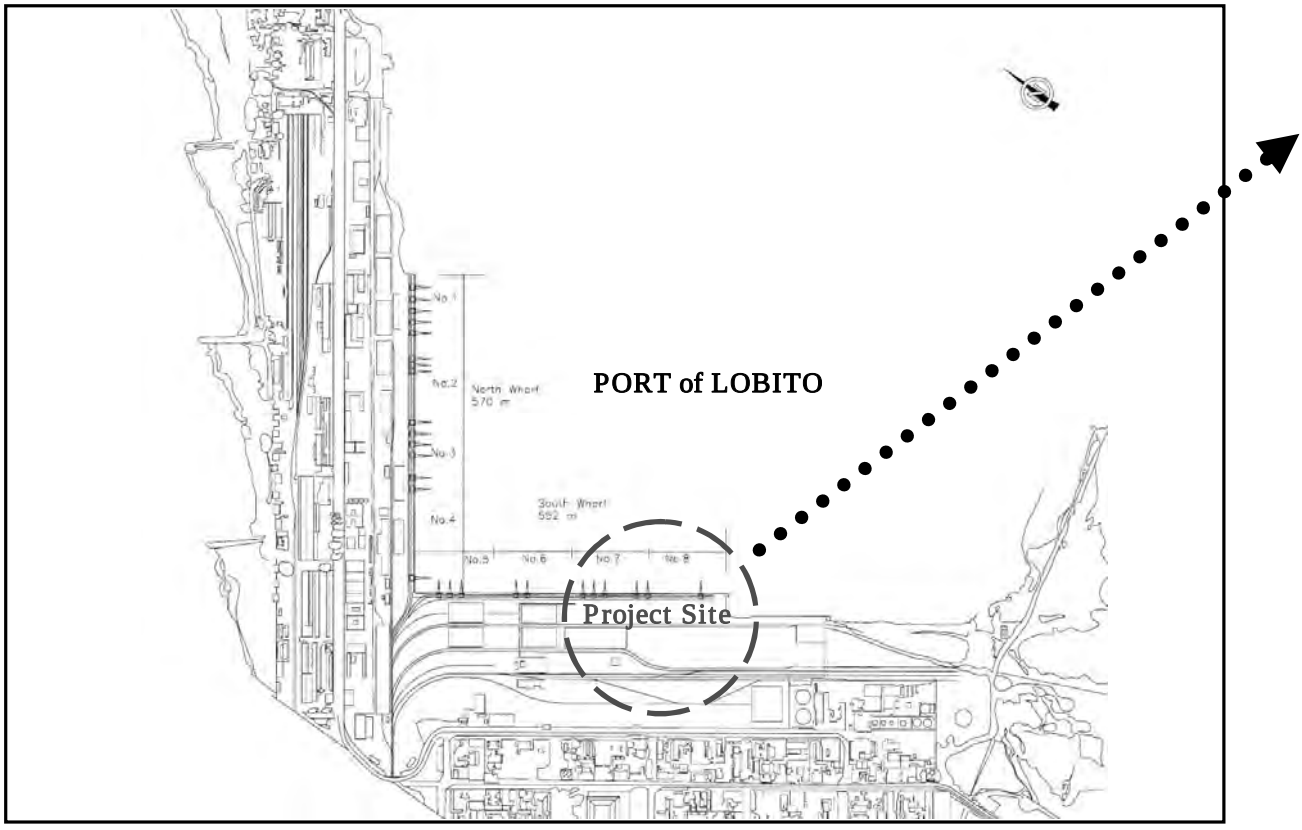


Figure-Title 3 Vicinity Topographic Map of Port of Lobito



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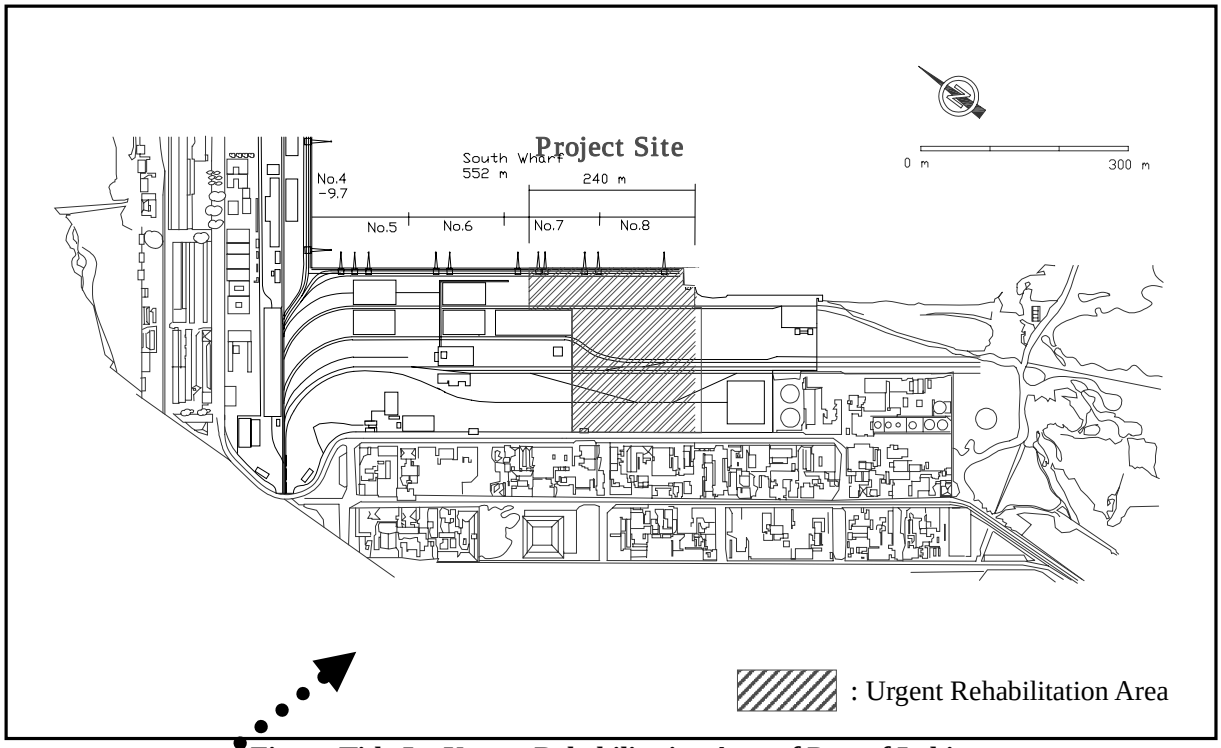
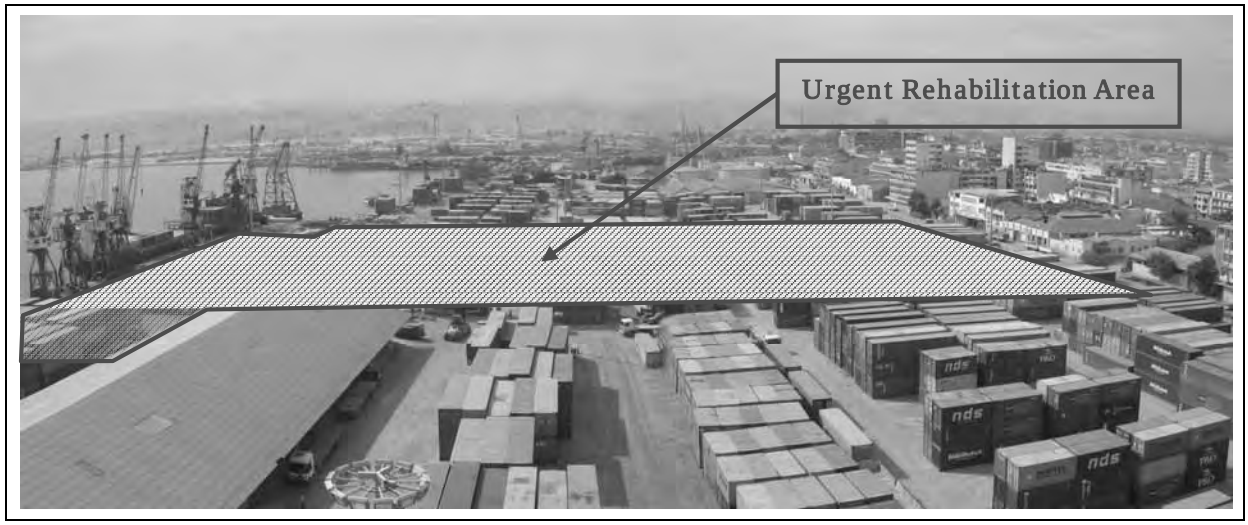


