MINISTRY OF TRANSPORT
SOCIALIST REPUBLIC OF VIET NAM

THE PREPARATORY SURVEY ON LACH HUYEN PORT INFRASTRUCTURE CONSTRUCTION IN VIET NAM

FINAL REPORT

(Summary)

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JULY 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request from the Government of The Socialist Republic of Vietnam, Government of Japan decided to conduct the Preparatory Survey for Lach Huyen Port Infrastructure Construction in The Socialist Republic of Vietnam and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Nagao Nobuaki of Oriental Consultants co., LTD and consist of Oriental Consultants co., LTD and PADECO co., LTD between Oct 2009 and July 2010.

The team held discussions with the officials concerned of Ministry of Transport and The Vietnam Maritime Administration and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of The Socialist Republic of Vietnam for their close cooperation extended to the study.

July 2010

Kiyofumi Konishi,

Director General
Economic Infrastructure Department
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

July 2010

Mr. Kiyofumi Konishi
Director General
Economic Infrastructure Department
Japan International Cooperation Agency

Dear Mr. Konishi,

It is my great pleasure to submit herewith the Final Report of a Preparatory Survey on Lach Huyen Port Infrastructure Construction in Viet Nam

The study team composed of ORIENTAL CONSULTANTS CO., LTD and PADECO CO., LTD. conducted surveys in the Socialist Republic of Vietnam over the period between October 2009 and May 2010 according to the contract with the Japan International Cooperation Agency (JICA).

The study team compiled this report, which proposes a medium term port development plan for 2020 and an implementation plan as Japan's ODA loan project, through close consultation with officials of the Government of the Socialist Republic of Vietnam and other authorities concerned.

On behalf of the study team, I would like to express my sincere appreciation to the Government of Vietnam and other authorities for their diligent cooperation and assistance and for the heartfelt hospitality, which they extended to the study team during our stay in Vietnam.

I am also very grateful to the Japan International Cooperation Agency, the Ministry of Foreign Affairs of Japan, the Ministry of Land, Infrastructure, Transport and Tourism of Japan, and the Embassy of Japan in the Socialist Republic of Vietnam for giving us valuable suggestions and assistance during the course of the study.

Yours faithfully,

Nobuaki Nagao
Team Leader
The Preparatory Survey
on Lach Huyen Port Infrastructure
Construction in Viet Nam

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A	AASHTO	American Association of State Highway and Transportation Officials
	ACL	American Container Line, Inc.
	AIDS	Acquired Immune Deficiency Syndrome
	AIS	Automatic Identification System
	ALiCC	Arch action Low improvement ratio Cement Column
	APL	American President Lines
	ADCP	Acoustic Doppler Current Profiler
	ADB	Asian Development Bank
	ASEAN	Association of South East Asian Nations
B	B/C	Cost-Benefit Ratio
	BKK	Bangkok
	BLT	Build - Lease - Transfer
	BOD	Biological Oxygen Demand
	BOO	Build-Operate-Own
	BOR	Berth Occupancy Ratio
	BOT	Build-Operate-Transfer
	BRICs	Brazil, Russia, India and China
	BS	British Standard
	BT	Built – Transfer
	BTO	Build - Transfer - Operate
C	CBR	California Bearing Ratio
	CBTA	Cross Border Transport Agreement
	CD	Chart Datum
	CDL	Chart Datum Level
	CDM	Cement Deep Mixing
	CFS	Container Freight Station
	CHE	Cargo Handling Equipment
	CIF	Cost, Insurance and Freight
	CIQ	Customs, Immigration, Quarantine
	CKYH	Coscon, "K"LINE, Yang Ming, Hanjin Shipping
	CNC	CNC Lines
	COSCO	China Ocean Shipping Company
	COSCON	COSCO Container Lines Co., Ltd
	CSD	Cutter Suction Dredger
	CTP	China-Transpacific Service
	CY	Container Yard
D	DAP	Diammonia Phosphate Fertilizer
	DO	Dissolved Oxygen
	DSCR	Debt Service Coverage Ratio
	DVIZ	Dinh Vu Industrial Zone
	DWT	Deadweight Tonnage
E	ECD	Empty Container Depot
	ECDIS	Electronic Chart Display and Information System
	EHS	Environment, Health and Safety
	EIA	Environmental Impact Assessment
	EIR	Equipment Interchange Receipt
	EIRR	Economic Internal Rate of Return

	EMP	Environmental Management Plan
F	FC	Full Container Ship
	FDI	Foreign Direct Investment
	FEU	Forty-Foot Equivalent Unit
	FIRR	Financial Internal Rate of Return
	FOB	Free On Board
	F/S	Feasibility Study
	FTA	Free Trade Agreement
G	GL	Ground Level
	GOJ	The Government of Japan
	GOV	The Government of Socialist Republic of Viet Nam
	GDP	Gross Domestic Product
	GMS	Greater Mekong Subregion
	GPS	Global Positioning System
	GSO	General Statistics Office of Vietnam
	GT	Gross Tonnage
H	HAPACO	Hai Phong Industrial Zone Joint Stock Company
	HCM	Ho Chi Minh
	HECO	Highway Engineering Consultants
	HHWL	Highest High Water Level
	HIV	Human Immunodeficiency Virus
	HK	Hong Kong
	HP	Haiphong
	HPH	Hutchison Port Holdings
	HWL	High Water Level
	HYMENET	The Center fot Hydrometeorological and Environmental Station Network
I	ICB	Interlocking Concrete Block
	IDC	Interest During Construction
	IMF	International Monetary Fund
	IMO	International Maritime Organization
	IP	Industrial Park
	IZ	Industrial Zone
	IRR	Internal Rate of Return
	ISL	Institute of Shipping Economics and Logistics
	IT	Information Technology
J	JBIC	Japan Bank for International Cooperation
	JBSI	Japan Bridge & Structure Institute, Inc.
	JCC	Joint Coordination Committee
	JETRO	Japan External Trade Organization
	JICA	Japan International Cooperation Agency
	JIS	Japanese Industrial Standards
	JIT	Just in Time
	JOPCA	Japan Overseas Ports Cooperation Association
	JPY	Japanese Yen
	JV	Joint Venture
L	LC	Laem Chabang
	LCP	Laem Chabang Port
	LCL	Less than Container Load

	LED	Light Emitting Diode
	LIBOR	London Interbank Offered Rate
	LLWL	Lowest Low Water Level
	Loa	Length Over All
	LWL	Low Water Level
M	MARPOL	International Convention for the Prevention of Pollution from Ships
	METI	Ministry of Economy, Trade and Industry
	MLWL	Mean Low Water Level
	MOM	Minutes of Meeting
	MONRE	Ministry of Natural Resources and Environment
	MOT	Ministry of Transport
	MOU	Memorandum of Understanding
	MP	Multi Purpose Ship
	MPA	Maritime and Port Authority of Singapore
	MPI	Ministry of Planning and Investment
	MPMU	Major Projects Management Unit
	MSC	Mediterranean Shipping Company S.A.
	MSC No.1	Maritime Safety Company No.1
	MSL	Mean Sea Level
	MWL	Mean Water Level
N	N.A.	Not Applicable
	NCPFP	National Committee for Population and Family Planning
	NK	Nippon Koei Co., Ltd
	NPV	Net Present Value
O	ODA	Official Development Assistance
	OOCL	Orient Overseas Container Line
P	PAB	Project Affected Fishing Boats
	PAH	Project Affected Household
	PAP	Project Affected People
	PAT	The Port Authority of Thailand
	PC	Prestressed Concrete
	PC	The People's Committee
	PCU	Passenger Car Unit
	PDA	Pile Driving Analyzer
	PHC	Prestressed High-strength Concrete
	PIANC	Permanent International Association of Navigation Congress
	PIL	Pacific International Lines (Pte) Ltd .
	PM	Prime Minister
	PMB	Port Management Body
	PMU	Project Management Unit
	POC	Port Operating Company
	PPP	Public Private Partnership
	PRC	People's Republic of China
	PSA	Port of Singapore Authority
	PTI	Pre Trip Inspection
	PVD	Prefabricated Vertical Drain
Q	QGC	Quay Gantry Crane
R	RAP	Resettlement Assistance Program

	RC	Reinforced Concrete
	RCL	Regional Container Lines
	RO	Rehabilitate – Own
	ROE	Return on Equity
	RORO	Roll-On/Roll-Off ship
	ROT	Rehabilitate - Operate - Transfer
	RTG	Rubber Tyred Gantry (Crane)
S	SAPROF	Special Assistance for Project Formation
	SC	Slot Charter
	SCF	Standard Conversion Factor
	SDVDC	South Dinh Vu Development Joint Stock Company
	SITC	SITC Container Lines Co., Ltd
	SP	Singapore
	SPC	Special-Purpose Company
	SPP	Steel Pipe Pile
	SPT	Standard Penetration Test
	SSPP	Steel Sheet Pipe Pile
	STEP	Special Terms for Economic Partnership
T	TCVN	Vietnam Standards (Tiêu Chuẩn Việt Nam)
	TCXDVN	Vietnamese Construction Standard (Tiêu chuẩn Xây dựng Việt Nam)
	TDSI	Transport Development and Strategy Institute
	TEDI	Transport Engineering Design Incorporated
	TEDIPORT	Port & Waterway Engineering Consultant Joint Stock Company
	TEU	Twenty-foot Equivalent Unit
	TNWA	The New World Alliance
	TSHD	Trailing Suction Hopper Dredger
	TSS	Total Suspended Solids
U	UKC	Under Keel Clearance
	UNCTAD	United Nations Conference on Trade and Development
	UNESCO	United Nations Educational, Scientific and Cultural Organization
	USA	United States of America
	UXO	Unexploded Ordnance
V	VAT	Value-Added Tax
	VHF	Very High Frequency
	VIDIFI	Vietnam Infrastructure Development and Financial Investment
	VINALINES	Vietnam National Shipping Lines
	VINAMARINE	Vietnam National Maritime Bureau
	VINASHIN	Vietnam Shipbuilding Industry Corporation
	VITRANSS	National Transport Development Strategy in the Socialist Republic of Vietnam
	VMS	Vietnam Maritime Safety Agency
	VND	Vietnamese Dong
	VNHC	Vietnam National Hydrographic Center
	VPA	Vietnam Seaports Association
	VTS	Vessel Traffic Service
W	WACC	Weighted Average Cost of Capital
	WB	The World Bank
	WTO	World Trade Organization

Executive Summary

1. Background and Objective of the Study

In the northern region of Viet Nam, maritime cargo traffic volume is likely to increase to 56 million tons in the year 2010, and to 110 – 130 million tons in the year 2020. These figures will exceed the cargo handling capacity of both Hai Phong and Cai Lan ports (total capacity of 75 million tons) located in the northern region. There is an urgent need to boost the cargo handling capacity of ports located in the northern region of Viet Nam.

2. Demand Forecast and Port Development Scale

The estimated container cargo volume are 3.59 million TEU in 2015 and 5.08 million TEU in 2020 and the general cargo and bulk cargo volume are 11.2 million ton in 2015 and 12.9 million ton in 2020 for Northern Vietnam. These cargoes should be shared by Hai Phong port, Cai Lan port and Lach Huyen port. As a result, the container volume and general & bulk cargo volume for Lach Huyen Port are estimated as 2.23 million TEU and 2.38 million ton respectively in 2020.

In order to handle these cargoes in Lach Huyen port in 2020, the **five (5) container berths** (L=375m x 5, D= -14m CDL) and **three (3) multi-purpose berths** (L=250m x 3, D= -13m CDL) need to be constructed.

3. Container Berth No.1 & No.2 Development by 2015

In the frame work of Medium Term Development Plan of Lach Huyen Port for target year of 2020, the first two (2) container berths has been decided to be implemented by VINALINES as a Project Owner by the Prime Minister Decision dated April 11, 2007 and MOT Decision on December 22, 2008. Therefore, this Initial Development Plan for the target year of 2015 is prepared for the first two (2) container berths development and other related port infrastructure development.

The scale and scope of container berths development was reviewed by SAPROF study and following modifications on original plan were proposed:

(1) The design container vessel sizes should be 50,000DWT (full load) and 100,000DWT (partial load) instead of 30,000DWT (full load) and 50,000DWT (partial load).

(2) According to the above modification for vessel sizes, total length of berths No.1 & 2 should be extended from 600m to 750m.

(3) The terminal yard area should be enlarged from 36ha to 45ha.

(4) Quay Gantry Cranes should be large-size one suitable for 100,000DWT container vessels.

(5) Barge berths for domestic waterway traffic should be constructed in the north-eastern part of terminal.

(6) The construction of terminal land reclamation and soil improvement should be carried out by the public sector instead of VINALINES.

4. Cost Estimate for Container Berth No.1 & No.2 Development by 2015

The project cost is summarized in Table 4.1, the breakdown of the cost is shown in Table 4.2, and project cost by year is shown in Table 4.3.

Table 4.1 Summary of the Project Cost

Breakdown of Cost	Foreign Currency Portion (in million JPY)			Local Currency Portion (in million VND)			Total (in million JPY)		
	Total	Public Portion	Others	Total	Public Portion	Others	Total	Public Portion	Others
Package-1	16,473	16,473	0	2,093,062	2,093,062	0	27,525	27,525	0
Package-2	5,555	5,555	0	4,689,474	4,689,474	0	30,315	30,315	0
Price Escalation	2,437	2,437	0	2,742,219	2,742,219	0	16,916	16,916	0
Physical Contingency (5%)	1,223	1,223	0	476,238	476,238	0	3,738	3,738	0
Consulting Service	646	646	0	58,071	58,071	0	952	952	0
Land Acquisition	0	0	0	7,482	0	7,482	40	0	40
Administration Cost	0	0	0	503,327	0	503,327	2,658	0	2,658
VAT	0	0	0	1,504,659	0	1,504,659	7,945	0	7,945
Import Tax	0	0	0	486,526	0	486,526	2,569	0	2,569
Interest during Construction	477	477	0	0	0	0	477	477	0
Commitment Charge	320	320	0	0	0		320	320	0
Total	**27,132**	**27,132**	**0**	**12,561,058**	**10,059,064**	**2,501,994**	**93,454**	**80,244**	**13,211**

Source: SAPROF Team

Table 4.2 Breakdown of the Project Cost

No.	Item	Unit	Quantity	Local Currency Portion (in VND)		Foreign Currency Portion (in JPY)		Remarks
				Unit Price	Amount	Unit Price	Amount	
I	Construction Expenses							
A	Package-1 (Dredging)				***2,093,062,015,200***		***16,473,438,600***	Public Portion
0	Temporary Facility				***34,851,216,000***		***0***	Public Portion
a	Temporary Yard	m2	8,000.0	4,356,402	34,851,216,000	0	0	
1	Dredging				***2,058,210,799,200***		***16,473,438,600***	Public Portion
a	Access Channel	m3	32,300,860.0	159,300	2,058,210,799,200	850	16,473,438,600	VN40:JP60
b	Wharf Slope Dredging	m3	567,514.0	N.A.	0	0	0	*Private Portion*
c	Berth Box	m3	54,553.0	N.A.	0	0	0	*Private Portion*
d	Between Channel and Berth Box	m3	98,142.0	N.A.	0	0	0	*Private Portion*
B	Package-2 (CT, Protection, Public Facilities)				***4,689,474,307,639***		***5,554,726,722***	Public Portion
0	Temporary Facility				***139,404,864,000***		***0***	Public Portion
a	Temporary Yard	m2	32,000.0	4,356,402	139,404,864,000	0	0	
1	Container Terminal				***79,073,459,100***		***2,350,001,970***	Public Portion
a	Berth Structure	L.S	1.0	N.A.	0	0	0	*Private Portion*
b	Earth Retaining Wall	m	750.0	103,054,818	77,291,113,500	3,027,009	2,270,256,750	
c	Earth Retaining Wall for Barge Berth	m	180.0	9,901,920	1,782,345,600	443,029	79,745,220	
2	Reclamation				***600,087,179,286***		***0***	Public Portion
a	Terminal Area	m3	2,955,483.0	203,042	600,087,179,286	0	0	
3	Port Protection Facilities				***2,473,677,207,710***		***0***	Public Portion
a	Inner Revetment	m	750.0	40,162,324	30,121,743,000	0	0	
b	Outer Revetment-A	m	720.0	193,692,006	139,458,244,320	0	0	
c	Outer Revetment-B	m	2,510.0	198,346,558	497,849,860,580	0	0	
d	Training Dike-1	m	3,110.0	119,133,461	370,505,063,710	0	0	
e	Training Dike-2	m	3,290.0	307,135,810	1,010,476,814,900	0	0	
f	Training Dike-3	m	1,200.0	354,387,901	425,265,481,200	0	0	
4	Soil Improvement				***1,004,710,309,560***		***2,100,315,625***	Public Portion
a	Terminal Area	m2	366,625.0	1,261,246	462,404,314,750	4,665	1,710,305,625	
b	Barge Berth Area	m2	5,000.0	3,373,909	16,869,545,000	78,002	390,010,000	
c	Inner Revetment	m2	4,550.0	2,324,418	10,576,101,900	0	0	
d	Outer Revetment A	m2	13,104.0	2,094,872	27,451,202,688	0	0	
e	Outer Revetment B	m2	52,459.0	5,019,258	263,305,255,422	0	0	
f	Access Road	m2	192,900.0	1,161,762	224,103,889,800	0	0	
5	Access Road behind Port				***62,027,985,000***		***0***	Public Portion
a	Access Road	m	1,000.0	62,027,985	62,027,985,000	0	0	
6	Public Related Facilities (CIQ)				***328,503,425,659***		***472,238,250***	Public Portion
a	Reclamation	m3	344,131.0	203,042	69,873,046,502	0	0	
b	Dredging	m3	103,897.0	223,127	23,182,225,919	0	0	
c	Quaywall	m	375.0	237,948,361	89,230,635,375	1,259,302	472,238,250	
d	Pavement	m2	40,300.0	1,071,745	43,191,323,500	0	0	
e	Building	L.S.	1.0	59,935,258,841	59,935,258,841	0	0	
f	Utilities	L.S.	1.0	28,349,124,722	28,349,124,722	0	0	
g	Soil Improvement	m2	23,600.0	624,653	14,741,810,800	0	0	
7	Navigational Aids				***1,989,877,324***		***632,170,877***	Public Portion
a	New Channel Buoys	nos	20.0	74,547,220	1,490,944,400	28,323,068	566,461,360	
b	Relpace Existing Buoy	nos	3.0	97,456,616	292,369,848	0	0	
c	Light Beacon	nos	4.0	51,640,769	206,563,076	4,531,691	18,126,764	
d	Pilot Assistance System	L.S.	1.0	0	0	47,582,753	47,582,753	
	Total Expense				6,782,536,322,839		22,028,165,322	
II	Price Escalation				2,742,219,111,537		2,437,148,434	Public Portion
III	Physical Contingency (5%)				476,237,771,719		1,223,265,688	Public Portion
IV	Consulting Service				58,071,069,646		645,546,327	Public Portion
V	Land Acquisition				7,481,807,000		0	Other Portion
VI	Administration Cost				503,327,304,137		0	Other Portion
VII	VAT				1,504,658,809,587		0	Other Portion
VIII	Import Tax				486,526,125,823		0	Other Portion
IX	Interest during Construction				0		477,285,786	Public Portion
X	Commitment Charge				0		320,230,622	Public Portion
	Total Project Cost				12,561,056,322,289		27,131,642,178	
	(In VND)				17,699,626,916,589			
	(In JPY)						93,454,030,120	

Source: SAPROF Team

Table 4.3 Cost by Year

Breakdown of Cost	Total (in million JPY)	Public Portion (in million JPY)	Others (in million JPY)
2010	80	80	0
2011	80	80	0
2012	11,948	10,254	1,694
2013	37,339	31,998	5,341
2014	30,408	26,070	4,338
2015	13,348	11,521	1,827
2016	202	197	5
2017	47	43	5
Total	**93,454**	**80,244**	**13,211**

Source: SAPROF Team

5. Vessel Access Channel

In the original plan, the dimensions of vessel access channel were one way traffic system, 130m in width, -10.3m CDL in depth and 1:10 of side slope, however, SAPROF study recommended following modifications:

5.1 Dimension

a) The width of channel should be 160m for the portion protected by the sand protection dyke and 210m for the portion without sand protection dyke, suitable for 100,000DWT container vessels in accordance with the guidelines of PIANC.

b) The depth of channel should be -14m CDL from initial stage since there is high possibility that mother container vessels more than 50,000DWT (4,000TEU) of international trunk route of Asia – North America (Trans Pacific) will call Lach Huyen Port directly and the international gateway port should be able to accept such mother vessels at any tidal conditions.

5.2 New Navigation Aid

a) Channel buoys should be replaced from the existing floating buoys to Spar Buoys which will not move around like a floating buoy and be able to show exact position.

b) Light beacons should be installed on the sand protection dyke to show the existence of obstacle for fishermen.

c) A pilot assistance system which could display own ship position at real time should be provided to the pilot office.

5.3 Measures against Sedimentation

a) The sand protection dyke should be constructed up to seabed elevation of -5.0m CDL for 7,600m long.

6. Public Related Facilities

The public related facilities such as buildings for Maritime Administration, Customs, Immigration, Quarantine and amenity for port workers, and a mooring facility for service vessels are not included in the scope of Project. However, SAPROF study team recommends these basic public related facilities to be included in the scope of Project.

The proposed scales of public related facilities are ①Land reclamation: 344,000 m3, ②Dredging in front of berth: 104,000 m3, ③Service boats berth: 375m L x 30m W x -4m D, ④Pavement: 121,000 m2, ⑤Buildings: 4,600 m2 and ⑥Utilities and Others: 1 set.

7. Implementation Schedule

GOV wants to complete the construction of container Berth No.1 & 2 by the end of 2014 and commence operation from beginning of 2015, however, considering the standard process and steps necessary for the yen loan agreement, it is estimated that the construction work will commence from middle of the year 2012. As the construction work period is required about 41 months, the port operation can only be started in July 2015.

It should be noted that above implementation schedule is prepared based on the assumption that all procurement process proceeds without any delay.

8. Contract Packages

Considering the required technical qualification for each main work, interface between each work, financial scale of each work, smooth and quick implementation of work, etc., the packaging of contract for the port portion of ODA Project is recommended to be divided into two (2) packages as follows:

- Package 1: Dredging of Navigation Channel
- Package 2: Construction of Container Terminal, Port Protection Facilities and Public Related Facilities.

In addition to above 2 construction packages, the consulting service of construction supervision for both constructions should be added as Package 3.

- Package 3: Consulting Services for Construction Supervision

9. Financial and Economic Analysis

9.1 Financial Analysis

Financial analysis is made in order to confirm 1) the financial viability of public investment portion and 2) the financial affordability of private investment portion. Since the Project is designed as PPP concept, the financial arrangement is intended to fulfill the requirement of both public and private.

Public sector requires the reasonable return to cover the weighted average capital cost (WACC) in long term. 85.9 percent of the project is financed by ODA loan (STEP condition) and 14.1 percent is financed by the budget of the Government of Vietnam. The budget portion should have a reasonable return to cover the opportunity cost of the capital (15%). WACC is calculated as 0.32 percent.

Financial Internal Rate of Return (FIRR) of the public investment in the middle growth case is 1.24 percent, which is above WACC. It is considered that the public investment is financially viable.

Sensitivity analysis indicates that change of capital cost makes bigger impact on FIRR. Attention

should be paid to management of the capital cost.

Private sector requires the return on their equity to cover at least the opportunity cost of the capital. 15 percent is considered as the opportunity cost. At the same time, private banks request the enough margins of the available cash to debt service. Average annual debt service coverage ratio (DSCR) should be bigger than 1.5

Return on Equity (ROE) of the private investment in the middle growth case is 16.2 percent, which is above the opportunity cost. Average DSCR for this case is 1.68, which is above 1.5. It is considered that the private investment is financially affordable.

Sensitivity analysis indicates the change of container handling charges makes bigger impact to ROE as well as the impact on public financial return. Attention should be paid to structure of container handling charges as well as sharing mechanism of the profit regarding berth operation.

Table 9.1 Summary of FIRR, ROE, DSCR Sensitivity Analysis

Case		ROE	DSCR	Public FIRR
Container Volume	High Gowth Case	18.2%	1.68	1.33%
	Middle Growth Case (Base Case)	16.2%	1.68	1.24%
	Low Growth Case	14.0%	1.66*	1.11%
Capital Cost	Base Case +10 %	13.3%	1.53	1.21%
	Base Case +5%	14.7%	1.60	1.23%
	Base Case	16.2%	1.68	1.24%
Container Charges	85$	12.8%	1.44*	0.17%
	95 $ for 40 feet (Base Case)	16.2%	1.68	1.24%
	105$	19.5%	1.93	2.15%

*: Less than 1.0 for the first repayment year

9.2 Economic Analysis

1) EIRR Results

EIRR of the base case of the Lach Huyen Port project with Tan Vu-Lach Huyen Highway Project is estimated at 23.9% /annum. The rate exceeds the social discount rate or opportunity cost of capital of 12% in the Vietnam.

Accordingly, it can be concluded that the project is economically feasible.

2) Sensitivity Analysis

In order to examine the feasibility of a project when the given assumptions are changed, the following sensitivity analysis is carried out.

- Project costs increase by 10% and 20%, and
- Project benefits decrease by 10% and 20%

On the results of sensitivity analysis, Lach Huyen Port project can be concluded that the projects are economically feasible, even if the project cost is increased 20% and at same time, the benefits are decreased by 20% from the base case. (See Table 9.2)

Table 9.2 Sensitivity Analysis of EIRR for Medium-tem Development Project in 2020 (5 Container Terminals and 3 Multi Purpose Terminals)

		Benefits		
		Base case	10% down	20% down
Project Cost	Base case	23.9%	21.9%	19.7%
	10% up	21.9%	20.1%	18.1%
	20% up	19.7%	18.6%	16.6%

3) EIRR for Short-term Development Project (2 Container Terminals)

For reference, based on following components, the short-term development project (2 container terminals) is also considered for analyzing of EIRR.

The benefit concept of "With" and "Without" cases are same condition as economic analysis for medium term project. The cargo handling capacities of 2 container terminals are assumed 890,000TEU per year. And the period of calculation for the economic analysis (project life) is assumed to be 30 years (2015-2046) after the completion of short-term port development project implementation.

EIRR for the Short-term Project (2 Container Terminals) is estimated at 14.3%/annum. Therefore, the project is economically feasible for both short-term and medium-term development project

Table 9.3 Sensitivity Analysis of EIRR for Short-term Development Project (2 Container Terminals)

		Benefits		
		Base case	10% down	20% down
Project Cost	Base case	14.3%	12.8%	11.1%
	10% up	12.8%	11.4%	9.9%
	20% up	11.1%	10.3%	8.8%

10. Port Management Unit (PMU)

It is strongly advisable to enhance and improve port management capability that is essential for accomplishing a sustainable development of Lach Huyen Port .In dealing with a lack of effective port management system in the current administrative framework and looking for great growth opportunities of the Lack Huyen port, a Port Management Unit (PMU) which will bear broader responsibilities and duties over port operations is recommended to be set up under the supervision of VINAMARINE.

11. Detailed Design Stage

In addition to ordinary scope of Detailed Design, following issues are recommended to be studied and surveyed.

11.1 Dredged Material Dumping Site

At present the dumping site for dredged material is planned in South Dinh Vu area because this area is nearest candidate site among the dumping sites already approved by Hai Phong P.C. in EIA report. However this dumping site requires constructing a temporary dyke which is very costly and the dumped soil land shall be improved with huge cost before using there for IZ development since the dredged material is not suitable for reclamation.

Comparing with south Dinh Vu site, the future expansion site of Lach Huyen Port or Lach Huyen offshore area will be better candidate sites from the viewpoint of saving dredging cost. Therefore, it is recommendable to conduct EIA study for these sites and getting approval from authorities concerned before bidding for selection of dredging contractor.

11.2 Ship Maneuvering Simulation

This Lach Huyen Channel is one way, width of 160m with sand protection dyke and 210m without sand protection dyke and length of approx. 18 km. For the partial loaded 100,000DWT container vessel, the navigation in this channel is not easy when marine conditions and climate conditions are not favorable. In order to know the limit natural conditions and suitable tug assistance, therefore, the ship maneuvering simulation is recommended to be conducted during detailed design stage.

12. Construction Stage

12.1 Maintenance Dredging Plan

In order to establish a reliable maintenance dredging plan, check surveys on actual sedimentation phenomena and marine conditions should be carried out at every three (3) months during capital dredging period and mathematical sedimentation analysis should be conducted by the Consultant.

13. Operation Stage

13.1 Operation and Efficiency Indicators

In order to evaluate the efficient utilization of the facilities constructed in this ODA Project, following operation and efficiency indicators should be checked in 2017, after 2 years from the commencement of Lach Huyen Port operation.

Table 13.1 Performance Guidelines

	Measuring Item	Guideline
1	Berth Occupancy Rate	30%
2	Container Dwell Time	6 Days
3	Throughput	500,000TEU in 2016 750,000TEU in 2020
4	Maximum DWT of Vessels Docked at Berth One and Two	More than 50,000DWT vessels

14. Natural and Social Environment Consideration

14.1 Natural Environment

1) Baseline Environmental Condition Surveys in Preparation Stage of the Project

The baseline environmental surveys done at the project site and its surroundings are regarded as adequate as the minimum requirement for the purpose of the approved EIA Report (2008). Still the

important limitation of the survey is that it was done only once (in May 2006) and hence cannot be regarded as fully representative to account for seasonal variation. Accordingly, during the detailed engineering stage ecosystem surveys with at-least 2 times of sampling as appropriate to account for the 2 predominant dry and rainy seasons is recommended.

2) Significant Aspects of Construction Stage of the Project

The construction contractor shall fully comply with EHS (environment, health and safety) aspects concerned to the execution of construction works with strictly adhering the concept of "Safety First". The contractor shall ensure all natural resources required for the construction of port such as sand, soil and stones are procured from legally certified suppliers. Moreover, the contractor shall be obligated to use the service of an independent reputed organization to conduct regular periodical environmental monitoring of the construction site and its vicinity that would cover ambient environment of on-land area (Cat Hai Island) and coastal water environment (Lach Huyen Estuary).

3) Significant aspects of operation stage of the project

The port shall be equipped with operational waste reception, treatment and disposal facilities as appropriate to manage all wastes generated both due direct port operation and wastes disposed by ships and vessels. Moreover, an emergency management system to effectively deal with potential emergency situation like accidents, fires and oil spills shall be in place with capability to activation at short notice. Port operational agency shall be obligated to conduct regular periodical environmental monitoring with priority focus on the estuarine coastal water environment.

14.2 Social Environment

1) Significant Aspects of Preparation Stage of the Project

Land acquisition and safeguard policy for coastal fishing activities are two primary social impacts to be addressed. The project requires acquiring clearance of some aquaculture ponds, which requires support for the livelihood recovery of the affected people. As there are some gap between JBIC Guideline/WB OP 4.12 and Vietnamese safeguard policy, it is recommendable to refer the resettlement policy framework (RPF) of "Northern Delta Transport Development Project", which is ongoing project by MOT supported by the World Bank.

The safeguard policy should cover the safeguard measures for potentially affected coastal fishermen. It is not necessary to compensate by money but support for livelihood recovery or vocational training for job transfer.

2) Significant Aspects of Construction Stage of the Project

Considering the labor safety, proper training and management is essential. As the responsible agency for the project implementation, MPMU2 shall include the supervisory mechanism to ensure the contractor's EHS training and enforcement on the ground in the EMP.

As for the control of the transmittable diseases, proper supervision and collaboration with contractors for the health care training are recommendable.

In order to maintain the affordability of goods for the local communities, it is recommendable to monitor the price indexes and affordability/income level of the local communities. Such monitoring result shall be shared among MPMU2 and local authorities to consider necessary measures if it is necessary.

Due to no requirement for the residential resettlement, follow-up for livelihood support should be focused. Although MPMU2 is not responsible for the implementation of the safeguard policy, it is

recommendable to include a mechanism to check the appropriate implementation of such policy in EMP.

In order to monitor unexpected negative impacts on fishing communities, it is recommendable to conduct periodical sample survey including the fish yield and income level of the project affected fishermen. In the case of necessity to improve the safeguard policy for the coastal fishing, MPMU2 shall coordinate responsible authorities to improve the modified policy.

3) Significant aspects of operation stage of the project

As a part of environmental management plan (EMP) and responsibility of the implementation agency, MPMU2 shall supervise VINALINE and other private operators to ensure the EMP including the proper implementation and follow-up of the safe guard policies.

1. Background and Objective of the Study

In the northern region of Viet Nam, maritime cargo traffic volume is likely to increase to 56 million tons in the year 2010, and to 110 – 130 million tons in the year 2020. These figures will exceed the cargo handling capacity of both Hai Phong and Cai Lan ports (total capacity of 75 million tons) located in the northern region. There is an urgent need to boost the cargo handling capacity of ports located in the northern region of Viet Nam.

Facing this situation, the Government of Socialist Republic of Viet Nam (hereinafter referred to as "GOV") directed Transport Engineering Design Incorporated (hereinafter referred to as "TEDI") to make a feasibility study on Lach Huyen Port Infrastructure Construction Project (hereinafter referred to as "the Project") located in the northern region of Viet Nam. Based on the result of the feasibility study, GOV has requested the Government of Japan (hereinafter referred to as "GOJ") to provide yen loan to the Project in order to enforce the development plan proposed in its feasibility study stage. In accordance with this request, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a mission on the Project (hereinafter referred to as "the JICA Mission") to Viet Nam from July 20 to 23, 2009 in order to develop scope and implementing arrangements of a further survey which will review the currently available data and conduct supplementary study to facilitate formation of the Project (hereinafter referred to as "the Preparatory Survey"). Based on this preliminary survey, the scope and implementing arrangements of the Preparatory Survey were settled and signed by JICA, Ministry of Transports and Vietnam National Shipping Lines (hereinafter referred to as "VINALINES").

The principal objectives of the Preparatory Survey are to examine the existing feasibility study on port development plans including the Hai Phong – Lach Huyen International Gateway Port development plan from a technical and a financial as well as a natural and social environmental standpoint, and refine the implementation plan of the future development plan of Lach Huyen Port Infrastructure Construction Project.

2. Socio – Economic Background Information

2.1 Population

According to the preliminary results of census April 1, 2009, the population of Vietnam is estimated as 85,789,573. Furthermore, according to the National Committee for Population and Family Planning (NCPFP), it is estimated that the annual population growth rate for the period from 2010 through 2020 is 1.3%. With this growth rate, the populations are estimated as 92.9 million in 2015, 99.3 million in 2020.

2.2 Economic Indices

Actual GDPs of Viet Nam, Asian countries and USA since 2000 and their forecasts by IMF are shown in Figure 2.1. From 2004 to 2007, annual GDP growth rate in Viet Nam rose to over 8%, and then slowed down to 6.2% in 2008. Figure 2.1 clearly indicates the impact of global financial crisis on each country's GDP in the years of 2008 and 2009. After 2009, the GDPs growth rates are estimated to recover from the year 2010.

In the international donor agency's forecast, only Viet Nam, China, India and Indonesia is estimated more than 4% of GDP growth rate in 2009. Ministry of Planning and Investment (MPI) in Viet Nam is assumed for GDP growth rate in 2010-2020 as 6.5% for sustainable growth of GDP and 7.5% for high level of GDP.