Figure-Title 5 Urgent Rehabilitation Area of Port of Lobito



<No.7,8 Quay & Container Yard behind>

Figure-Title 6 Urgent Rehabilitation Area of Port of Lobito

■**Plan of Scope of Work 2 : Port of Namibe**

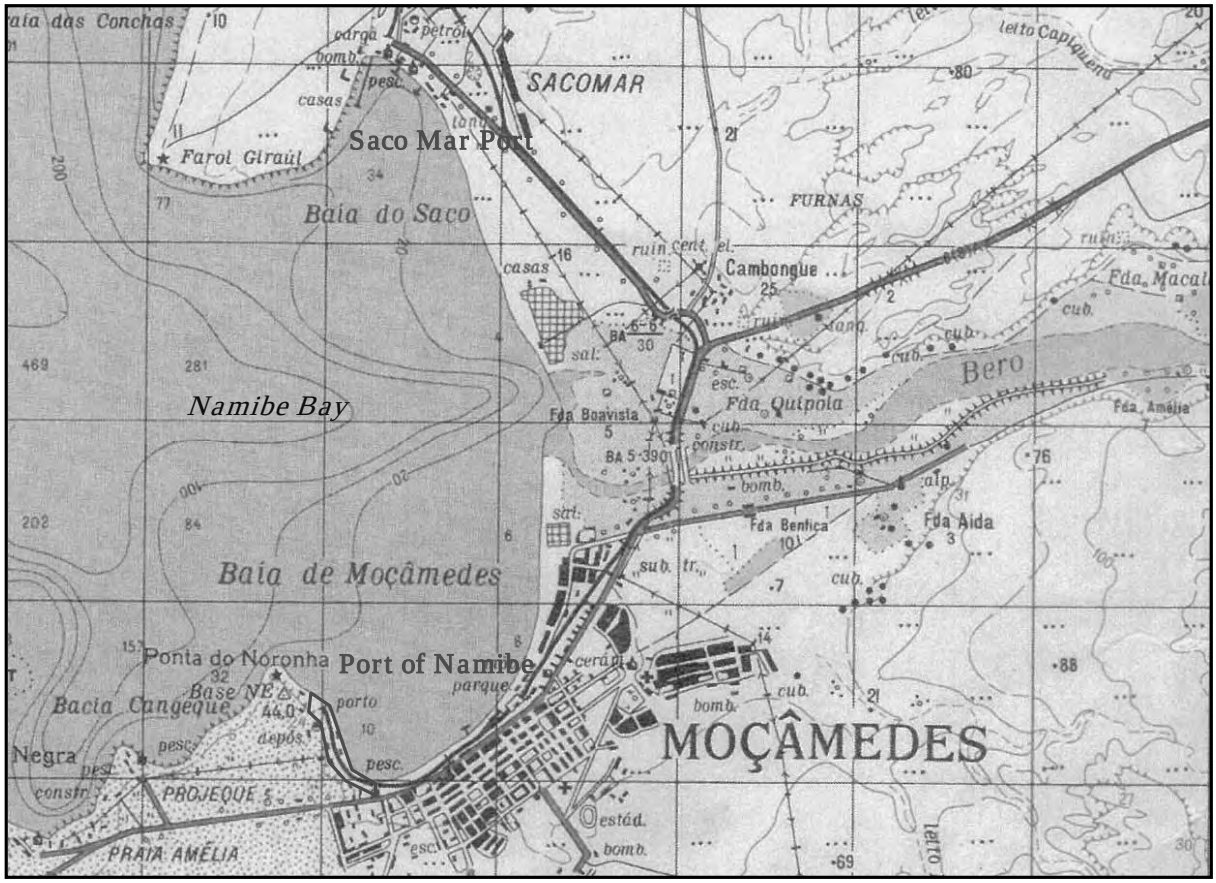


Figure-Title 7 Vicinity Topographic Map of Port of Namibe

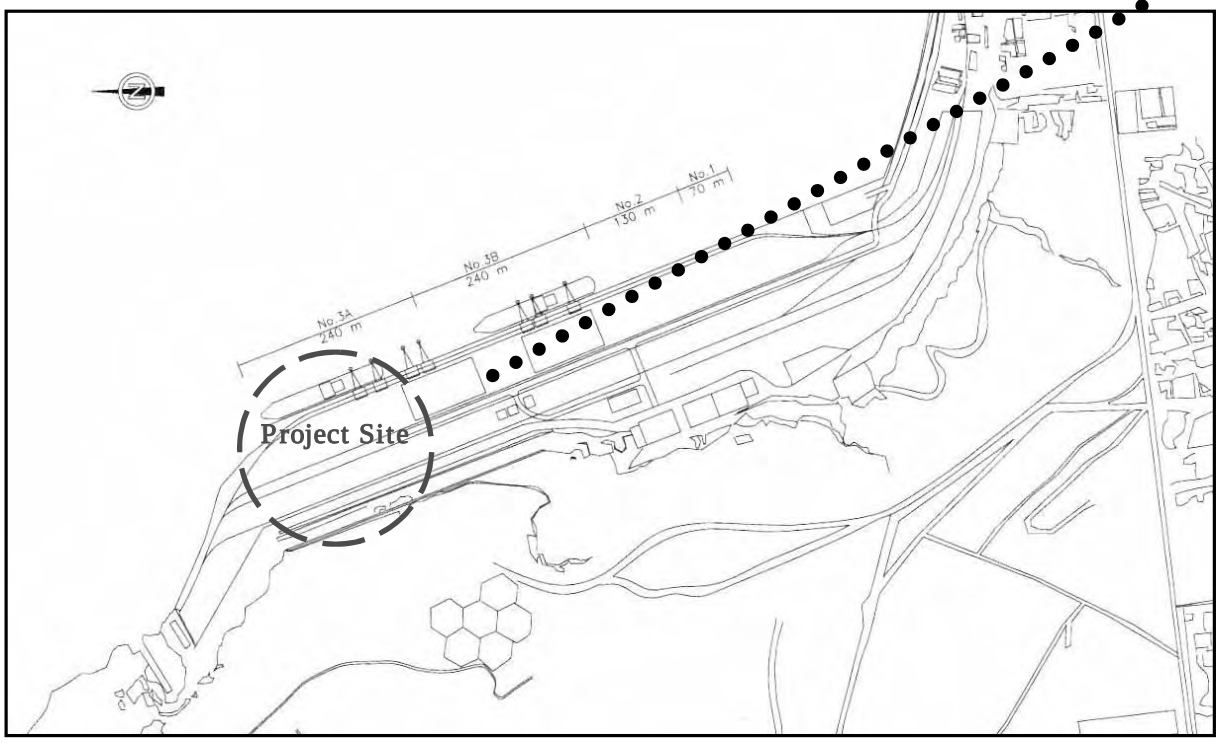
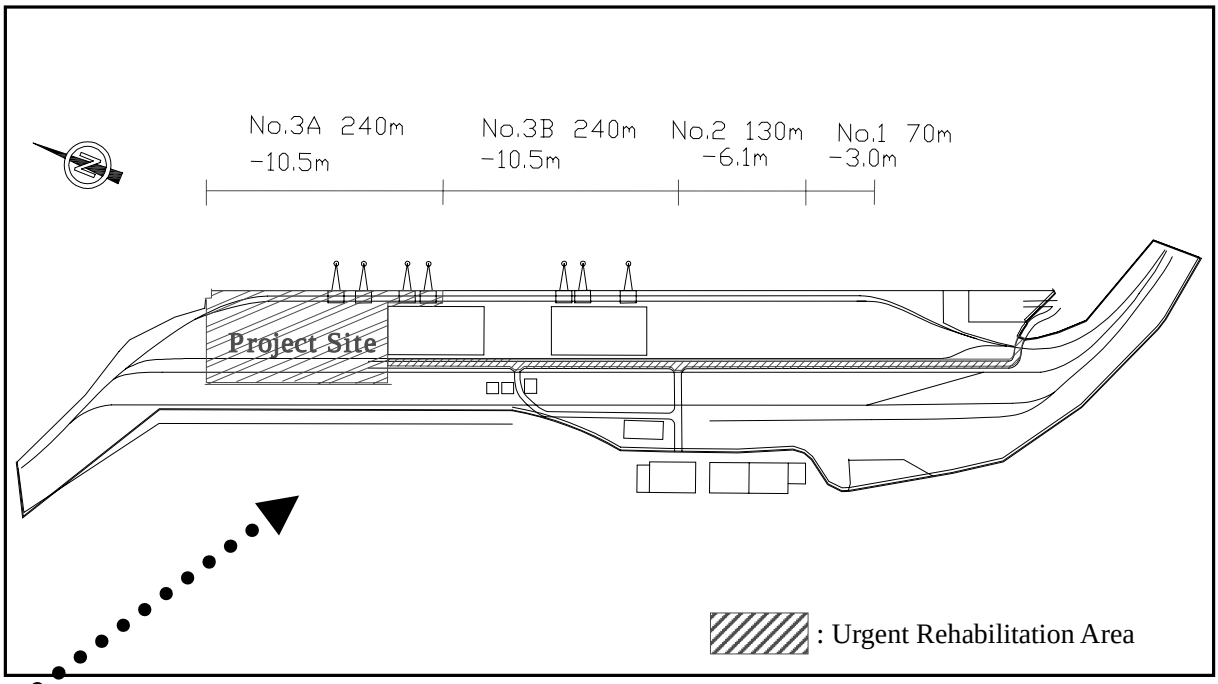