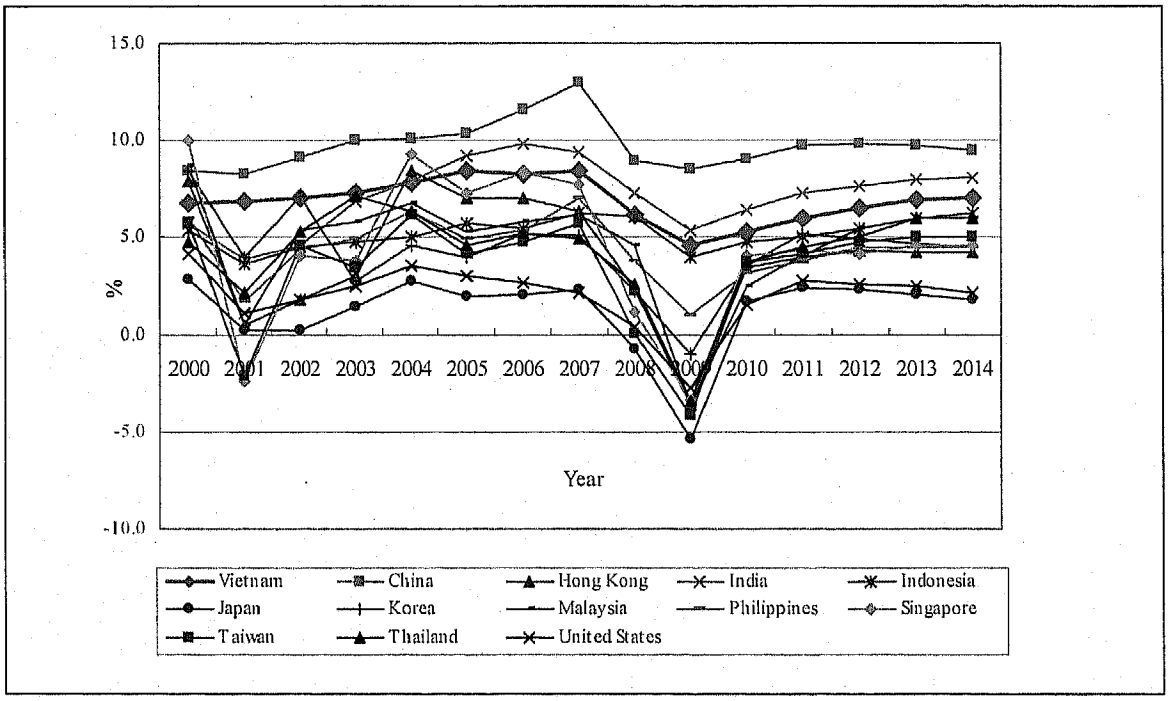


Figure 2.1 Actual GDP Growth Rates and IMF's Forecast in Vietnam, Asian Countries/USA

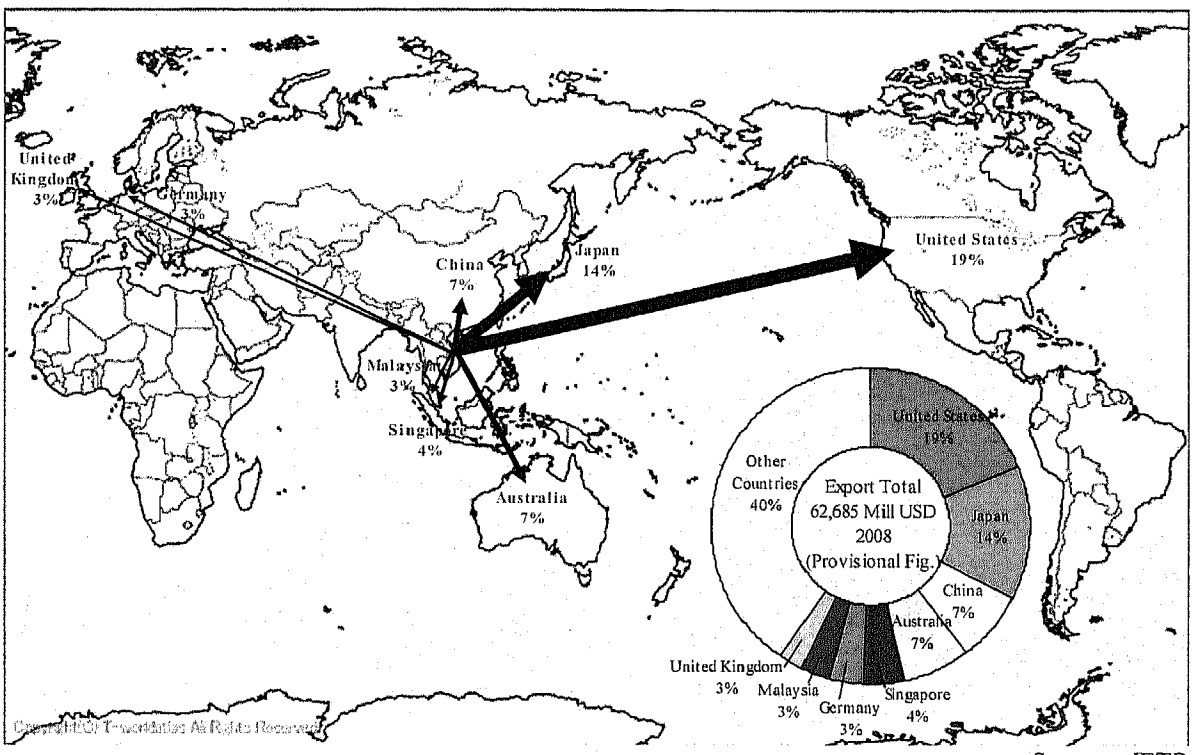
2.3 Distribution of Goods and Ocean Shipping

2.3.1 Trade in Viet Nam

Vietnam has demonstrated its strong commitment to trade liberalization in recent years. It has joined the WTO in 2007 and signed Free Trade Agreements (FTAs) with ASEAN countries and the USA. Vietnam also has a cooperation agreement with the EU. In 2008, exports are mainly made up of crude oil, apparel/clothing and shoes, whereas imports are mainly made up of machinery, refined oil and

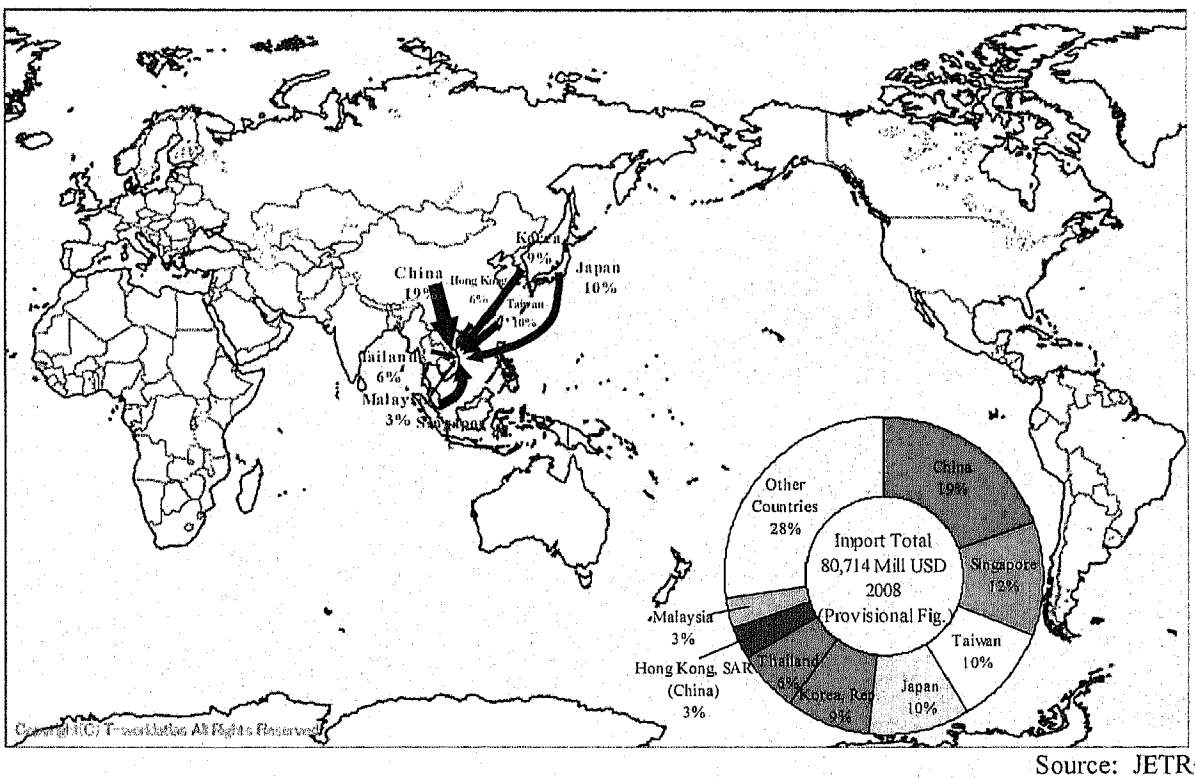
steel.

The main export customers of Vietnam are the USA, Japan, Australia and China. For imports, the country's main partners are China, Singapore, Taiwan, Japan, South Korea and Thailand. (See Figure 2.2 and Figure 2.3 Trade Partner Country of Import and Export in 2008)



Source: JETRO

Figure 2.2 Trade Partner Country of Export in 2008

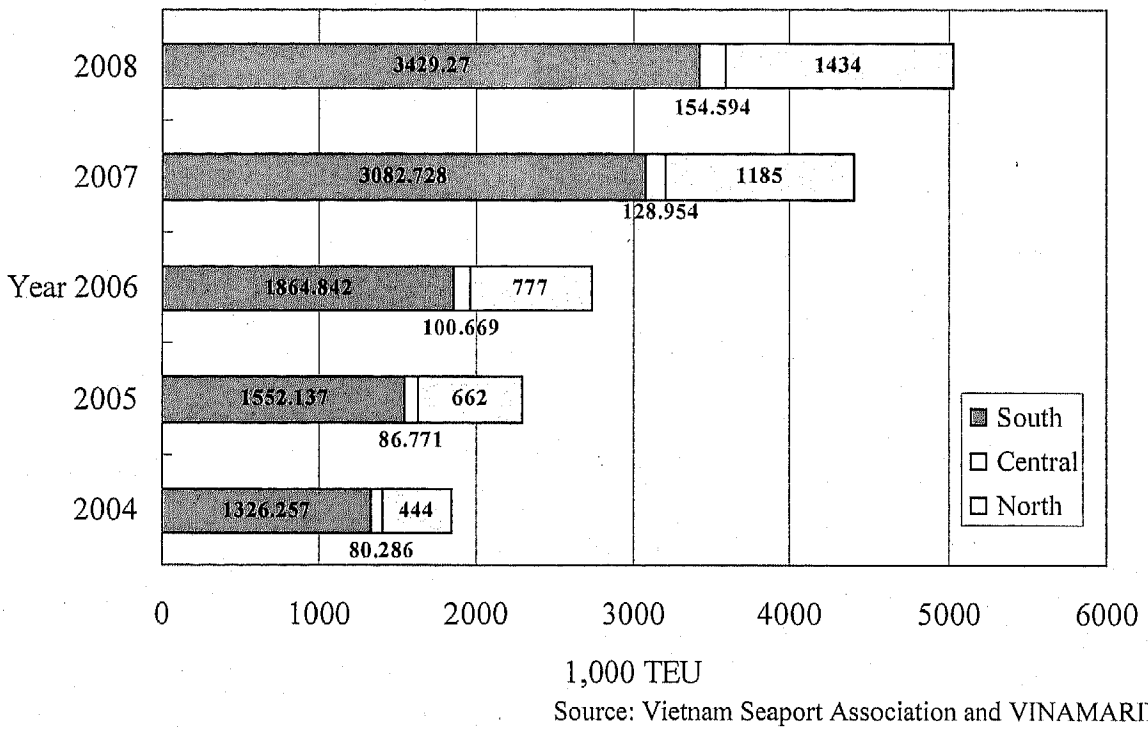


Source: JETRO

Figure 2.3 Trade Partner Country of Import in 2008

2.3.2 Rapid Growth of Container Movement in Viet Nam's Sea Ports

In 2008, Viet Nam's seaport handled 5,018,000 TEU, 2.7 times of 1,851,000 TEU in 2004. Especially, Northern Vet Nam's sea ports handled 1,434,000 TEU, 3.2 times of 444,000 TEU in 2004 (Figure 2.4).



Source: Vietnam Seaport Association and VINAMARINE

Figure 2.4 Rapid Growth of Container Movement in Viet Nam's Sea Ports

3. Present Situation of Ports

There are two big port groups in the North of Vietnam, namely Hai Phong and Quang Ninh with national general ports of Hai Phong and Cai Lan and many local ports and dedicated ports. Total throughput in Hai Phong and Cai Lan ports in 2000 was 9.2 million tons and had strongly grown every year and reached to 29.8 million tons in 2008. However, seaport sales have not been facilitated because Hai Phong Port is located deep inside riverbank with a limited channel depth to the ports, and the industrial zone development and logistic facilities have not been developed yet synchronously in Cai Lan Port. There is no international gateway seaport in the region and big vessels are obliged to reduce load and transfer a part of cargo by barges before entering into the port.

4. Past Port Development Plans in Northern Viet Nam

In the past, following port development plans were studied in Northern Viet Nam:

(1) Urgent Rehabilitation Plan of Hai Phong Port Master Plan Study (JICA, 1993)

(2) Hai Phong Port Rehabilitation Project Phase I (JICA, 1995/6)

(3) General Study of Access Channel to Hai Phong Port (Haecon, 1995/6)

(4) Access Channel to the Ports in Hai Phong Area (MOT/TEDI, 1997)

(5) Cai Lan port Expansion Project (JICA, 1998)

(6) Feasibility Study of Hai Phong Rehabilitation Project Phase II (MOT/TEDI, 1998)

(7) Master Plan of Northern Seaport Group 1 till year 2010 and orientation to 2020 (VINAMARINE, 1999)

(8) Construction Investment Project of Hai Phong - Lach Huyen Gateway Port (VINAMARINE/TEDI, 2007)

5. Demand Forecast

The method of the demand forecast is conducted by Macro forecast for whole cargo and Micro forecast for commodity-wise cargo in the Northern Vietnam Ports. And the cargo demand Lach Huyen port is analyzed as overflowed cargo based on the cargo handling capacity of the existing Northern Vietnam Ports including their future expansion.

The basic considerations of allocation of cargo among Haiphong port, Cai Lan port and Lach Huyen port are as follows:

(1) All container terminals in the existing ports are still very new constructed only 6 to 7 years ago and new four (4) container berths in Dinh Vu port will open soon and No.2 to No.4 container berths in Cai Lan port are determined to be completed within a few years. From national economic view point these facilities should be utilized effectively as much as possible.

(2) This Hai Phong International Gateway Port Development Project is planned to be implemented by Public Private Partnership (PPP). In PPP the public sector should provide incentives to private sector and should not interfere business activities of private sector as much as possible. Therefore, actual cargo volume to be handled at each port should be left for their free marketing efforts.

(3) When Lach Huyen port is opened and left for free competition among three ports, it will be highly provable that most cargoes will shift from the existing ports to Lach Huyen port, since all kind of vessels from small size to large size can enter at any tidal conditions with shortest distance from ocean route.

From above considerations, SAPROF team propose to allocate to Lach Huyen port the cargo which exceed the capacity of existing ports and the cargo equivalent to 10% of the existing ports capacity which will shift from the existing ports at 2015 and it will increase up to 20% by 2020 for development planning of Lach Huyen port.

Consequently, the allocation of cargo volumes among the three (3) ports will become as follows:

Table 5.1 Allocation of Cargo among Three Ports

Cargo Type	Unit	Haiphong port		Cai Lan port		Lach Huyen port	
		2015	2020	2015	2020	2015	2020
High Growth Case							
Container	000 ton	27,290	24,258	8,940	7,946	10,182	34,937
	000 TEU	2,352	2,091	771	685	878	3,012
GC + Bulk	000 ton	9,339	7,927	2,536	2,153	0	3,853
Total	000 ton	**36,629**	**32,185**	**11,476**	**10,099**	**10,182**	**38,790**
Middle Growth Case							
Container	000 ton	27,269	24,240	8,933	7,940	5,394	26,691
	000 TEU	2,352	2,091	771	685	463	2,299
GC + Bulk	000 ton	8,808	7,927	2,392	2,153	0	2,834
Total	000 ton	**36,077**	**32,167**	**11,325**	**10,093**	**5,394**	**29,525**
Low Growth Case							
Container	000 ton	24,935	24,240	8,168	7,940	3,678	18,421
	000 TEU	2,150	2,091	704	685	317	1,586
GC + Bulk	000 ton	8,276	7,484	2,248	2,032	0	2,379
Total	000 ton	**33,211**	**31,723**	**10,416**	**9,973**	**3,678**	**20,800**

The demand forecast of Northern Ports, cargo handling capacities of Hai Phong and Cai Lan Port and required of cargo handling capacity of Lach Huyen Port are described in the Figure 5.1.

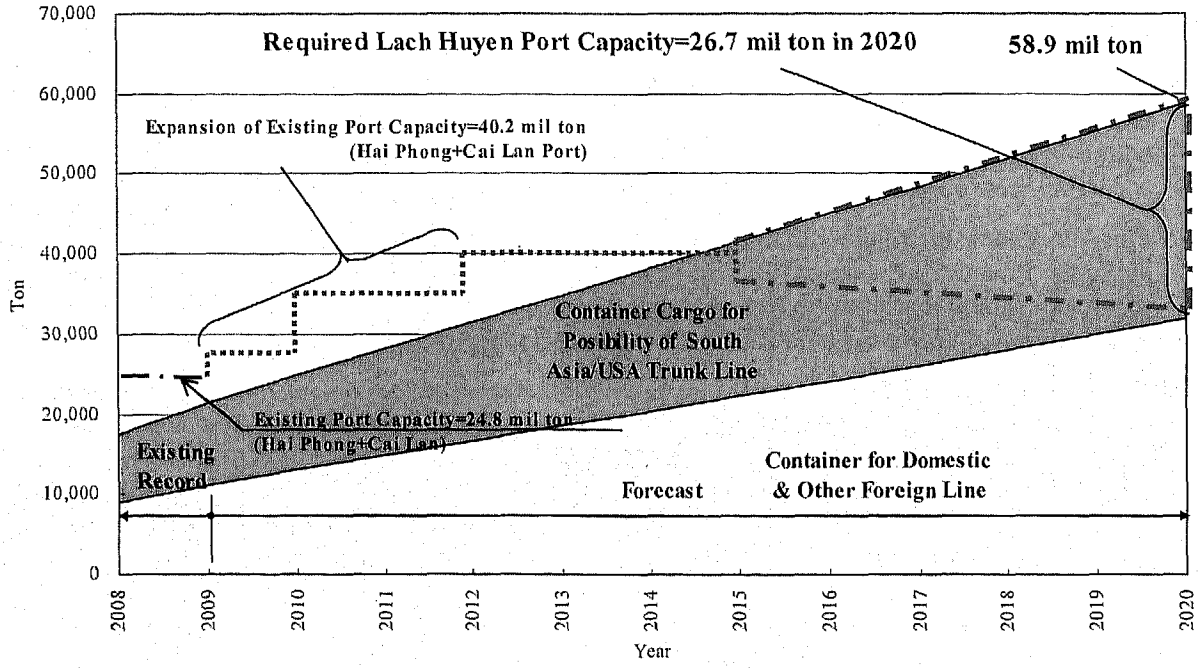


Figure 5.1 Demand Forecast of Northern ports in the Viet Nam and Lach Huyen Port (Middle Growth Case)

Yearly cargo volume of Lach Huyen port is forecast as shown in Table 5.2.

Table 5.2 Forecast Cargo Volume of Lach Huyen Port

Cargo	Unit	2015	2016	2017	2018	2019	2020
High Growth Case							
Container	000 ton	10,182	15,077	20,000	24,951	29,930	34,937
	000 TEU	878	4,300	1,724	2,151	2,580	3,012
GC + Bulk	000 ton	-	-	1,947	2,610	3,246	3,853
Total	000 ton	**10,182**	**15,077**	**21,947**	**27,561**	**33,176**	**38,790**
Middle Growth Case							
Container	000 ton	5,394	9,607	13,843	18,102	22,385	26,691
	000 TEU	463	826	1,191	1,559	1,928	2,299
GC + Bulk	000 ton	-	-	1,119	1,714	2,286	2,834
Total	000 ton	**5,394**	**9,607**	**14,962**	**19,817**	**24,671**	**29,525**
Low Growth Case							
Container	000 ton	3,678	4,741	7,660	11,228	14,815	18,421
	000 TEU	317	409	658	966	1,275	1,586
GC + Bulk	000 ton	-	-	1,102	1,610	2,098	2,379
Total	000 ton	**3,678**	**4,741**	**8,762**	**12,838**	**16,914**	**20,800**

Consequently, cargo volume of Middle Growth case of Lach Huyen Port is estimated 3,156,000 TEU for container and 3,181,000 tons for general cargo and bulk cargo in 2020.