Figure-Title 8 Topographic Map of Port of Namibe



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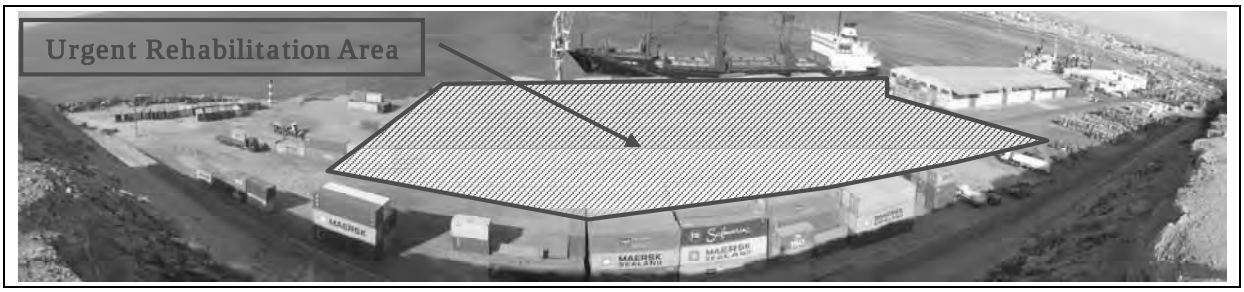
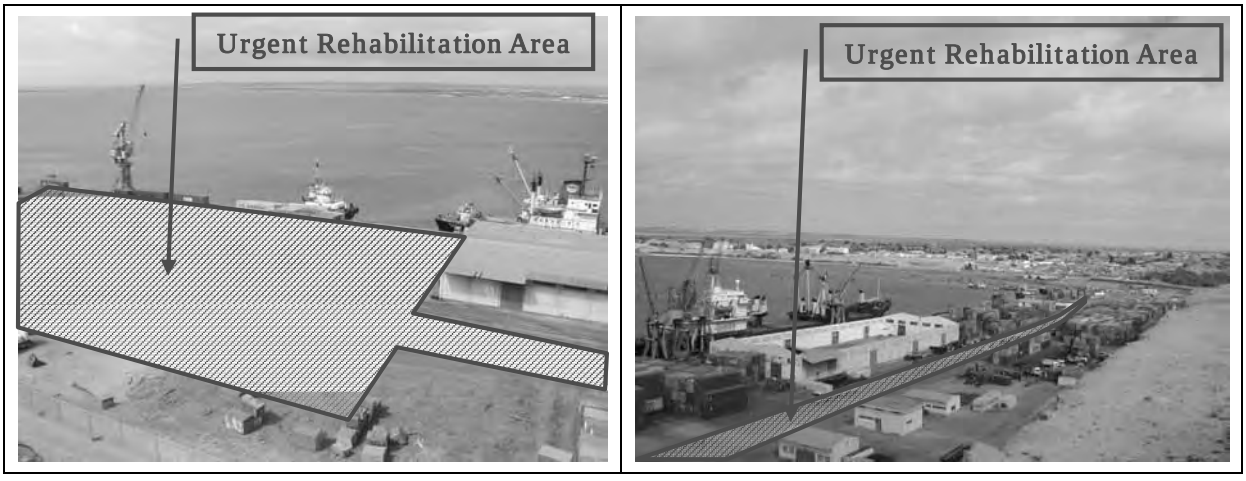


<No.3A Quay & Container Yard behind>



<No3A Quay> **<Access Road >**

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■ **Perspective （Port of Lobito）**

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Abbreviation

A	AFDB	African Development Bank
	AIDS	Acquired Immunodeficiency Syndrome
B	B/L	Bill of Lading
C	CBD	Convention on Biological Diversity
	CDL	Chart Datum Level
	CEC	Commission of the European Committees
	CFB	Benguela Railway
	CFL	Luanda Railway
	CFM	Mocamedes Railway
	CFS	Container Freight Station
	CIA	Central Intelligence Agency
	CIF	Cost, Insurance and Freight
	CLC	International Convention on Civil Liability for Oil Pollution Damage
	COD	Chemical Oxygen Demand
D	DBSA	Development Bank of Southern Africa
	DRC	Democratic Republic of Congo
E	EC	European Community
	ECP	Poverty Reduction Strategy (Estrategia de Combate a Pobreza)
	EDI	Electronic Data Interchange
	EDP	Electronic Data Processing
	EIA	Emvironmental Impact Assessment
	EIS	Emvironmental Impact Study
	EMRP	Emergency Multisector Recovery Project
	ENTA	Estratégia para Desenvolvimento dos Transportes em Angola
	EPL	Public Corporation of Port of Luanda
	EPLO	Public Corporation of Port of Lobito
	EPN	Public Corporation of Port of Namibe
	EU	European Union
F	FAO	Food and Agricultural Organization of the United Nations
	FRP	Fiber Reinforced Plastic
G	GDP	Gross Domestic Product

	GEPE	Cabinet of Study, Planning and Statistics
	GRC	Glass Fiber Reinforced Cement
H	HDI	Human Development Index
	HIV	Human Immunodeficiency Virus
I	IBRD	International Bank for Reconstruction and Development
	ICT	Information and Communication Technology
	IEE	Initial Environmental Examination
	IMF	International Monetary Fund
	IMO	The International Maritime Organization
	INAMET	The National Institute of Meteorology and Geophysics
	IMPA	Institute of Maritime and Ports of Angola
	INEA	National Institute for Roads of Angola
	ISPS	International Ship and Port Facility Security
	IUCN	International Union for Conservation of Nature and Natural Resources
J	JICA	Japan International Cooperation Agency
K	Kz	Kwanza
L	LDC	Less Developed Country
	LDC/LC	London Dumping Convention (Convention on the prevention of marine pollution by Dumping of Wastes and other matter)
	LNG	Liquefied Natural Gas
	LRRD	Link between Relief, Rehabilitation and Development
M	MDG	Millennium Development Goals
	MHWN	Mean High Water Neap
	MHWS	Mean High Water Springs
	MINADER	Ministry of Agriculture and Rural Development
	MINARS	Ministry of Social Affairs and Reintegration
	MINOP	Ministry of Public Works
	MINPLAN	Ministry of Planning
	MINTRANS	Ministry of Transport
	MINUA	Ministry of Urban Affairs and Environment
	MIREX	Ministry of External Relationship of Angola
	MSL	Mean Sea Level
	MLWN	Mean Low Water Neap

	MLWS	Mean Low Water Spring
	MPLA	The Popular Movement for Liberation of Angola
N	NEPAD	New Partnership for Africa's Development
	NGO	Non-Governmental Organization
O	OCHA	Office for the Coordination of Humanitarian Affairs
	ODA	Official Development Assistance
	OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
P	PIC	Polymer Impregnated Concrete
	PIP	Project Investment Plan
	PMAWCA	Port Management Association of West and Central Africa
	PPMRRP	Priority Phase Multisector Rehabilitation and Reconstruction Program
	PRSP	Poverty Reduction Strategy Paper
	PSP	Port Security Plan
S	SADC	Southern African Development Community
	SONANGOL	Angola's National Oil Company
T	TEU	Twenty-Foot Equivalent Unit
U	UN	United Nations
	UNCCD	United Nations Convention to Combat Desertification
	UNCLOS	United Nations Convention on the Low of the Sea
	UNDP	United Nations Development Program
	UNITA	The Union for the Total Independence of Angola
	USAID	U.S. Agency for International Development
W	WB	The World Bank
	WFP	World Food Program

Chapter 1 Background of the Project

Chapter 1 Background of the Project

1-1 Background of the Request

(1) Background

Ports in Angola have important roles to maintain the suitable logistic supporting to the economy and restoration of the country, because most of crops, building material and industrial goods are imported in the ports. Unfortunately, major 4 ports, Port of Luanda, Lobito, Namibe and Cabinda have not been maintained suitably during civil war, therefore, their facilities could not be utilized effectually.