6. Necessity of the Project

6.1 Increase of Sea Borne Traffic Volume

In recent years the sea borne traffic volume in Northern Vietnam has been showing rapid increase. The general cargo volume excluding oil, coal, cement and clinker which are handled at dedicated ports was 25.3 million tons in total and of which container were 1.43 million TEUs in 2008. Its average growth rate during last 5 years was 19% per annum for total cargo volume and 29% per annum by TEU basis. These cargoes are forecasted to be 72 million tons and 5.1 million TEUs in 2020 respectively.

While, the total handling capacity including the provable expansion capacity of the existing ports are assessed at 53 million tons in which container cargo volume will be 40 million tons or 3.5 million TEUs and container cargo will be saturated in 2015 and non-container cargo 2017.

Since the port is a vital nation's infrastructure that contributes to the growth of Vietnamese economy, it should therefore be avoided that the port is saturated with the cargoes and can not provide any more services to the customers to the extent that would cause jeopardizing the nation's economy.

To cope with this situation, well before the critical moment comes to the reality, the development of sufficient capacity of additional port is inevitable to absorb the spill-over cargoes from the ports of Hai Phong and Cai Lan.

6.2 Global Container Shipping Trend

What to be considered when developing a new port is the trend of global shipping market. The sharp increase in world container traffic throughout the decades wielded influence on many fields. The shipping industries sought to increase the scale of their service capacities by forming strategic consortium, acquiring other shipping lines, and throwing many large sized vessels in the market. At the same time, these major shipping companies, as well as some of the ship financiers, have been continuing to order larger sized vessels to comply with growing customers' needs and seeking the economies of scale.

From the geographic condition of Hai Phong Port, there is a high possibility that if deep-sea port is developed, the mother container vessels (4,000TEU – 8,000TEU) now plying in the Trans-Pacific trunk route between Hong Kong, Kaohsiung, etc and the north coast of USA will extend their service range up to Hai Phong Port. However, regarding the container vessels now plying Asia-Europe trunk route will not call Hai Phong Port in foreseeable future, since deviation time from trunk route is big, and the cargoes to/from Europe will be transshipped traditionally at Singapore, Tanjung Pelepas, etc., for the time being. However, for this feeder services, it is apparent that medium size mother ships (2,000TEU to 4,000TEU) currently deployed in the trunk routes are most likely to be cascaded down to the feeder routes. A necessity and rationale to construct a deep sea port is that the port must be ready to accommodate such redeployed larger and deep draft ships into the feeder routes.

Therefore, to cope with the rapidly increasing sea borne traffic demand and global trends of ship size of container vessels, it is necessary to develop another port which can accommodate 50,000DWT to 100,00DWT (4,000TEU – 8,000TEU).

6.3 Vietnam Seaport System Development Master Plan

VINAMARINE has prepared the Master Plan of Vietnam Seaport System Development until 2020 toward to 2030, which was approved by the Prime Minister on December 24, 2009. In this master plan, the Hai Phong Port is designated to develop as an International Gateway Port, national general hub port of the North.

Lach Huyen Terminal is the main terminal of Hai Phong Port, mainly used for import-export container vessel of 4,000 TEU to 6,000 TEU and 50,000 DWT to 80,000 DWT, operated in far navigation transportation routes. Port infrastructures and cargo handling technology will be developed as synchronous and modern system at international level.

Hai Phong international gateway port should sufficiently meet the market demand of volume of cargo and size of in/out vessel, ensuring the competitiveness in international market and regional market. At the same time to be the driving force for development of industrial, economical and urban zones of coastal areas. To develop container and other cargo receiving and forwarding centers in industrial and services zone behind the berths for maximum use of port capacity and regional public transport networks.

This Vietnam Seaport Development Master Plan is one of the important rationales for the development of Lach Huyen Port.

7. Natural Conditions

7.1 General

During the Work in Vietnam, data and project-related information on the natural conditions in and around Lach Huyen new international gateway port area were collected from both governmental and non-governmental sources of agencies. The data and information collected on the natural conditions will be used to determine the basis for port planning, preliminary design of port facilities, environmental impact study, etc., in order to formulate the medium term development plan or implementation plan as Japan's ODA Loan Project together with design, construction plan and cost estimate for various proposed port facilities.

In addition, a series of site surveys such as bathymetric survey in new port area, subsoil investigation at reclamation area and along breakwater/training dyke, seabed material survey, current and tide survey, were carried out during the 1st Work in Vietnam from October 2009 to January 2010.

7.2 Outline of Natural Conditions

Topography	The proposed Project Site is located along the east edge of the Bay of Haiphong on the south of Cat Hai Island. The proposed site area is well sheltered by Cat Ba Island from the intruding northerly and easterly waves generated in the Gulf of Tonkin.
Bathymetry	The Bay bathymetry has being developed by the effects of the estuaries of such major rivers to follow into the bay as the Lach Huyen River, Cam river, Bach Dang river and Chanh river. The site mostly lies at tidal flats of the Haiphong Bay. The bathymetry of Haiphong Bay is gradually sloped in an average slope of 0.04 to 0.08% to the directions of south-southeast. The sand bars and littoral dunes have been developed along the river estuaries, and appear at the low tide. The Project site for reclamation locates at the sand bars developed along the west bank of Lach Huyen river estuary and the water depth varies from CD+2.0 to ±0.0 m and gradually deepens to southeast direction.
Meteorological Feature	
Temperature	Highest temperature; 38.0°C (in October), Lowest temperature; 3.7°C (in December) Yearly mean temperature; 24.1°C (Source: EIA Report, Ministry of Transportation, 2008)
Humidity	The Humidity is very high at the project site area. The area experiences normally about 75 to 90 % all the year around. Yearly average humidity is 83.1% (Ditto)
Rainfall	The average rainfall at Cat Hai area is about 1,600 and 200 mm/year in the rainy season (May to October) and the dry season (November to April) respectively, and 1,800 mm/year through a year. (Ditto)
Fog	Fog occurrence concentrates in winter season from December to April. The frequency of foggy day is 21.2 days annum and 6.5 days in peak month of March. In the month from January to April, fog with visibility of less than 1 km (Grade 0-3) occurs in an average of about 0.4 days per month while foggy day with visibility of less than 10 km (Grade 0- 6) occurs 4.3 days per month. (Source: Report on Port Capacity Reinforcement Plan in Northern Viet Nam, Nippon Koei Co., LTD and Associates, 2009)
Winds	The climate in Northern Vietnam and the adjacent area is relatively calm except for stormy season which usually starts in June and finishes in November. The wind in Viet Nam is normally governed by the prevailing seasonable climate character. The prevailing wind direction is north to northeast due to the northeast monsoon climate in dry season (September to February) while south to southeast wind due to southwest monsoon climate in rainy season (March to July). (Ditto)
Seismic Conditions	The regional earthquake activities in and around Vietnam are deemed to be quite negligible.
Oceanographic Feature	
Tides	HWL: CD +3.55 m, MHWL: CD +3.05 m, MWL: CD +1.95 m, MLWL: CD+0.91 m, LWL: CD +0.43 m. * CD referred and equals to Chart Datum. (at Hon Dau Station)
Currents	The current at Lach Huyen estuary is governed semi-diurnal tidal flow. The survey in January 1987 shows that average current speed is 0.3 -0.5 m/s. But due to the effects of wind and wave generated flow, the current becomes the maximum speed of 1.0 to 1.2 m/s at flood as well as ebb tide and may reach to the greatest speed at 1.5 to 1.8 m/s during ebb tides at the river estuaries. Sea chart on Hai Phong to Cam Pha indicates that the tidal stream is 2.6 knot (=1.34 m/s) highest speed 8 hours after high water along Cua Nam Trieu.
Waves	Hon Dau Station records (3-year period from 2006 to 2008) shows the following normal waves which are generated by local winds at the area. The wave height more than 1.0 m occupied 8.59% of occurrence. 60% of waves come from directions from E to S prevailing wave direction is E to S. But high waves seem much prevail from SE and S directions.
Geological Conditions	The Lach Huyen Port Development area is located in the lower reaches of the Red River (Coi River). Large amounts of soil and sand now in from the Nam Trieu River and the Lach Huyen River, resulting in a thick buildup of a soft clay layer. This project area belongs to Cat Hai district, Haiphong city. It is situated on the right of Lach Huyen river. The right bank of the river, beginning from stone jetty in the south of Cat Hai island, is a big sand bar with the length of about 6,000m and the width of 1,000m, its altitude is from 0 to +1.0m.

7.3 Natural Conditions Surveys in this Study

The following surveys have been carried out in this Study to check the existing data and obtain the latest information for reviewing the Feasibility Study Report implemented by TEDI.

Sub Soil Conditions Surveys	
Offshore Boring	10 offshore borings at the first phase reclamation area and along the planned sand prevention groin.
Seabed Material Survey	80 locations in and around the port development area
Hydrographic Surveys	
Bathymetric Survey	420 km long (1km long per section in every 50 m interval, which is perpendicular to navigation channel) (Km 26+000 – Km 47+000)
Tidal Observation	1 location at Ben Got Jetty in Cat Hai Island, Observation for 15 consecutive days
Current Observations	
Current Measurement	4 locations along the navigation channel
Cylinder Sampling	4 locations along the navigation channel
Water Sampling	4 locations along the navigation channel

Soil stratifications at study area have been identified due to the boring investigation results. Soil stratifications identified in this survey area are tabulated in the following Table.

Existing Investigation Result			**Soil Stratification identified in this Study**		
Layer	**Soil Description**	**N-value**	**Layer Name**	**Color**	**N-Value**
Layer-1	Grey small sand mixed clamshell (Sand)	4 – 8 (6)	Layer 1: Loose Sand (SP) - Clayey Sand (SC)	Grey, Light Grey	3 – 10 (6)
Layer-2	Liquid plastic grey clay (Clay)	1 – 5 (3)	Layer 2: Fat Clay with Sand (CH)	Brownish and Yellowish Grey	0 – 8 (2)
Layer-3	Plastic mixed Sand (Sand)	-	Layer 3: Clayey Sand (SC)	Light Grey, Greenish Grey	0 – 17 (6)
Layer-4	Soft plastic clay (Clay)	4 – 8 (6)	Layer 4: Stiff Sandy Lean Clay (CL)	Reddish and Yellowish Brown	2 – 23 (10)
Layer-5	Spotted clay, plastic clay (Clay)	5 – 23 (12)			
Layer-6	Green grey, grey, soft plastic clay (Clay)	4 – 9 (7)	Layer 5: Firm Fat Clay with Sand (CH)	Grey, Yellowish Light Grey	0 – 15 (6)
-	-	-	Layer 6: Stiff - very Stiff Fat Clay with Sand (CH)	Grey	9 – 21 (14)
-	-	-	Layer 7: Stiff – very Stiff Sandy Lean Clay (CL)	Yellowish Grey, Light Grey	9 – 50 (22)
Layer-7	Medium dense, yellow grey sand (Sand)	19 – 25 (22)	Layer 8: Very Dense Sand (SP)	Yellowish Grey, Light Grey	9 – 50 (45)
Layer-8	Clay / strongly to medium strongly weathered silt stone	-	Layer 9: Completely Weathered Silt/Sand Stone	Reddish Brown	>50
Layer 9	Moderately Weathered Silt/Clay Stone	-	Layer 10: Highly – Moderately Weathered Silt/Clay Stone	Reddish Brown	-
Layer 10	Silt/ Clay Stone	-			

* The number in the bracket shows the average value.

8. Sedimentation Simulation

8.1 Sedimentation in Lach Huyen Channel

Sedimentation in Lach Huyen channel, where the channel deepening by 14 m is planned, is discussed in this chapter. For appropriate prediction, at first, characteristics of sedimentation on the present situation were analyzed by using 7 sets of bathymetric survey data as shown in Figure 8.1. In addition, characteristics of sediment in and around the channel were examined by the results of sediment sampling survey. The results indicate that 1) the sediment on the bottom of the channel is almost mud, 2) the sedimentation is prevail in the offshore part of the channel, and 3) the speed of sedimentation decreases with time elapsed after initial dredging as shown in Figure 8.2.

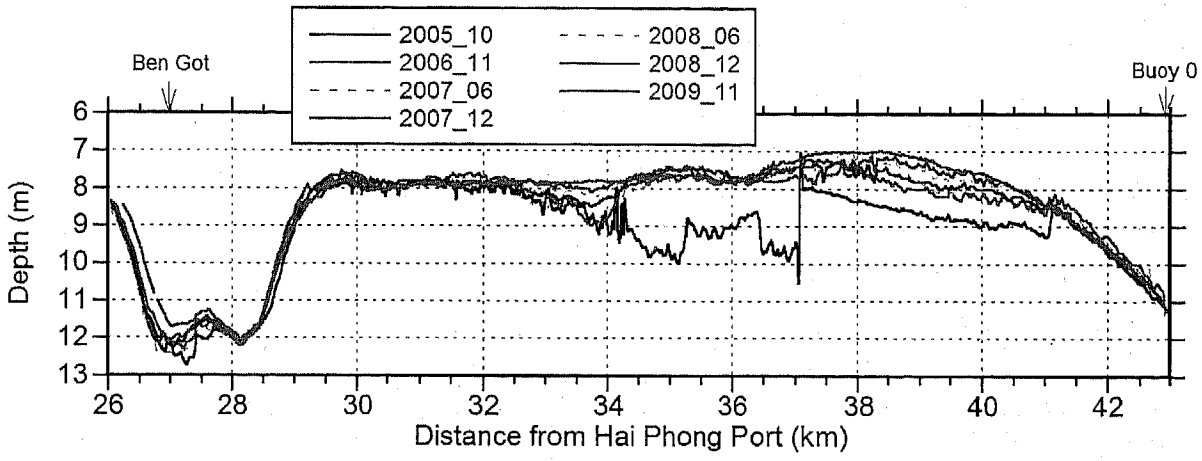


Figure 8.1 Longitudinal Cross-Section along Lach Huyen Channel

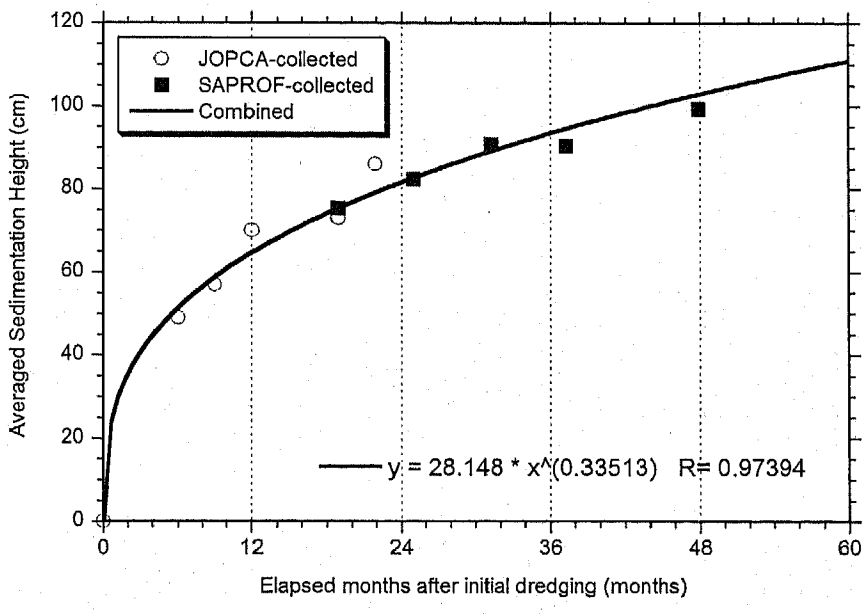


Figure 8.2 Averaged Sedimentation Height with Elapsed Months after Initial Dredging

8.2 Predictions of future sedimentation

Next, numerical simulations have been carried out to predict future sedimentation on the deepened channel. Simulations were made by calculating mud transport by waves and tidal currents. On the topography of present situation, which is approximately 8 m in depth, the sedimentation speed along the channel was reproduced by calibration of the models. After the reproduction phase, predictions for

the channel deepened by 14 m were conducted and some arrangements of the sand protection dike to reduce sedimentation were tested. The tested arrangements of the dike are as shown in Figure 8.3 and the simulated sedimentation speed along the channel is shown in Figure 8.4.

The results of simulation are summarized in Table 8.1. In the table, the sedimentation volumes of the first year and those after second year are shown. The first year sedimentation generally tends to be larger than the second year due to effects of excessive dredging and so on. As the simulations were made based on the sedimentation speed after the second year, the values for the first year are estimated by referring to the time-variation of actual sedimentation speed as shown in Figure 8.2. As shown in the table, the sedimentation of case 3, which is the case without any structures, is the highest in all cases. It is about 6 times larger than the sedimentation of present situation (Case 1&2). The cases with dike (case 5, 6, and 7) show a certain decrease of sedimentation comparing to case 3 and 4. The results indicate that

a) The sedimentation will increase by the channel deepening.
b) The sand protection dike is effective in reducing sedimentation because it prevents the suspended mud generated out the channel from flowing into the channel.
c) The effective arrangement of the sand protection dike is that the dike is set as long as possible and as close to the channel as possible. However, the details of length, arrangement, and structure should be determined to minimize the life-cycle cost between initial and maintenance cost.

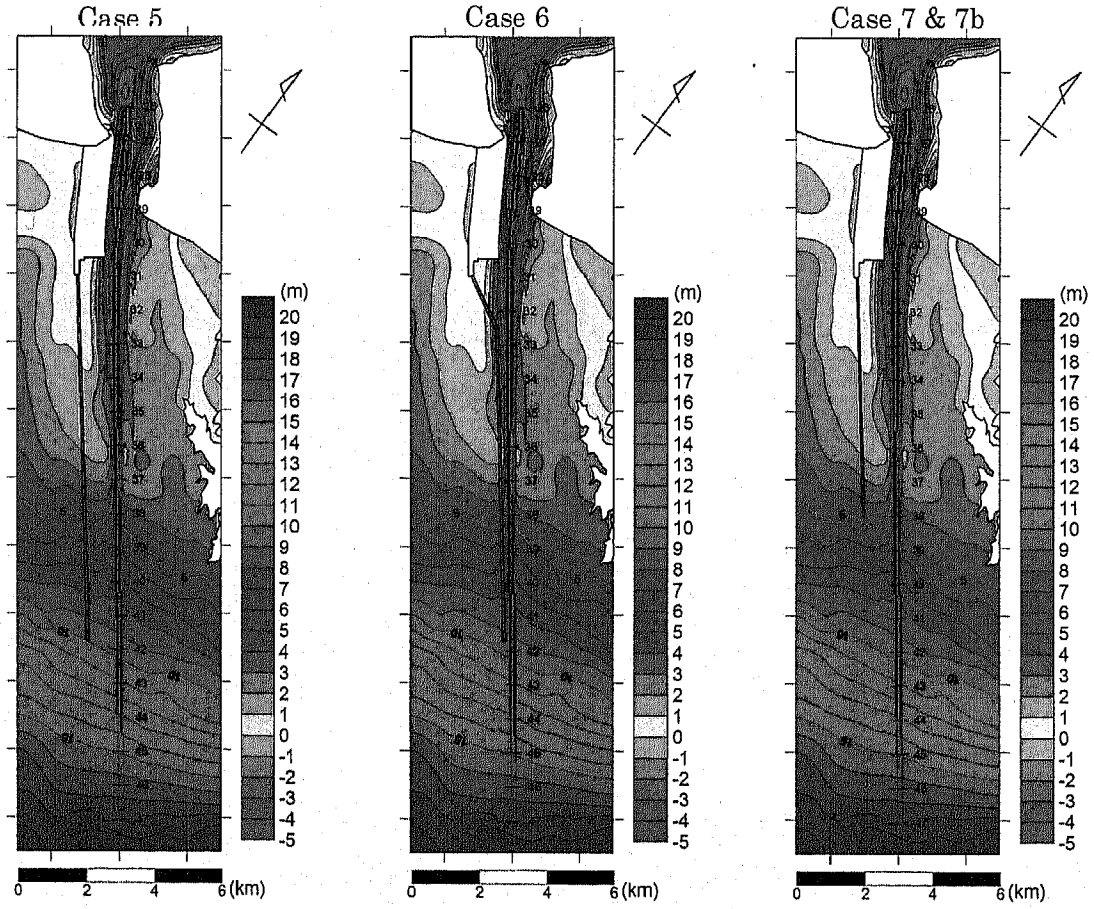


Figure 8.3 Tested arrangements of the sand protection dike

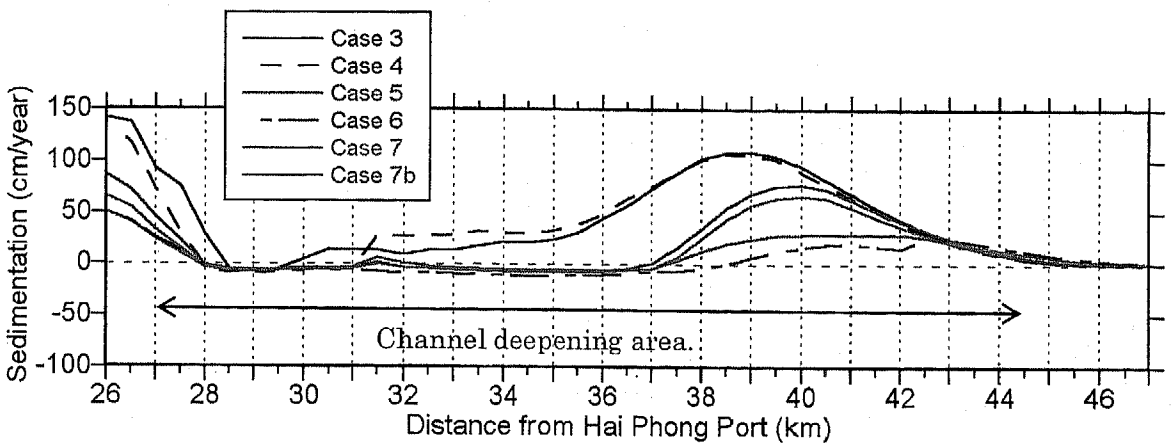


Figure 8.4 Predicted Sedimentation Speed with 14 m in Channel Depth

Table 8.1 Summary of sedimentation

Case	Description	1st year (m^3/y)	After 2nd year(m^3/y)
1&2	8m in depth approximately, Present situation	1,200,000*	260,000
3	14 m, without any structures	6,873,000	1,491,000
4	14 m, with port facilities	6,712,000	1,456,000
5	14m, with port and dike of 10,000m, 1.5km apart from channel	1,678,000	364,000
6	14m,with port and dike of 11,000m, close to channel	1,107,000	240,000
7	14m,with port and dike of 7,000m	2,829,000	614,000
7b	14m, with port and dike of 7,000m (hc=+2m, C.D.)	3,442,000	747,000

*) Estimated by analyzing bathymetric survey data.

The sedimentation volume predicted here is based on the actual sedimentation speed which is analyzed on the bathymetric survey data of Nov. 2006 to Nov. 2009. The term is the second year or later after completion of initial dredging. The sedimentation speed is relatively slow and the depth of the channel is almost maintained in 8 m as shown in Figure 8.1 and Figure 8.2. However, the bathymetric survey data of Oct. 2005 and Nov. 2006 shows the rapid sedimentation in the first year after initial dredging. It is considered that the rapid sedimentation is mainly caused by that the partly deep area on the topography just after initial dredging was refilled rapidly, but the detail mechanism of the rapid sedimentation in the first year has not been clear yet. Therefore, the rapid sedimentation may occur every year if the maintenance dredging is annually carried out. Thus, there is a risk of rapid sedimentation on the planned channel deepening, and therefore continuous monitoring during and after the port construction work are necessary to check and verify the sedimentation rate.

9. Natural and Social Environmental Conditions

9.1 Overall Information and Compliance for the JBIC Environmental and Social Considerations

As a part of Japanese ODA loan procedures, the approved environmental impact assessment (EIA) report*1 and relevant supporting documents were reviewed to complement the EIA reports for the purpose of the verification of JBIC Environmental and Social Consideration (the JBIC Guideline).

*1: Environmental Impact Assessment Report, Lach Huyen gateway port infrastructure construction project, approved by MONRE No.2231/QD-BTNMT, Hanoi 31 Oct. 2008

The fundamentals of the environmental and social consideration are stated in the "Constitution of the Socialist Republic of Vietnam" and specified in "Environmental Protection Law (2005) and Land Law (2003)." Due to the complexity of the issues and continuous changes in reality, relevant regulations have been continuously issued.

In principal, JICA respects the legal framework of the borrower's environmental and social considerations. However in the case of the borrower's legal framework and common practices are significantly different from regional practices or/and internationally acceptable level, JICA may request the responsible ODA recipient(s) to accept the JBIC Guide line level. Due to the recent reorganization of the Japanese ODA agencies in 2008, specifically JICA and former Japan Bank for International Cooperation (JBIC), "Guidelines for Confirmation of Environmental and Social Consideration, 2002 by JBIC" (the JBIC Guideline) is applied for the proposed Lach Huyen Port project.

Considering the compliance of the EIA report of Lach Huyen Gateway Port Construction Project (2010-2015), it principally complies with the JBIC Guideline except the proper consideration for the coastal fishing activities, which is beyond the Vietnamese safeguard policies at this moment. There are few legal frameworks to address such issues under the present Vietnamese laws and regulations. Although MPMU II is not the responsible agency to develop the safeguard policy for coastal fishing activities, as the responsible implementation agency of the project implementation, MPMU II agreed to propose the additional safety guard measures with the consultation with Hai Phong City and Cat Hai district PC by the beginning of May 2010 to meet the JIBC Guide line.

In addition to the consideration for coastal fishing activities, slight gaps between Vietnamese involuntary resettlement policy and the World Bank's involuntary resettlement policy (OP 4.12) is reported by a resettlement action plan of "Tan Vu-Lach Huyen Highway Project" and the ongoing resettlement policy framework of "Northern Delta Transport Development Project" by MOT supported by the World Bank. Considering the applicable policy frameworks for the Lach Huyen port, the resettlement policy framework of the Northern Delta Transport Development Project should be applied due to the consistency of the ODA projects in the same region.

9.2 Natural Environment

Lach Huyen gateway port is planned as offshore extension of the southeastern corner part of the Cat Hai Island belonging to the Cat Hai District of Hai Phong city. Cat Ba Island is located across the Lach Huyen estuary at the opposite side of the planned port location. Most of the western part of both the terrestrial and coastal seawater environment of Cat Ba Island is a well-known protected ecotourism area (Cat Ba National Park/Man and Biosphere reserve of UNESCO). This Lach Huyen Estuary is a part of the access channel for ships and vessels for Hai Phong port. Accordingly the shipping activity with vessel movement along Lach Huyen Estuary and the nearby Cat Ba Island in which most of its western part is a protected area has been coexisting over a long period of time with no apparent adverse effects on the protected national park of Cat Ba Island.

Alternative study on suitable alternative locations for deep-sea port development in the region of northern Vietnam was conducted as component of the Feasibility Study by TEDI F/S and described in Chapter IV of the Report. The alternative study comparatively evaluated 3 alternative locations for the port from economic, environmental and social viewpoints on comprehensive manner, and concluded that Cat Hai as the most appropriate location. The other 2 alternative locations investigated are Cam Pha in Quang Ninh Province and southern part of Do Son also located within Hai Phong City. It is noted that the approved EIA Report (2008) failed to mention the alternative study described in the TEDI F/S.

The baseline environmental surveys done at the project site and its surroundings for the approved EIA Report, considering its vicinity to Cat Ba National Park is regarded as adequate as the minimum requirement. The baseline surveys covered ambient air, coastal water, coastal seabed sediment and

groundwater including coastal water ecological sampling (phytoplankton, zooplankton and seabed benthos) in the planned port water areas. Moreover, the coastal wetland flora located along the western coast of Cat Ba Island (Phu Long area), where significant mangrove vegetation exists, is also included.

The survey results indicated no significant overall environmental quality deterioration in the planned port development area. Moreover, all species identified in the ecological survey are normal species with no rare or endangered ones. Regarding seabed sediment quality this SAPROF study also conducted additional surveys in 80 locations of the proposed dredging area and its vicinity of the port development area and confirmed that the seabed area is not significantly contaminated and in overall sense could be regarded as in natural condition.

Still significant limitation of the baseline environmental survey for the approved EIA Report is that it was done only once (in May 2006) and hence cannot be regarded as fully representative to account for seasonal variation. Accordingly, during the detailed engineering stage ecosystem surveys with at-least 2 times of sampling as appropriate to account for the 2 predominant dry and rainy seasons is recommended to clearly define the baseline environmental condition to facilitate future comparative evaluation with the results of environmental monitoring during the stages of project construction and subsequent operation.

9.3 Social Environment

Due to the physical and economical boundaries within the expected project area for the Lach Huyen port and Tan Vu-Lach Huyen Highway projects, the affected area would be categorized into six (6) zones: (1) Hoan Chau Commune (south west end of the Cat Hai island), (2) Nghia Lo Commune (west end of the Cat Hai island), (3) Van Phong Commune (central and south end of the Cat Hai island), (4) Dong Bai Commune (north east end of the Cat Hai island), (5) Cat Hai TT (the central village and south east end of the Cat Hai island), (6) Phu Long Commune (west end of Cat Ba island and facing the new port berths). Due to the limited access to the Hai Phong city, there are limited opportunities for income generation except traditional labor-intensive work, such as salt making, aquaculture and fish source, one of the most famous products throughout the nation. One of the common issues for the project affected zones is that young people have few chances to come back to Cat Hai or Cat Ba island after the school education. As a result, the communities are very expected about the port and connecting highway project and willing to participate in a part of the regional development.

Considering the legal updates after the approval of the EIA report, there are no updates relevant to the law on environmental protection while there are significant improvement in regulation related to law on land, especially compensation policies for land acquisition and resettlement. However, there are still some gap between the JBIC standards, which refers the World Bank's involuntary resentment policy (WB OP4.12), especially in the condition of eligibility and compensation. As stated in Vietnamese regulation, the donors safeguard policies shall be applied for ODA project when such policies are not acceptable by the donor(s). Thus, the JBIC Guideline/WB OP4.12 is likely to be applied for the proposed Lach Huyen port project.

Considering the impacts on social environment, in general, negative impacts are acceptable level with proper safeguard measures except consideration for coastal fishing activities. Safe guard policy on coastal fishing activities is on the process of development and expected to be implemented before the actual compensation process in detail design stage.

In order to properly understand actual fishing activities, JICA SAPROF experts have consulted additional fishing survey. It is confirmed that there are significant number of fishermen conducting fishing activities in and around the proposed project area. Based on the sample survey at the site, fishermen have neutral opinion for the port development but fear of losing income sources and lack of capacity to adapt new job opportunities.

10. Review on Past Studies of Tan Vu – Lach Huyen Highway

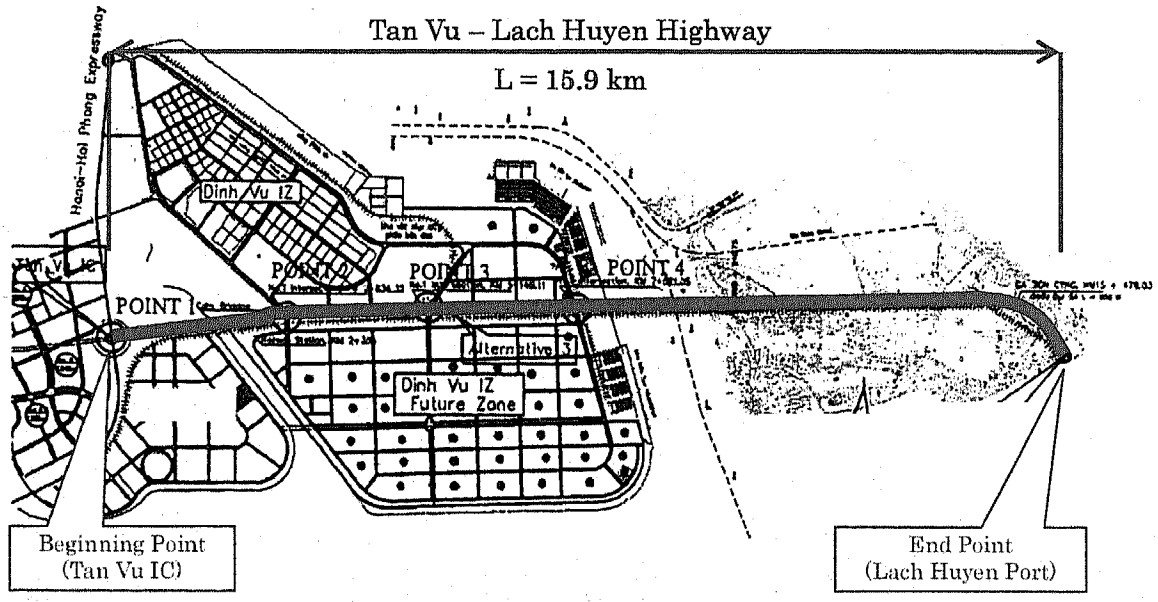
Lach Huyen Port will be constructed in Cat Hai Island, where is located at approximately 16km east of the mainland. In order to connect the mainland and Lach Huyen Port, it is required to construct the new highway (hereinafter referred to as "Tan Vu – Lach Huyen Highway") including the bridge at Nam Trieu River.

To date, 3 studies have been carried out regarding Tan Vu – Lach Huyen Highway. In this SAPROF, their studies will be reviewed, and the consultant's recommendations will be provided as well.

The major objectives for the review are as follows.

- The project should be revised as an ODA project although it has been planned as a BOT project.
- The plan and design should be modified for the purpose of shortening the construction period since Tan Vu – Lach Huyen Highway must be operated at the same time of the Lach Huyen Port operation.

The location map of the Tan Vu – Lach Huyen Highway is shown in Figure 10.1.



Source: Planning Construction Investment Project Tan Vu - Lach Huyen Highway Project in Hai Phong City, VIDIFI, 2009

Figure 10.1 Location Map

Summary of each study item in "VIDIFI's Study" and "MOT's Study" is shown in Table 10.1.

Table 10.1 Summary of Relevant Studies

Item	VIDIFI's Study (July 2009)	MOT's Study (September 2009)
Implementation Schedule	36 months.	30 months.
Traffic Demand Forecast	4-lane in 2016. 6-lane without railway, 4-lane with railway in 2022.	6-lane.
Route Alignment	Follow the Hai Phong City Master Plan.	Not follow the Hai Phong City Master Plan to avoid residential areas.
Connection to Lach Huyen Port	Follow the port location proposed in VINAMARINE's Study.	2 alternatives were proposed.
Consistency with Dinh Vu IZ Master Plan	2 flyovers were planned at intersections.	No intersection, interchange and flyover are planned.
Soft Soil Treatment	Sand drain, with geo-textile and counterweight Soft soil replacement	
Bridge Length	L=5.44 km.	L=1.78 km.
Navigation Clearance	W 100 m × H 12 m × 2 Design vessel is 1000DWT	W 80 m × H 12 m × 2 Design vessel is less than 1000DWT
Bridge Type Main Bridge	PC box girder with V-shaped pier. 1 Box with rib slab. Maximum span length is 150 m.	PC box girder. Separate 2 box. Maximum span length is 90 m.
Approach Bridge	PC Super-Tee Girder. Span length is continuously 40 m.	
Foundation Type Main Bridge	Cast in place concrete pile D 1200.	
Approach Bridge	Cast in place concrete pile D 1200.	
Construction Method	Open cut method with temporary dyke.	Not considered.
Construction Cost	29 billion Japanese Yen	23 billion Japanese Yen
Natural Environment Resettlement	331 houses in Cat Hai.	19 houses in Cat Hai.
Fishery	Small impact to fishery.	Propose additional survey and investigation.
Unexploded bomb	Not considered.	Not considered.
Social Environment	Complete EIA, but not approved by MONRE.	Not considered.

The following studies should be carried out in the further design.

- Traffic Demand Forecast
- Required Number of Traffic Lane
- Route Alignment in Cat-Hai Island
- Connection Point to Lach Huyen Port
- Consistency with Dinh Vu IZ Master Plan
- Soft Soil Treatment Method
- Required Navigation Clearance
- Bridge Length and Span Layout
- Bridge Type and Foundation Type
- Construction Method
- Construction Cost
- Construction Period and Implementation Schedule
- Economic and Financial Analysis
- Update of EIA and RAP

11. Scale of Medium Term Port Development

11.1 Container Terminal

11.1.1 Design Vessels

In TEDI's FS, the design vessels for the container terminals of Medium Term development were fully loaded 50,000DWT container vessels and partial loaded 80,000DWT container vessels. However, SAPROF study would like to propose following design vessels:

- Fully loaded 50,000DWT Container Vessel
  (LOA= 274m, Width= 32.3m, Draft= 12.7m)
- Partial loaded 100,000DWT Container Vessel
  (LOA= 330m, Width= 45.5m, Draft= 11.7m (80%)

11.1.2 Required Number and Dimensions of Berth

Dimensions of container berth for design vessels are 750m in length per 2 berths and 14m in depth below CDL. As explained in Chapter 5, the total container volume to be handled at Lach Huyen Port in 2020 is forecasted at 2.229,000 TEUs. To handle these containers, required number of container berth was calculated as five (5).