(2) History of Execution of the Basic Design Study

In order to improve current condition of these ports, the Government of Angola has requested the Government of Japan to undertake the study on the urgent rehabilitation program (hereinafter referred to as "Development Study") which is comprised of three important items, namely 1) Urgent rehabilitation program of major ports, 2) Long-term port development plan all over the country and 3) Establishment of an organization and operation system in the ports. According to this request, the study has been carried out by Japan International Cooperation Agency (hereinafter referred to as "JICA") from January 2005 to August 2006. Principal object of the study was urgent rehabilitation of port function. Depending on result of the study, the Government of Angola has requested the Government of Japan to execute rehabilitation works in Ports of Lobito and Namibe.

Short-term rehabilitation plan which will rehabilitate these ports facilities was established by Development Study to meet demand forecast showed that cargo throughput in 2010 would reach more than twice of its quantity in 2004. Especially, urgent rehabilitation program has been planned for urgent restoration to the serious damaged facilities. The urgent rehabilitation program intended to Ports of Lobito and Namibe among four major ports in Angola. The program selected the poor conditioned and well utilized quays and yards as the project sites. Basic Design Study has conducted based on request of the Government of Angola for the components which needs urgent restoration regarding results of Development Study.

In accordance with above-mentioned requests, the Government of Japan decided to conduct the basic design study on the urgent rehabilitation project of port facilities at the Port of Lobito and the Port of Namibe (hereinafter referred to as "Basic Design Study").

1-2 Component of the Request

Urgent rehabilitations were requested in Ports of Lobito and Namibe. Detailed contents of request are described below.

(1) Port of Lobito

1) Pavement on apron and yard(approximately 46,000 ㎡), Removal of existing pavement
2) Rehabilitation of coping concrete and quay wall and installation of car stoppers (240m as length of project site), Installation of mooring bollards on quay wall（240m as length of project site）, Installation of rubber fenders on quay wall(240m as length of project site.）
3) Installation of reefer plugs and power generator, Installation of water and oil supply pipes
4) Supply of cargo handling equipment（reach stacker 1 unit and top lifter 1 unit）

(2) Port of Namibe

1) Pavement on apron and yard（23,300m^2）, Removal of existing pavement

2) Rehabilitation of coping concrete and quay wall and installation of car stoppers, Installation of mooring bollards on quay wall（240m as length of project site）, Installation of rubber fenders on quay wall(240m as length of project site), Pavement of inner port road（620m）

3) Installation of reefer plugs and power generator, Installation of water and oil supply pipes, Construction of yard lighting towers

4) Supply of cargo handling equipment（reach stacker 1 unit, top lifter 1 unit and mobile crane 1 unit）, Removal of a quay crane, Removal of South Warehouse

1-3 Natural Condition

1-3-1 Meteorological Condition

We collected past meteorological data at INAMET (Instituto Nacional de Meteorologia e Geofísica de Angola). Meteorological data of Lobito was observed at Benguela Air Port where is located at 30 km from Lobito. Meteorological data of Namibe was observed at Nmibe Air Port. Also, study team used global objective analysis data (GANAL data) by Japan Meteorological Agency as supporting information.

(1) Wind direction and Wind velocity

South wind is predominant throughout a year and wind velocity has a tendency to become stronger as it directs to south in south-west Atlantic Ocean where Angola is located by GANAL data (2002 to 2006) of Japan Meteorological Agency. There is almost no seasonal fluctuation in Wind direction and velocity. South wind is frequently occurred through year round at Lobito and Namibe area. Percentage of occurrence of wind direction between WSW and S is 73.7% and between SW and SSW is 48.98% at Lobito Area. Percentage of occurrence of wind direction between SSW and S is 71.6% and the change of wind direction is less than Lobito area.

Also, the percentages of wind velocity over 5.0m/s, 7.5m/s and 10.0m/s throughout a year are 12.0%, 0.4% and 0.0% at Lobito area, and 43.2%, 8.4% and 0.8% at Namibe area. Percentage of strong wind at Namibe area is higher than Lobito area.

(2) Temperature

1) Lobito

Difference of maximum and minimum temperature is 6 to 7 degrees in centigrade throughout a year, and maximum temperature is around 30 degree in November to May and around 25 degree in June to September. Minimum temperature is around 23 degree in October to April and around 18 degree in May to September.

Table 1-3-1. (1) Monthly Maximum, Minimum and Mean Temperature in Lobito(℃) (1996～2005)

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Max. Temp.	29.8	30.6	31.1	30.1	28.0	25.5	24.3	24.4	25.6	27.9	28.9	29.1
Min. Temp.	23.6	24.4	24.8	23.9	21.1	18.6	17.7	18.2	19.5	22.1	23.0	23.1
Mean Temp.	26.7	27.5	27.9	27.0	24.6	22.0	21.0	21.3	22.5	25.0	26.0	26.1

2) Namibe

Difference of maximum and minimum temperature is 7 to 10 degrees in centigrade, maximum temperature is around 29 degree in February to April and 21 to 27 degrees in May to January. Minimum temperature is 14 to 21 degrees throughout a year.

Table 1-3-1.(2) Monthly Maximum, Minimum and Mean Temperature in Namibe(℃) (1998～2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max. Temp.	27.9	29.3	29.4	28.9	26.3	24.7	22.9	21.5	23.1	25.2	26.2	26.6
Min. Temp.	20.1	21.2	21.4	20.2	16.0	14.4	14.0	14.5	15.8	17.7	18.2	18.4
Average Temp.	24.0	25.3	25.4	24.5	21.2	19.6	18.4	18.0	19.4	21.5	22.2	22.5

Maximum temperature is around 30 degrees in centigrade at Lobito and Namibe. In minimum temperature, Namibe is lower than Lobito which is 14 degrees in centigrade on June to August.

(3) Humidity

1) Lobito

Monthly mean humidity is 69 to 72 % that is high and almost constant throughout a year.

Table 1-3-1.(3) Monthly Mean Humidity in Lobito (%) (1996～2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Hum.	69.1	69.8	70.8	72.6	74.8	75.3	73.8	72.5	72.2	72.3	70.2	70.8

2) Namibe

Monthly mean humidity is 68 to 81 % that is high and almost constant throughout a year.