11.1.3 Container handling Equipment

Following cargo handling equipment will be required in each container berth.

Table 11.1 Required Main Cargo Handling Equipment

Cargo Handling Equipment		Unit 1 terminal 1 berth	Unit 1 terminal 2 berths	Basic Specification
1	Quay Gantry Crane	4	8	Capacity: 60 tons, Outreach: 56.6m, Rail gauge: 30m, Lift Height: 40.m, Twin 20' type
2	RTG	12	24	Rail spun: 23.47m, Stacking Height: 15.24m (1 over 4), 16 wheels
3	Top Lifter	3	5	Lifting Capacity: 35 tons, with Telescopic Spreader
4	Yard Chassis	30	55	Convertible 40' & 20' with strong steel beam type
5	Yard Tractor-Head	25	50	More than 350 HP
6	Multipurpose Forklift	2	4	Lifting Capacity: 3tons
7	Hoist	1	2	Lifting capacity: 5 tons with 24m outreach
8	Mobile Crane (for barge)	1	2	Lifting Capacity: 40 tons with Outreach 4th row from Quay line available type

11.1.4 Summary of Land Requirement for Container Terminal

Table 11.2 Land Requirement/2 Berths for Container Port Facilities

Description	Area	Dimensions
1. Storage Area inc. Road, Drainage etc.	375,000m^2	750m × 500m
- Dry Container	160,000m^2	-
- Reefer Container	32,000m^2	-
2. Building Area inc. Road, Parking, etc.	75,000m^2	750m × 100m
Total	450,000m^2	750m × 600m

Source: Study Team

11.2 Multi-Purpose Terminal

11.2.1 Design Vessels

In TEDI FS, the general cargo vessels were divided into general cargo vessel and bulker but in SAPROF study both type of vessels are not divided and regarded as a general cargo vessel and terminal is designed as Multi-Purpose Berth since reviewed demand forecast showed that the bulk cargo volume is not big amount.

The design vessel of 50,000DWT general cargo vessel (LOA: 225m, B: 31m, D: 12.0m) is adopted for the multi-purpose berth which is same as that of TEDI FS.

11.2.2 Required Number and Dimensions of Berth

Dimensions of multi-purpose berth for design vessels are 250m in length per berth and 13m in depth below CDL. As explained in Chapter 5, the total general and bulk cargo volume to be handled at Lach Huyen Port in 2020 is forecasted at 2,834,000 tons. To handle these cargoes, required number of multi-purpose berth was calculated as three (3).

11.2.3 General Cargo Handling Equipment

Table 11.3 Required General Cargo Handling Equipment

Equipment	Type	Nos. in demand	Remarks
Quay Crane	Jib type, Rail mounted	40 tons : 1 20 tons : 1	Outreach : 38m Outreach : 20m
Forklift	Finger Type	20 tons : 5 10 tons : 5	 With long mast type
Reach Stacker	Multipurpose, but mainly containers	4	For stuffed & empty Container handling.
Container Trailer	Yard type	10	
Hopper	For light weight cargo		For grain, fertilizer
Belt Conveyor	-" -	(40m × 2) 2 sets	-" -
Hopper	For heavy cargo		For ore loading
Belt Conveyor	-"-	Total 150m, 2 sets	-"-
Dump truck		20	Haulage quay/open yard
Reclaimer		2	For ore loading
Shovel loader		4	For ore loading
Excavator		2	For ore loading

11.2.4 Summary of Land Requirement for Multi-Purpose Terminal

Table 11.4 Land Requirement/Berth for Multipurpose Port Facilities

Description	Area	Dimensions
1. Storage Area inc. Road, Drainage etc.	85,000m^2	250m × 340m
- Transit Sheds	7,000m^2	-
- Open Yards	30,000m^2	-
2. Building Area inc. Road, Parking, etc.	15,000m^2	250m × 60m
Total	100,000m^2	250m × 400m

Source: Study Team

11.3 Access Channel

11.3.1 Number of Lane

In 2020, number and average length of ship calling for Haiphong Port and Lach Huyen Port will be 6,134 calls and 114m, and 1,268 and 239m respectively. One lane channel will be able to accommodate 11,700 ship-calls in a tear and enough for ship-calls at 2020.

11.3.2 Width of Channel

For this access channel, a sand protection dyke will be provided along the channel up to seabed elevation of -5.0m CDL and it will simultaneously function as a breakwater. Therefore, the portion of access channel protected by the sand protection dyke can be designed as so called in PIANC definition an "Inner Channel", however, the portion of access channel without sand protection dyke shall be designed as "Open Channel". Based on the PIANC formula, the width of channel is calculated as 160m for the portion of inner channel and 210m for the portion of open channel.

11.3.3 Depth of Channel

Lach Huyen port is designated as International Gateway Port of Vietnam by "Master Plan for Vietnam Seaport System Development till 2020 orientation to 2030". If container mother vessels shall wait tidal window before entering into Lach Huyen port, it can not be said that this port is international gateway port. In order to accept design vessels at any tidal conditions, the channel depth of 14.0m below CDL is required.

11.3.4 Slope of Dredged Channel

Based on the concept of underwater stability of slopes, the following rules of thumb for side slopes are presented in technical standard of Sea Channel Design Process of MOT.

According to the subsoil boring data, subsurface subsoil along the proposed channel is classified as CLAY. This clay deposit is classified as sandy/silty clay of which consistency is very soft to stiff having N-value in a range of 1 to 15 to the depth of CD-15m. Based on subsoil condition it is proposed that a slope in 1 (V) to 10 (H) is applied for capital dredging work to deepen Lach Huyen access channel to the depth of CD-14m.

Table 11.5 Side Slope of Channel

Soil Type and Soil Condition	Slope Value (m_o)
Clay mud, sandy clay, - strain condition	20 - 30
Clay mud, sandy clay, - fluid-plastic soil	15 - 20
Mud with shell	10 - 15
Plastic mud, sandy clay, dusty clay	7 - 10
Loose sand	7 - 9
Medium compact sand	5 - 7
Compact sand	3 - 5
Shell limestone	4 - 5
Clay and sandy clay, - soft and plastic	3 - 4
Clay and plastic sandy clay	2 - 3
Clay and sandy clay, - plastic and hard	1 - 2

Note: Side slope for channel depth of more than 5m shall be $2m_o$.

(Source: MOT Sea Channel Design Process 1998)

11.3.5 Distance between Quay and Access Channel

In TEDI FS the distance between quay line and edge of channel is taken very wide such as 260m at container berth and 365m at general cargo berth.

Vessel speed in the access channel is usually less than 10 knots and waves caused by the ship navigation are not big. Therefore, it is not adverse influences to the moored vessel at berth if the distance between vessels at berth and running vessel in the channel is kept more than 100m. The wide distance requires large capital dredging and maintenance dredging that is not economical. Therefore, in this design the distance between quay face line and edge of channel is recommended to be **150m**.

11.4 Road and railway behind Terminal

SAPROF study has estimated the road traffic volume as 24,320 trucks/day and 1,200 small cars/day for the container terminals and as 2,180 trucks/day and 600 small cars/day for multi-purpose terminals in 2020. These vehicles require 4 lanes for 2 ways of travelling lanes. In addition to the travelling lanes, 2 lanes of waiting lanes along terminal side are provided and 2.5m wide paved shoulders for motor-bike passage and emergency parking at accident are provided in both directions. Median is planned as 10m in consideration of U-turn of 45 feet container trailer. The total width of port road behind terminal is proposed to be **44m** for Medium Term Development.

The railway construction schedule is not determined yet and the land of 200m wide behind terminal area will be kept for future development.

11.5 Port Protection Facilities

11.5.1 Outer Revetment

Almost once a year, Lach Huyen offshore area is subject to extreme wave attack which is generated by tropical typhoon. Therefore, it is essential that outer peripheral revetment of the reclamation area is protected as Seawall which is properly designed and constructed against to the extreme wave attack with provision of armored protection by wave-dissipating precast concrete units.

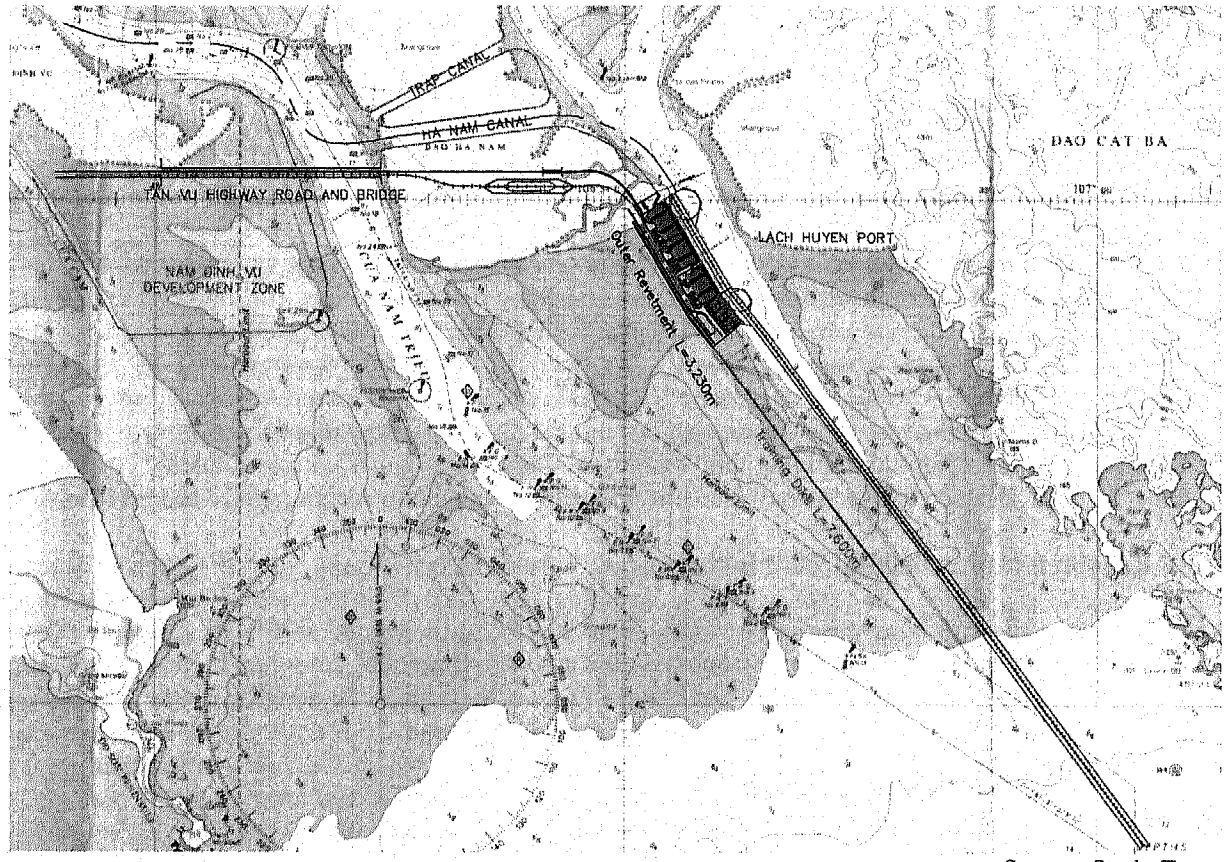
This seawall type of structure is required for 3,230m along the west side of reclamation area including future developing area by the year 2020. But, the south side area of the reclamation is provided with a

sloped revetment armored by relatively smaller size of rocks for a length of around 750m once this water area shall be sheltered by offshore training dyke construction.

11.5.2 Sand Protection Dyke

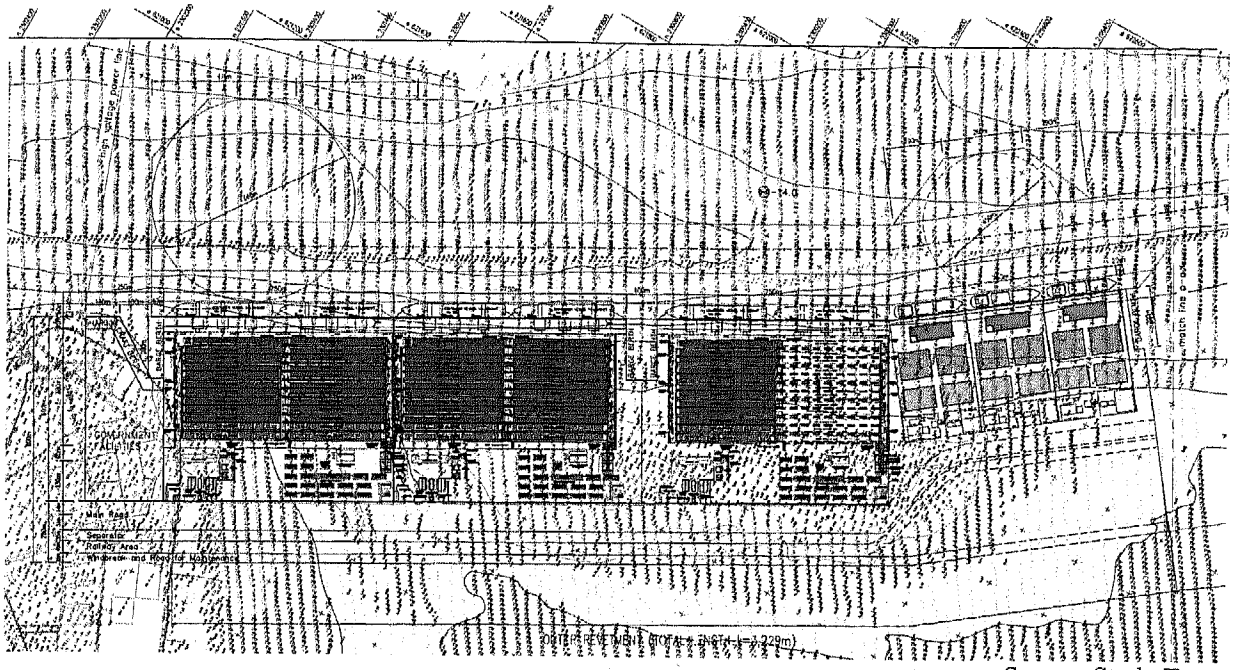
A dyke is provided along the access channel in order to trap sand transportation due to river estuary flow. It is recommended that the dyke is non-permeable type of structure with provision of enough stability against for extreme wave action. The top elevation is positioned to be +2.00m above CDL to trap sand transportation and properly function as breakwater to shelter access channel water area. The training dyke is provided along access channel for a length of around **7,600m**.

Proposed general port layout plan which shows alignment of access channel and port protection facilities is illustrated in Figure 11.1 and Container and Multipurpose terminal alternative layout plans are presented in Figure 11.2 and Figure 11.3.



Source: Study Team

Figure 11.1 Development Layout Plan



Source: Study Team

Figure 11.2 General Layout Plan of Terminal Facilities
(Alternative 1: Barge Berth Basin is arranged)

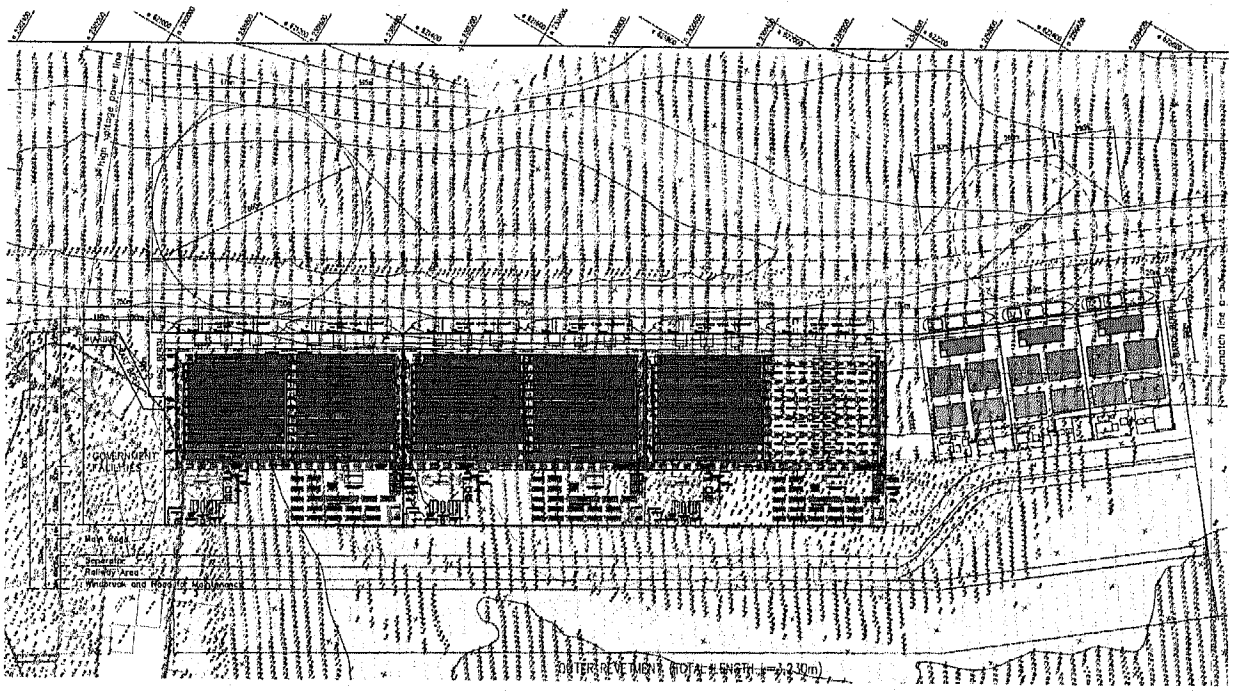


Figure 11.3 General Layout Plan of Terminal Facilities
(Alternative 2: Barge Berth Basin is not arranged)