Table 1-3-1.(4) Monthly Mean Humidity in Namibe (%) (2000～2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Hum.	68	68	72	72	75	77	81	81	80	75	71	71

(4) Precipitation

1) Lobito

Lobito area has not so much precipitation throughout a year, because it is tropical dry climate area. They have a few rainfalls between May and October and monthly mean precipitation is 10 to 40 mm in rainy season. However, it has been recorded 95 mm as maximum precipitation per day in November to April.

Table 1-3-1.(5) Monthly Mean and Maximum Precipitation per day in Lobito(mm)(1996～2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Precipitation	13.7	39.7	47.2	27.2	1.4	0.0	0.0	1.1	1.4	5.0	23.3	23.3
Max. Precipitation/day	18.2	85.4	95.4	53.6	4.1	0.0	0.1	2.2	5.6	27.5	52.4	54.6

There were 12 days with over 10 mm precipitation throughout the year in 1996 to 2005.

Table 1-3-1.(6) Number of Days over 10 mm Precipitation in Lobito (1996～2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Number of Days over 10mm Precipitation	1	2	4	2	0	0	0	0	0	1	1	1

2) Namibe

Republic of Angola defines Namibe as tropical desert climate area. Monthly mean precipitation regardless rainy season is only about 12 mm. Maximum precipitation per day is around 15 mm.

Table 1-3-1.(7) Monthly Mean and Maximum Precipitation per day in Lobito(mm)(1996～2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Precipitation	2.2	4.3	12.2	3.5	0.0	0.0	0.0	0.1	0.2	0.2	3.1	0.9
Max. Precipitation/day	4.6	10.8	15.2	7.8	0.0	0.0	0.0	0.6	2.1	1.9	15.7	2.7

Only 5 days were over 10 mm precipitation throughout the years in 1996 to 2005.

Table 1-3-1.(8) Number of Days over 10 mm Precipitation in Namibe (1996～2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Number of Days over 10mm Precipitation	0	1	3	0	0	0	0	0	0	0	1	0

1-3-2 Earthquake

Peak ground acceleration is 0.0 to 0.2m/s^2 at Lobito and 0.2 to 0.4m/s^2 at Namibe with 10% probability of exceedance in 50 years by Earthquake Hazards Program of United States Geological Survey (USGS). There were no occurrences of earthquake over the magnitude of 5. 9.8m/s^2 which is gravitational system of units = 980gal=1g which is The International System Units (SI). Therefore, ground acceleration of Namibe (0.4 m/s^2) is converted to 40 gal with the calculation of 0.4 m/s^2/9.8m/s^{2}x980gal=40gal. If ground acceleration is less than 200 gal, design seismic coefficient is expressed by ground acceleration divided by gravity acceleration according to harbor structure case design book by Coastal Development Institute of Technology 1999 April. Therefore ground acceleration of Namibe becomes 0.04 (=40/980).

1-3-3 Survey for Topographic and Structure Detailed Location

Topographic and structure detailed location survey was carried out at project site in Port of Lobito and Port of Namibe. Topographic maps are attached in Appendices.

(1) Lobito

As the results of topographic survey, crown height was 3.2 m at east side of No. 8 berth and 3.3 m at middle of No. 7 berth and 10 cm deference is confirmed between No. 7 and No. 8. Apron height becomes 3.0m at the location of about 15 m from the face of berth. Maximum yard height is 3.2 m at the location of 170m from the face of berth and distributed on a parallel to berth face. Yard height lowers towards the wall of port border from maximum yard height area and minimum height is 2.6 m.

(2) Namibe

As the results of topographic survey, crown height was almost 3.4 m. There are rails of railway and crane at middle of apron where is about 10 m from berth face and mean height is 3.1m. Paved container yard height is around 3.5 m. Height of north side of north warehouse which is used as road is around 3.3 m. Yard height is 3.3 m to 3.1 m at the location of 80 m and 120 m (along side of wall) from berth face. Middle of this area is like a cone-shaped hollow and the bottom height is 3 m. Road height at northern edge is 3.4 m, 3.2 m in front of south warehouse to canteen and 3.3 m at canteen to gate.

1-3-4 Design CBR (California Bearing Ratio) survey

Study team picked up samples for CBR test in laboratory at project site in Port of Lobito and Namibe and carried out CBR test.

(1) Lobito

Soil samples were picked up at 3 points. Point P-1 is located behind the No. 8 berth, point P-2 is located at center of yard and point P-3 is located at west edge of yard where is closer to port boundary. Soil samples were picked up with each sample of about 70 kg and test for the CBR of soils were carried out in laboratory. The results of all CBR tests were over 16.

Table1-3-4.(1) Results of CBR in Port of Lobito

Sample Number	CBR
P-1	16
P-2	16
P-3	23

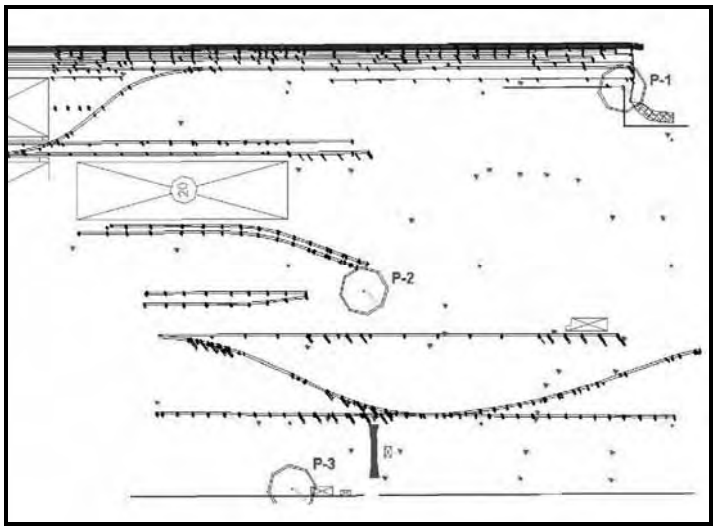


Figure1-3-4.(1) Sampling Location of CBR in Port of Lobito

(2) Namibe

Soil samples were picked up at 4 points. Point A-5 is located behind northern edge of 3A berth, point A-2 is located behind the paved container yard, Point A-3 is located at non paved yard behind 3A berth and point A-4 is located at road side behind the south warehouse. Soil samples were picked up with each sample of about 70 kg and were carried out test for the CBR of soils in laboratory. Results of all CBR tests were over 12.

Table 1-3-4.(2) Results of CBR in Port of Namibe

Sample Number	CBR
A-5	20
A-2	47
A-3	25
A-4	12

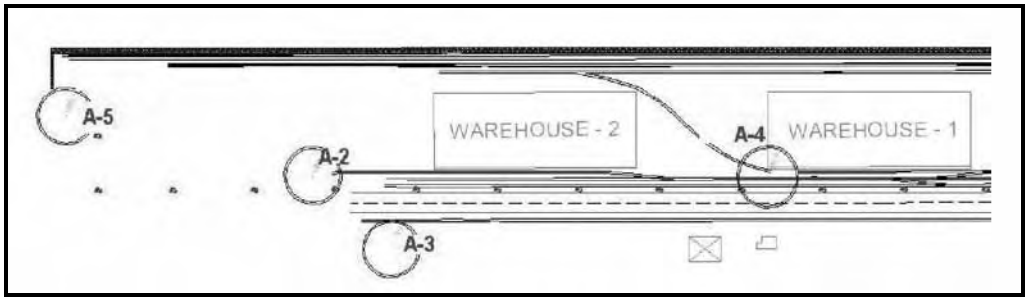


Figure 1-3-4.(2) Sampling Location of CBR in Port of Namibe

1-3-5 Soil Condition (Plate Bearing Test)

Study team carried out plate bearing test which was done at the same points where CBR test samples were picked up in Port of Lobito and Namibe.

(1) Employed testing machine etc.

Employed testing machine and others are shown at Table 1-3-5. (1) for both ports.

Table 1-3-5.(1) Equipments and Index etc.

Item	Port of Lobito	Port of Namibe
Shape of Loading Plate	Circle	Circle
Type of Jack	Hydraulic Jack	Hydraulic Jack
Capacity of Load Meter(kN)	50	50
Diameter of Loading Plate(cm)	30	30
Capacity of Jack(kN)	100	100
Area of Loading Plate (m^2)	7.07×10^{-2}	7.07×10^{-2}
Reaction Equipment	Truck Crane 16 tons	Forklift Truck 40 tons
Settlement for Calculation (mm)	1.25	1.25

(2) Results of plate bearing test

Results of plate bearing test are shown at Table 1-3-5.(2) for both ports.

Table 1-3-5.(2) Results of Plate Bearing Test

Port of Lobito		Port of Namibe	
Sample Number	K_{30}	Sample Number	K_{30}
P-1	144	A-5	84
P-2	224	A-2	84
P-3	116	A-3	220
		A-4	68

1-3-6 Sounding survey

Study team carried out sounding survey using simple sounding apparatus and portable GPS in front of berth at project site in Port of Lobito and Namibe.

(1) Port of Lobito

Study team surveyed the water depth from 1 m in front of No.8 berth toward 50 m offshore. Depth of 11 m to 12 m is recorded at the survey area. It was the same condition when The Study on Urgent Rehabilitation Program of Ports in the Republic of Angola was carried out. However, according to the interview to ships, width of channel at the harbor entrance is getting narrower and, it needs careful maneuvering when ships over 170 m length is arriving and/or leaving port.

Chipping works will be needed at water side (face of berth) when construction work will be commenced, because crown concrete will be improved in this project. If waste concrete is fell down into the sea, the depth of water in front of berth becomes shallower and it will cause to break ship therefore it is important to make construction method carefully.

(2) Port of Namibe

Study team surveyed the water depth from 1 m in front of No.3A berth toward 200 m offshore. Depth of 10 m to 22 m is recorded at survey area. Depth in front of berth tends to be shallower to 14m, 12m and 10m at No.3A, No.3B and No.2 accordingly. This trend is same as the results of The Study on Urgent

Rehabilitation Program of Ports in the Republic of Angola.

Port of Namibe is good natural harbor which has never dredged since the port was constructed. However, swell becomes bigger when the wind from SSW (generally after noon) becomes strong. Study team observed swell 50 cm to 1 m at No.3A berth on February 25, 2007 under Basic Design Study.

The same caution is definitely necessary for construction work at the Port of Namibe as well.

1-3-7 Others

(1) Water quality

Study team carried out simple water quality test for supplying water to ship in Port of Lobito and Namibe. Water samples were collected from water valve at north edge of North Quay in Port of Lobito and from water tank track in Port of Namibe. The water is produced by desalination plant in Port of Lobito. The water is city water provided by Namibe water supply public corporation in Port of Namibe.

Two test items are COD (chemical oxygen demand) and HNO_2 (Nitrous Acid), and Results of the tests are the same result in both ports. Results of water quality test are shown at Table 1-3-7.(1)

Table 1-3-7.(1) Results of Water Quality Test in Port of Lobito and Namibe

Test	Results	Remarks
Chemical Oxigen Demand (COD)	5 ppm	There is scarcely some organic material in the water.
Nitrous Acid (HNO_2)	0.02 ppm	There is scarcely some contaminant in the water.

(2) Concrete strength test at Quay

Simple concrete strength test was carried out by Schmidt Hammer at Port of Lobito and Namibe. Section points are shown in Figure 1-3-7.(1).

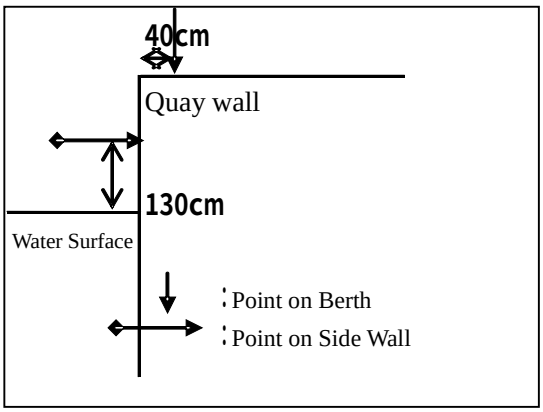


Figure 1-3-7.(1) Location of Strength by Test Hammer in Port of Lobito

1) Port of Lobito

Strength tests were carried out every 30 m where bollards are placed. 9 points are on the side of berth face in the No.7 berth and 7 points on the same of No.8 berth. Concrete strengths were over 270kg/cm^2 at all points. Crucial strength deterioration was not observed on top of concrete block of quay.