12. Conceptual Design and Cost Estimate

12.1 Conceptual Design

Table 12.1 Comparison Table of Major Port Facility Design

Faciliy	Item	TEDI F/S	JICA (SAPROF) Study
Access Channel Dredging	Side Slope	1:10	1:10
	Water Depth		-14.0m
	Width		160/210m
Reclamation	Elevation	CD+5.5m	CD+5.5 (to +6.0m)
	Consolidation Settlement	N.A.	S=143cm(U=100%)
	Soil Improvement	SVD 0.6m dia.@2.5m	PVD@1.2m
Outer Revetment (Seawall)	Structure	Sloped Rubble mound with Wave Breaking Work	Outer A:Sloped Rubble mound with Wave Breaking Work
	Armour Stone	6.7t/pc Wave Dissipating Concrete Block	4t/pc Wave Dissipating Concrete Block
	Crown Height	CD+5.5m with Wide Wave Breaking Work(13.7m)or CD+9.0m with Standard Wave	CD+6.5m Retaining Wall
	Soil Improvement	SVD 0.6m dia.@1.6m	PVD@1.2m
Inner Revetment	Structure	L shaped Retaining Wall on Sloped Rubble mound	Sloped Revetment
	Armour Stone	Not Required (Rubble Stone Only)	100-500kg Armour Stone
	Crown Height	CD+5.5m L shaped retaining wall	CD+5.5m(1:3 Gently sloped Revetment)
	Soil Improvement	SVD 0.6m dia.@2.5m	PVD@1.2m
Breakwater	Structure	Sloped Rubble mound with Wave Breaking Work	Outer B : Sloped Rubble mound with Wave Breaking Work
	Armour Stone	6.7t/pc Wave Dissipating Concrete Block	4t/pc Wave Dissipating Concrete Block
	Crown Height	CD+5.5m with Wide Wave Breaking Work(13.7m)or CD+9.0m with Standard Wave	CD+6.5m(with Wave Breaking Works of 2-row of blocks at the top)
	Soil Improvement	SVD 0.6m dia.@1.6m	PVD@1.2m
Container Berth	Design Vessel	(50,000DWT)	100,000DWT
	Water Depth	CD-14m	CD-16m
	Structure	Coupled RakePiled Open Deck	Coupled Rake Piled Open Deck
	Foundation Pile	Vertical & Rake Pile PHC800mm dia@5x5.0m	Vertical & Rake Pile SPP1,000mm dia. @6 x 7.5m
	Earth Retaining Wall	L shaped Retaining Wall on Sloped Rubble mound and supported by Foundation Piles	SSPPWall (500mm dia.) supported by Rake Pile (SPP 700mm dia.)
multi-purpose Berth	Design Vessel	N.A.	50,000DWT
	Water Depth		CD-13.0m
	Structure		PHC Vertical Piled Open Deck
	Foundation Pile		Vertical Pile:PHC1,000mm dia. @5x6m
	Earth Retaining Wall		Self-standing SSPP Wall 800mm dia.
Training Dyke	Structure	Peamiable Wave Breaking Work	Rubble mound Non-Permeable Dyke
	Armour Stone	8.9 to 25.1t/pc Wave Dissipating Concrete Block	4 to 8 t/pc Wave Dissipating Concrete Block
	Elevation	CD+2.0m	CD+2.0m
	Length	2015: 5.7km	2015: 6.4km
		2020: 10.7 km	2020: 6.4km
	Soil Improvement	SVD 0.6m dia.@2.1m	No Improvement

12.1.1 Dredging of Access Channel

It is proposed that a slope in 1 (V) to 10 (H) is applied for capital dredging work to deepen Lach Huyen access channel to the depth of CD-14m in initial development.

Though the sandy materials at a certain depth in the area where KL5 to KL 8 borings were carried out could be considered as being suitable for use in reclamation fill, the dredged material from access channel is generally not suitable for the use of reclamation fill and therefore the bulk of the dredged soils should be disposed at designated dumping site.

12.1.2 Natural Conditions for Port Facility Design

The design criteria were determined for the purpose of executing conceptual design work for the port facilities of the Project. In the process of determination of design criteria, primary design criteria proposed by the previous studies were carefully reviewed.

12.1.3 Reclamation

1) Reclamation Fill and Soil Improvement

Reclamation area is planned to fill up to CD +5.5. It is proposed that materials for reclamation fill will be sourced from river sand dredging.

The sandy/silty clay sediments below ground level at the Project site for reclamation are soft to firm with an N-value of 2 to 5 for upper clay or 4-7 for lower clay. The deposits are of a relatively low strength and decisively exhibit moderate compressibility once the overburden pressure is applied by reclamation fill and surcharges are loaded onto the reclamation fill for its intended use.

The value of pre-consolidation pressure indicates that the subsoil is over-consolidated clay. Therefore, the estimate on the consolidation settlement by reclamation fill and operational load is made based on e-logP curve for each layer of clayey deposits and the following results are obtained. The settlement is estimated to be more or less 1.5 m and will be quite slow because of its unconsolidated properties and low permeability.

Thickness of Clay Soil subject to consolidation: 26m
Load for Consolidation: 10.3 t/m^2
Estimated Settlement: 143cm
Time Elapse for U=90%: about 200 years

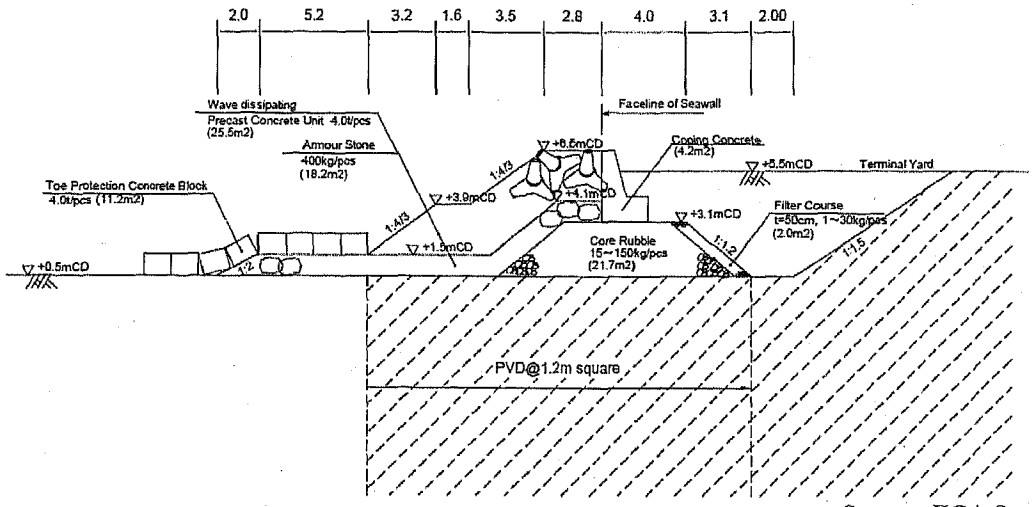
Therefore, it is recommended to apply plastic board vertical drain method (PVD) in combination with preloading to accelerate the process of consolidation which may caused by reclamation fill and surcharge loading during operation period. In the reclamation area, PVD method is applied in the following design.

Tip Elevation of Plastic Board: Around CD-26.0m
Plastic Board Interval: square 1.2m interval
Reclamation and Preloading: Three (3) stages of filling and preloading
Objective Degree of Consolidation: U=80%
Estimated Preloading Period: About 1.2 year

2) Revetment Work

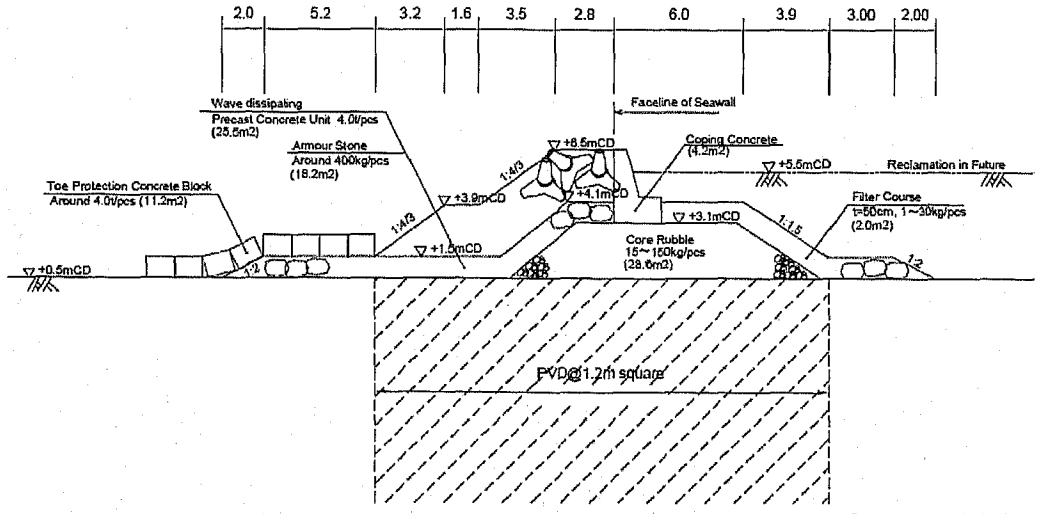
Outline of revetment for reclamation area is summarized as follows:

	Outer Revetment A (West Revetment for Initial Development)	Outer Revetment B (West Revetment for 2nd stage of Development)	Inner Revetment (South Revetment sheltered by Outer Revetment and Sand Protection Dyke)
Design Wave	Wave in50 Year Return Period Ho'=Ho×Kr×Kd=5.6m, T=11.6sec Design Wave $H_{1/3}$=3.4m		Design Wave $H_{1/3}$=1.8m (Wave transmitted through Sand Protection Dyke)
Design Tide Level	HHWL: CD+4.43m. HWL= CD+3.55m		
Structure	Sloped Rubble Mound armored by 4 t/pc wave dissipating concrete block		Sloped Revetment with armored by 100-500Kg stone surface layer
Crown Height	CD+6.5m (Rate of overtopping (q) less 0.05 m^3/m/s)		CD+5.5m



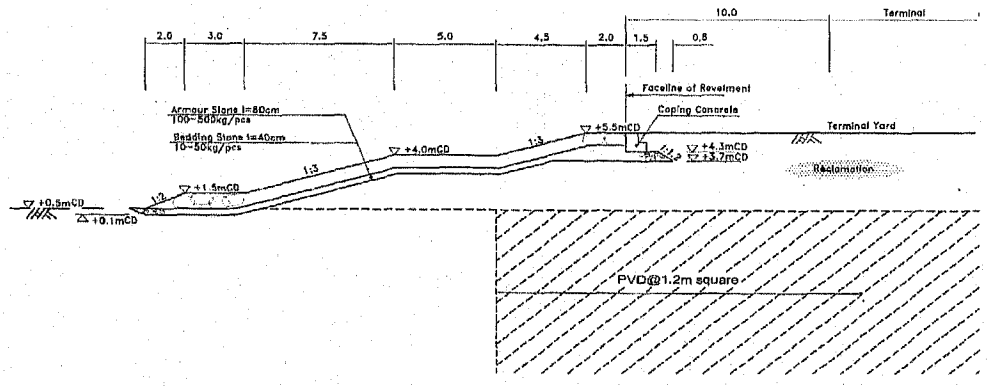
Source: JICA Study Team

Figure 12.1 Outer Revetment A (Seawall)



Source: JICA Study Team

Figure 12.2 Outer Revetment B (Seawall backfilled in future)



Source: JICA Study Team

Figure 12.3 Inner Revetment (Temporary Revetment for Future Terminal Expansion)

12.1.4 Berth Structure

1) Container Berth

Design Condition

Design Vessel: 100,000DWT class Super Post Panamax (Applied fully loaded vessel in designing berth structure)
Planned Water Depth: CD-16.0m
Design Water Depth: CD-16.0m
Cope-line Height: CD+5.5m

Type of Berth Structure

Open Deck supported by Coupled Rake Piles and Vertical Piles (Steel Pipe Pile 1,000 mm dia.) applied under the consideration of CD-16.0m deep sea berth, adaptability of type of structure and suitability to site subsoil conditions, etc.

2) Multi-purpose Berth

Design Condition

Design Vessel: 50,000DWT class Bulk Cargo and 30,000DWT General Cargo Vessel
Planned Water Depth: CD-13.0m
Design Water Depth: CD-13.0m
Cope-line Height: CD+5.5m

Type of Berth Structure

Open Deck supported by Vertical PHC Piles (1,000 mm dia.) applied in view of Suitability to Site Subsoil Conditions

12.1.5 Pavement

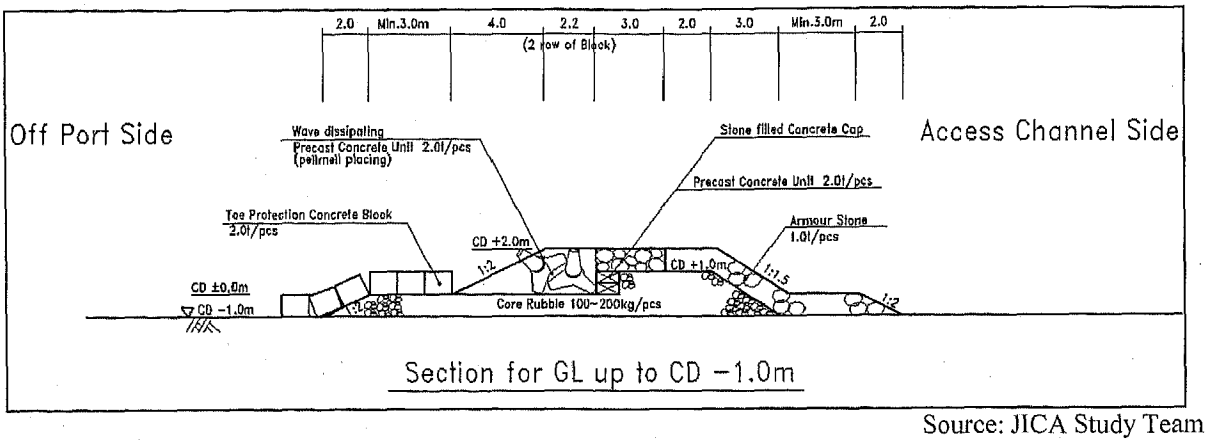
Pavement structure is outlined as follows:

	Container Yard	Multi-purpose Terminal Yard	Access Road
Structure	ICB	Asphalt Pavement	Asphalt Pavement
Thickness of Surface Layer	ICB12cm	Surface Course: 5cm, Binder Course: 10cm	Surface Course: 5cm, Binder Course: 10cm

12.1.6 Sand Protection Dyke

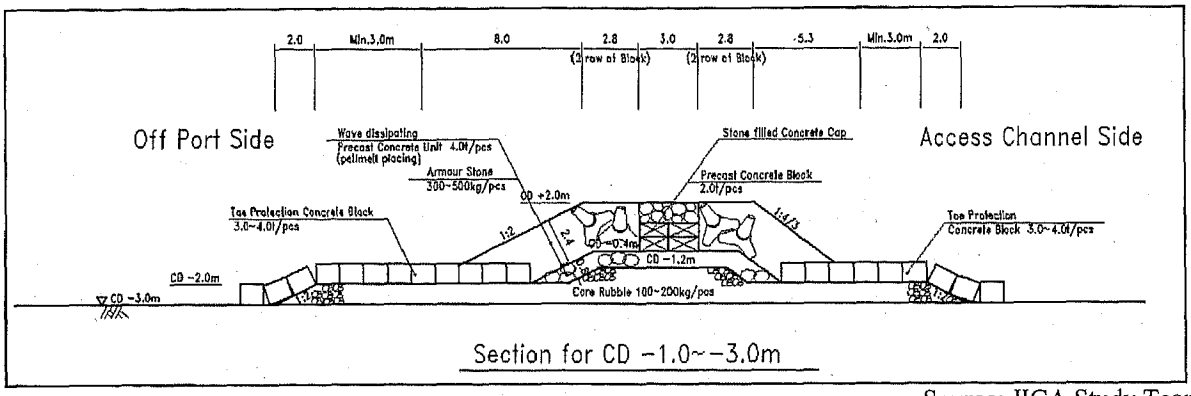
Sand Protection Dyke is designed to function as training jetty and sand protection jetty or groin dyke to trap littoral drift or sediment transport agitated by offshore waves or current movement. The structure is non-permeable in principle. Outline of the structure is as follows.

Design Wave: Wave in 30 year return period Ho'=Kr× Kd × Ho=4.45m, T=10.8sec
Crest Height: CD+2.0m
Structure: Non-permeable Rubble Mound armored by wave dissipating concrete block of 4 to 8 t/pc
Soil Improvement: Not Applied (Expected Consolidation Settlement 30-60cm)



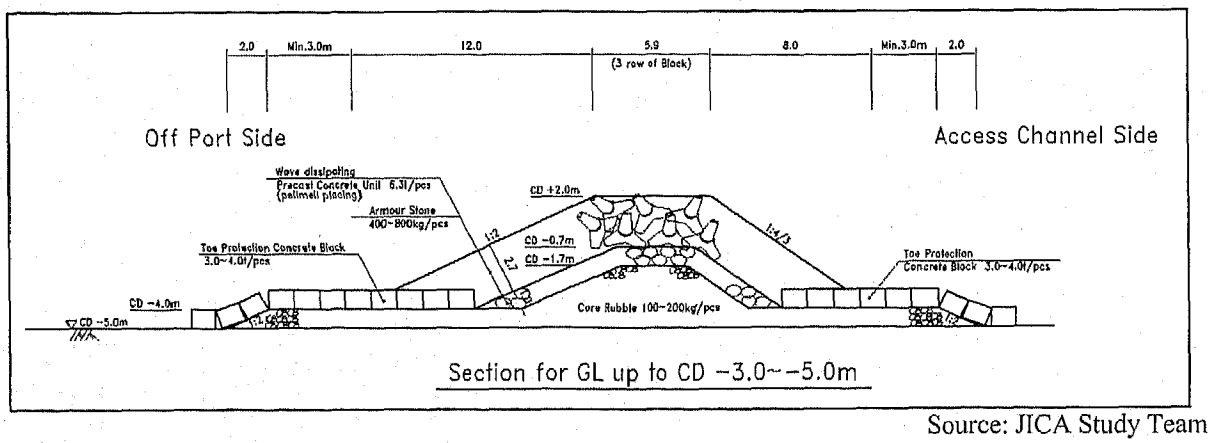
Source: JICA Study Team

Figure 12.4 Sand Protection Dyke at GL-1.0



Source: JICA Study Team

Figure 12.5 Sand Protection Dyke at GL-1.0 to -3.0m



Source: JICA Study Team

Figure 12.6 Sand Protection Dyke at GL-3.0 to -5.0m

12.2 Construction Method

12.2.1 Reclamation of the Terminal Yard

The terminal yard including access road width of 200m will be reclaimed to the elevation of +5.5mCD to +6.0mCD with river sand which will be transported to the site by barges, and pumped into the terminal yard by sand pump.

12.2.2 Soil Improvement Work

The existing soft soil of the reclamation yard will be improved by PVD (Plastic board Vertical Drain) method.

The base machine will install casing with plastic drain material into the reclaimed ground @1.2m square. After the installation of the plastic board drain material, thin layer of the sand (Sand mat: thickness around 0.5m to 1.0m) will be laid in order to create drain layer. Then preloading will be commenced by embankment.