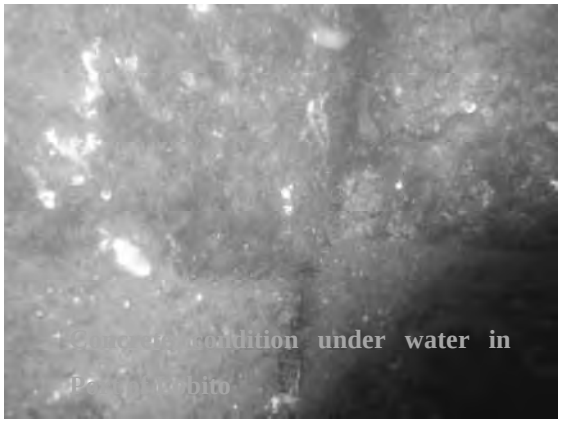
2) Port of Namibe

Strength tests were carried out every 20 m totaling 25 points made up 13 points on the berth and 12 points on the side of berth face in No. 3A berth. Concrete strengths were over 270kg/cm^2 at all points. However, part of cement paste is getting older as peeling off by nail. Accordingly, strength is measured by reflected aggregate strength. Therefore, study team proposes that concrete surface will be taken off

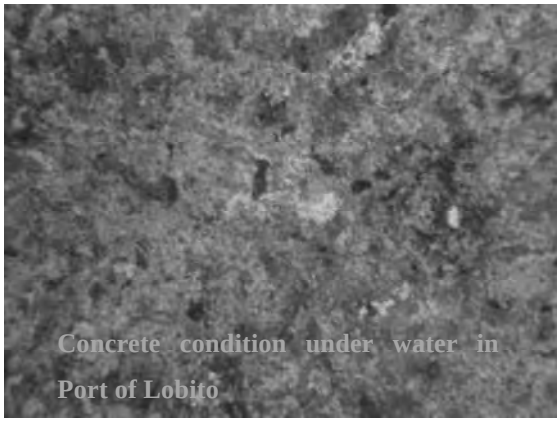
and new concrete will be poured to improve quay wall.

(3) Condition survey of under water concrete

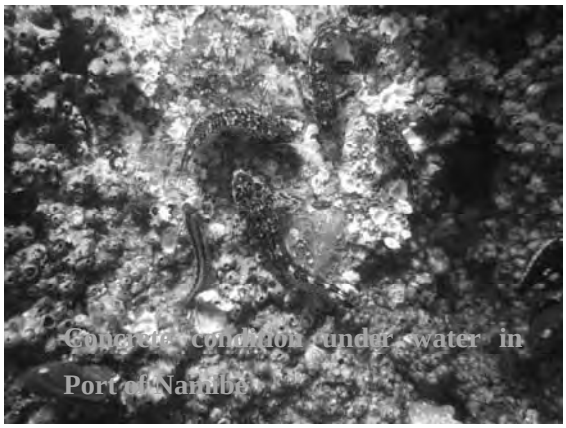
Around 2 m depth under water concrete condition was observed by visual examination of diver in Port of Lobito and Namibe. According to visual examination, crack was not observed, but dimple caused by marine life was observed in both ports. There observed 15 cm to 40 cm uneven joints of concrete blocks at 120 m, 160 m and 180 m from northern edge of quay wall. Especially at the point of around 180m, the fourth from the top block is popped out to sea ward with 20 cm than the third from the top block and the fifth block is popped out to sea ward with 40 cm than the fourth. Port of Namibe said that it was smooth when ordinary ship was moored, but bottom of large size ship has touched quay wall at lowest tide. In this plan, new concrete will be poured to part of top block concrete and fenders will be installed. Therefore, vessels will not touch quay wall because the 1.5 m distance from quay face line can be kept when vessels are moored.



Concrete condition under water in Port of Lobito

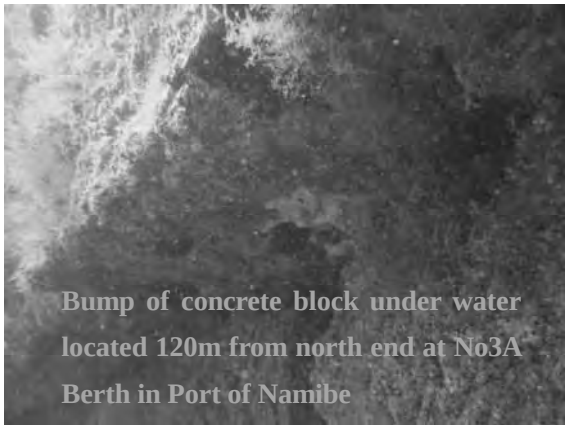


Concrete condition under water in Port of Lobito



Concrete condition under water in Port of Namibe

Concrete condition under water in Port of Namibe



Bump of concrete block under water located 120m from north end at No3A Berth in Port of Namibe

Bump of concrete blocks under water located 180m from north end at No3A Berth in Port of Namibe

Figure 1-3-7.(2) Concrete Condition under Water

1-4 Environmental and Social Consideration

Table 1-4.(1)&(2) shows mitigation measures for environment impact of this improvement works on the basis of stakeholders meeting in The Study on Urgent Rehabilitation Program of Ports in the Republic of Angola in 2002, environment impacts in each project port which were picked up from Initial Environmental Evaluation (IEE) and results of this field study.

According to the official letter issued by Ministry of Transport in Angola on May 21, 2007, Environmental Impact Assessment (EIA) is not needed for this project because contents of the Project are only for rehabilitation works of existing port facilities in the areas of Port of Lobito and Namibe.

Table 1-4.(1) Environmental Impact and Mitigation Measures in Port of Lobito (Construction Phase)

Environmental Impact	Contents	Mitigation Measures
① Generation of construction debris	There is a possibility of generation of construction debris caused by improvement works of existing quay wall, apron and yard.	・Secure the appropriate dumping area
② Exposure of dust	It is necessary to avoid change to worse condition in environment of urban area caused by an exposure of dust, because urban area is located nearby the port area.	・Watering to project site and construction vehicle
③ Protection of sea area when remove concrete blocks	Especially in improving quay wall, it is necessary to secure suitable depth planned before improvement works, because vessels will be moored at the quay wall even after improvement works.	・Installation of facilities to prevent falling objects

Table 1-4.(2) Environmental Impact and Mitigation Measures in Port of Namibe (Construction Phase)

Environmental Impact	Contents	Mitigation Measures
① Generation of construction debris	There is a possibility of generation of construction debris caused by improvement works of existing quay wall, apron and yard.	・Secure the appropriate dumping area
② Protection of sea area when remove concrete block	Especially in improving quay wall, it is necessary to secure suitable depth planned before improvement works, because vessels will be moored at quay wall even after improvement works.	・Installation of facilities to prevent falling objects
③ Increase traffic during construction	There is only one capable road in Port of Namibe. Therefore, the traffic will be temporary increased during construction. It is necessary to secure traffic safety to avoid congestion of construction vehicles and the port vehicles.	・Construct temporary Road for works ・Placement of vehicle guide persons at the road ・Identification of construction vehicle and control travelling/speed