12.2.3 Construction of Earth Retaining Wall and Berth Structure

Once soil improvement is completed, steel sheet pipe pile (SSPP) for the earth retaining wall will be driven by land piling machine. After the piling, the slope in front of the quay and berthing box will be dredged by grab dredger. Then the piles of the berth will be driven by piling barge, and the slope will be protected by placing the stones.

After the slope protection work, construction of the berth structure will start. The concrete structure shall be pre-fabricated on land as much as possible in order to shorten the construction schedule.

12.2.4 Multi-Purpose Wharf Construction

The construction method of the multi-purpose terminal is more or less same as the container terminal. One of the differences is the pile design which is Pre-stressed Spun High Strength pile (PHC pile) instead of the steel pipe pile.

12.2.5 Access Channel Dredging

The existing access channel with design depth of -7.2m CD and the width of 100m will be dredged to the elevation of -14.0m CD with the width of 160m by 2015. After 2015, maintenance dredging of the channel may be necessary. The total dredging volume is estimated around 32,300,000 m^3. Cutter suction dredger (CSD) and Trailing Suction Hopper Dredger (TSHD) will be used for the dredging work. As well as the local dredgers, foreign dredgers with larger capacity such as CSD of 6,000ps class and TSHD with hopper capacity of 10,000 - 20,000m^3 shall be mobilized.

12.3 Development Cost

The estimated total development cost for target year 2020 is shown in the below table.

Table 12.2 Estimated Development Cost for Target Year 2020

No.	Item	Unit	Quantity	in VND		in USD	in JPY
				Unit Price	Amount	Amount	Amount
I	**Construction Expenses**						
1	**Container Terminal**				***7,481,918,618,937***	***440,898,776***	***39,504,530,308***
a	Container Terminal	m	2,000.0	3,620,535,912	7,241,071,823,382	426,706,018	38,232,859,227
b	Barge Berth	m	150.0	1,605,645,304	240,846,795,555	14,192,758	1,271,671,081
2	**Dredging**				***5,918,886,127,689***	***348,791,504***	***31,251,718,754***
a	Access Channel	m3	32,300,860.0	160,927	5,198,064,989,137	306,314,544	27,445,783,143
b	Wharf Slope Dredging	m3	2,238,598.0	223,127	499,491,342,362	29,434,311	2,637,314,288
c	Berth Box	m3	337,886.0	223,127	75,391,442,191	4,442,710	398,066,815
d	Between Channel and Berth Box	m3	654,060.0	223,127	145,938,353,999	8,599,939	770,554,509
3	**Reclamation**				***2,454,564,015,423***	***144,643,951***	***12,960,098,001***
a	Terminal Area with Access Road	m3	12,088,923.0	203,042	2,454,564,015,423	144,643,951	12,960,098,001
4	**Port Protection Facilities**				***2,634,183,351,319***	***155,228,662***	***13,908,488,095***
a	Inner Revetment	m	750.0	40,162,324	30,121,742,708	1,775,031	159,042,801
b	Outer Revetment-A	m	720.0	193,692,006	139,458,244,549	8,218,075	736,339,531
c	Outer Revetment-B	m	2,510.0	193,692,006	486,166,935,860	28,649,123	2,566,961,421
d	Training Dike-1	m	3,110.0	135,785,924	422,294,223,886	24,885,195	2,229,713,502
e	Training Dike-2	m	3,290.0	332,374,699	1,093,512,759,260	64,439,145	5,773,747,369
f	Training Dike-3	m	1,200.0	385,524,538	462,629,445,055	27,262,092	2,442,683,470
5	**Soil Improvement**				***3,423,654,172,886***	***201,751,049***	***18,076,894,033***
a	Terminal Area	m2	1,730,975.0	1,356,451	2,347,983,425,697	138,363,309	12,397,352,488
b	Barge Berth Area	m2	5,000.0	3,373,909	16,869,543,472	994,098	89,071,190
c	Inner Revetment	m2	4,550.0	2,324,418	10,576,099,708	623,234	55,841,806
d	Outer Revetment A	m2	13,104.0	2,094,872	27,451,201,872	1,617,660	144,942,346
e	Outer Revetment B	m2	52,459.0	5,019,258	263,305,260,915	15,516,203	1,390,251,778
f	Access Road	m2	652,000.0	1,161,762	757,468,641,221	44,636,545	3,999,434,426
6	**Access Road behind Port**				***233,938,987,178***	***13,785,690***	***1,235,197,852***
a	Access Road	m	3,260.0	71,760,426	233,938,987,178	13,785,690	1,235,197,852
7	**Public Related Facilities (CIQ)**				***504,218,092,199***	***29,712,852***	***2,662,271,527***
a	Reclamation	m3	344,131.0	203,042	69,873,186,320	4,117,527	368,930,424
b	Dredging	m3	103,897.0	223,127	23,182,211,365	1,366,095	122,402,076
c	Quaywall	m	375.0	476,452,600	178,669,725,151	10,528,752	943,376,149
d	Pavement	m2	120,800.0	1,071,745	129,466,780,803	7,629,292	683,584,603
e	Building	L.S.	1.0	59,935,258,841	59,935,258,841	3,531,899	316,458,167
f	Utilities	L.S.	1.0	28,349,124,722	28,349,124,722	1,670,573	149,683,379
g	Soil Improvement	m2	23,600.0	624,653	14,741,804,996	868,714	77,836,730
8	**Multi Per Purpose Terminal**				***1,061,519,133,890***	***62,553,806***	***5,604,821,027***
a	Multi Purpose Terminal	m	750.0	1,415,358,845	1,061,519,133,890	62,553,806	5,604,821,027
9	**Navigational Aids**				***121,719,208,121***	***7,172,739***	***642,677,419***
a	New Channel Buoys	nos	20.0	5,438,764,550	108,775,290,991	6,409,973	574,333,536
b	Relpace Existing Buoy	nos	3.0	97,456,616	292,369,849	17,229	1,543,713
c	Light Beacon	nos	4.0	909,915,542	3,639,662,168	214,480	19,217,416
d	Pilot Assistance System	L.S.	1.0	9,011,885,114	9,011,885,114	531,058	47,582,753
	Total Construction Expense				**23,834,601,707,642**	**1,404,539,029**	**125,846,697,016**
I	**Equipment Expenses**				***6,909,301,597,091***	***407,155,273***	***36,481,112,433***
1	**Equipment for Container Terminal**	Berth	5.0	1,038,827,888,000	5,194,139,440,000	306,083,217	27,425,056,243
2	**Equipment for Multi Purpose Terminal**	Berth	3.0	571,720,719,030	1,715,162,157,091	101,072,056	9,056,056,189
	Total Equipment Expense				**6,909,301,597,091**	**407,155,273**	**36,481,112,433**
	Total Cost				**30,743,903,304,732**	**1,811,694,302**	**162,327,809,449**

13. Consideration of Natural and Social Environment

After the comprehensive review of the TEDI's Lach Huyen port infrastructure construction study, SAPROF study team recommended some change in design of the TEDI's port design. MOT agrees the recommended change in design. Following are the major changes between TEDI-F/S and SAPROF study. Summary of the change in design relevant to natural and social environment is as follows.

Item	TEDI F/S	SAPROF study team	Remarks
1. Design vessel for container berth	Fully loaded 30,000DWT vessel Partial loaded 50,000DWT vessel	Fully loaded 50,000DWT vessel Partial loaded 100,000DWT	Total berth length changes from 600m to 750m accordingly
2. Channel Width and Depth	130m wide, -10.3m deep below CDL	160m to 210m wide, -14m deep below CDL	Due to change of design vessels.
3. Length of sand protection dyke	Applying till -3m	Applying till -5m	Total length changes from 5,700m to 7,600m
4. Public Related Facilities/ Service Berth	Not included	1) Land reclamation 2) Service boats berth, 3) Port Admin. Bld., 4) Amenity Bld. 5) Pavement	1) Land Reclamation: 344,000 m^3/Berthfront dredging: 104,000 m^3 2) 375mL x 30m W, -4m, 3) & 4) 4,600 m^2 5) 121,000 m^2

13.1 Natural Environment

The natural environmental issues concerned to construction stage of the project falls into 3 broader categories. They are; (1) Effects due to sourcing of required material for construction works (2) Dredging and dredged material management issues which is very significant in particular considering the generation of high quantity of dredged material estimated at around 30 million m3 and (3) EHS (environment, health and safety) management and monitoring aspects of construction works by the construction contractor.

Concerned to operation of the port, operational safety in port terminal including navigational safety and effective measures to handle emergency situation like ship accidents, fire and oil spills is the most significant aspect. Moreover, effective surveillance system to ensure all ship originated wastes are duly disposed in the port terminal and not illegally dumped into the port waters is also very important. All these port operational aspects could be comprehensively categorized as EHS of port operational management.

13.2 Social Environment

13.2.1 Preparation Stage Aspects

For the consideration of the social environmental impacts during the preparation stage, following two primary issues are expected to be addressed. They are; 1) land acquisition, and 2) development and enforcement of safeguard policy for loss of coastal fishing area (Figure 13.1).

1) Land Acquisition

The expected impact of land use change would be 11.4Ha (considerable impact) excluding the existing government facilities, which is likely to function as a part of the new port's public facilities without

major change (Table 13.1). At this moment, MPMU II is preparing the land acquisition plan with the collaboration with relevant authorities. Detailed land use information and land acquisition plan will be given and implemented in six (6) month after MPMU II starts the initial process.

There are some gaps between the JBIC Guideline and Vietnamese safeguard policies. The separately studied connecting highway between Tan Vu and Lach Huyen port is likely to be required to adapt the JBIC Guideline due to the gap between the Vietnamese policies and the JBIC Guideline. Thus, a CONSISTENT POLICY on resettlement, compensation, and support for the recovery of PAP's livelihood between port portion and shall be considered as the Japanese ODA projects in the same area under MOT.

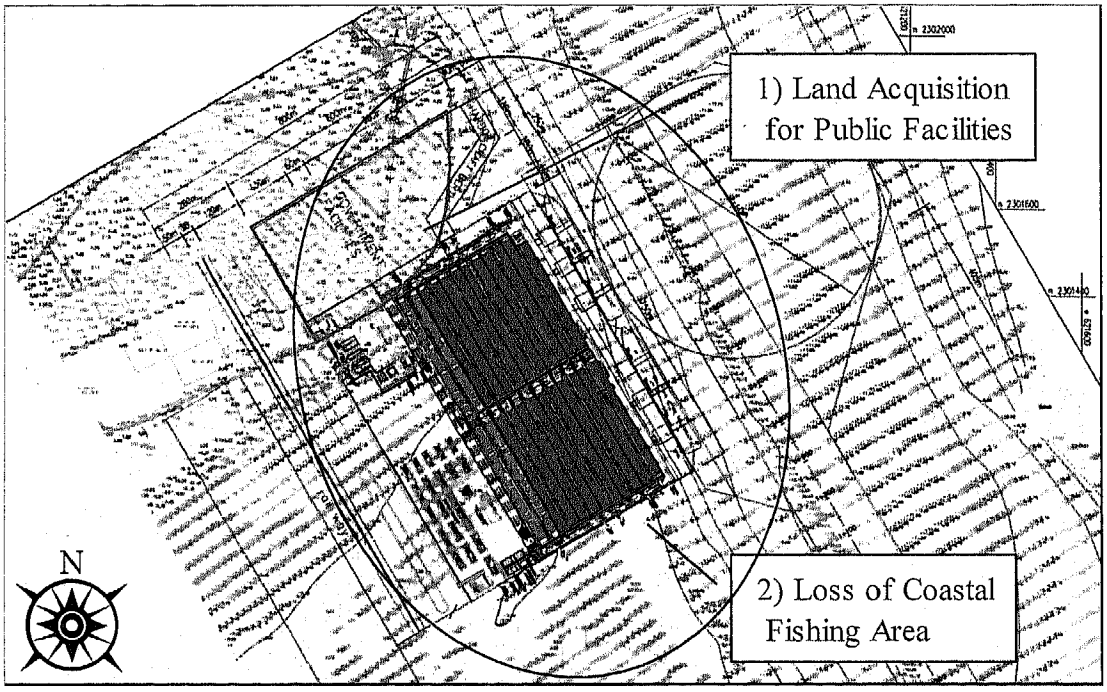


Figure 13.1 Special Attention Area for Social Environmental Consideration

Table 13.1 Expected Impacts by the Land Acquisition

Present Use	Area (m^2)	Potential Impacts
1. Unknown use	7,200	There are no sign of land use at this moment. However, the property is just next to residential area so that the land use rights may belong to private. In case it does not belong to public, it is necessary to acquire the land with market price as defined by the effective regulations.
2. Gov. facilities	13,600	No potential impacts are expected due to its continuous functionality and no or little change in their facilities and properties for the new port.
3. Bare ground	26,300	There are no sign of land use at this moment except 5 graves. 5 graves will be relocated by the full support of responsible authorities.
4. Salt pan	1,500	This salt pan is still active in use. Though the acquired portion of the land would be minority of the targeted area, but it would be majority of the targeted area in case we count affected area by TanVu-LachHuyen Highway land clearance. In the case of the minor impacts, it would be only compensated by monetary under present regulation. In the case of the major impacts with the consideration of highway construction, not only monetary or land to land compensation but also support for livelihood recovery is also needed.
5. Aquaculture pond	64,700	Based on the MPMU II's explanation, the aquaculture ponds belong to the border control office adjacent to the ponds. Since there are no activities in the pond at this moment, we assumed no impacts on the either local communities and the border control office.
6. Forest	10,200	The forest belongs to the local community and there are no sign of the environmentally essential species. Due to the land clearance for the highway, majority of the community forest will be cleared.
7. Road	4,300	These two (2) roads are primary connection between Cat Hai TT (town) and Got harbor at this moment. Reroutes along the public facilities of the port will be constructed and present necessary connection between Cat Hai TT and Got harbor.
Total	127,800	Total area
Considerable impacts	**114,200**	**Potentially required area for the land clearance**

2) Development and Enforcement of Safeguard Policy for Coastal Fishing Activities

Expected loss of coastal fishing area is shown in Figure 13.1 with blue circle area. Based on the sample fishing survey at the project site and surrounding area, there are continuous and regular fishing activities at the proposed port development area. The project affected fishing boats (PAB) could be a couple of hundred to several hundred. However unlike farming, fishermen regularly move around to gain the fish yield so that impacts for such fishermen are relatively smaller than that of other land related economic activities, but it is not easy to estimate for the consideration of safeguards. However, it is highly recommendable to conduct detailed base line survey to consider the potential safeguard policy for such affected people. In addition, unlike aquaculture and other farming activities, there are many immigrant fishermen living on their boats. The maximum source of impact area would be 208 ha in and around Lach Huyen estuary adjacent to Cat Hai island.

Table 13.2 Expected Impacts on Coastal Fishing

Proposed Use	Area (m^2)	Potential Impacts
1. Container terminal with service road	561,750	There is active coastal fishing in the area due to the favorable environment for small fish, shell fishes, and shrimp, and octopus are actively taken by local and immigrant fishermen living on the fishing boats. The fishing area will be permanently removed so that it is highly recommendable to provide reasonable safeguard measures to maintain or improve the standard of living for those who depend on coastal fishing in the project area. Though there are no safeguard policies at this moment under Vietnamese law and regulation, Hai Phong people's committee (the responsible authority) and MPMU II (the responsible implementation agency of the project) shall pay attention to such fishermen and implement a safeguard policy for such people on time.
2. Access Channel	278,400	Few potential impacts are expected due to its present functions. Though there are some fixed fishing nets along the existing channel, they have already been compensated for the relocation of the net for the port development project. However, deepening and widening of the channel might lead further loss of the fishing area.
3. Turning Basin	342,200	Some fixed fishing nets are observed at the proposed turning basin. Such fishing net owner may have already been given a 500,000VND for the relocation of the fishing net in the past. There are also some coastal fishing activities in the area at this moment.
4. Sand Protection Dyke	334,400	The cross section of the dyke increases water depth respectively. The dyke is also constructed on the shallower area along the channel where preferable fishing area at this moment. It is highly recommended to conduct detailed fishing survey to estimate the potential loss of fishing and discuss any possibility of occupation change as a sustainable solution.

Considering the safeguard policy for coastal fishing activities, there are not applicable policies in Vietnam at this moment. Based on the records of public consultations, vocational training is the highest interest for local residents including fishermen to adapt the new environment and enjoy the potential benefits from the proposed port development. In order to address such interests, all concerned authorities should consider effective training programs for such interests with the collaboration with privates that are expected to generate employments in the new port area.

3) Construction Stage Aspects

For the consideration of the social environmental impacts during the construction stage, following four (4) primary issues are expected to be addressed. They are; 1) labor safety and community health, 2) Socio economic, 3) Transport, 4) Coastal fishing.

Considering labor safety and community health, without proper training and safety management, it is likely to lead fatal accidents letting delay of schedule. Securing the labor safety, sufficient and continuous training and management of EHS officers/managers would be minimal requirement for contractors. Control of the transmittable diseases in the local and workers' communities would be another critical issue. Awareness training for such diseases and protection for locals and immigrant workers would be minimal requirements for contractors. Control of the physical contacts between immigrant workers and locals, such as workers' township, would be another possible option to reduce the risk.

Considering the socio economic impacts, pricing of goods are likely to increase and shall be addressed to control. Counter measures to control the radical price change shall be considered before the construction stage. Physical separation between local communities and workers community would be another solution for the initial stage by means of sufficient goods supply in the workers' township. Follow-up for the resettlement would be another important matter in the construction stage. Due to no requirement for the housing resettlement, the livelihood support for PAP should be focused.

Considering the following up the coastal fishing, construction period would be the critical moment for coastal fishermen since the fishing in the proposed port area will be completely banned leading significant change in their fishing activities. Periodical sample survey to monitor the fish yield and income level of the project affected fishermen would be recommendable. If it is necessary to provide additional support based on the sample survey, responsible authorities shall consider modification of the safeguard policy for coastal fishing or additional counter measures such as encouragement of job transfer.

4) Operation Stage Aspects

For the consideration of the social environmental impacts during the operation stage, monitoring the implemented safety guard measures in the previous stages would be the primary matter in this stage. As a part of environmental management plan (EMP) and responsibility of the implementation agency, MPMU II shall cooperate with VINALINE and other privates, expected operator of the port, to ensure the EMP including the proper implementation and follow-up of the safe guard measures.

14. Project Scope

The original project scope was determined by MOT with their Decision No. 3793/QD-BGTVT, dated 22 December 2008. However, SAPROF study recommended some modifications as follows:

14.1 Change of Scope

1) Land Reclamation and Soil Improvement

The responsibility of land reclamation and soil improvement of container terminal berth No. 1 & 2 should be shift from the private sector, VINALINES to the public sector, VINAMARINE.

14.2 Change of Scale

1) Design Vessel Size

Design vessel size for this Project was changed to 50,000DWT (full load) and 100,000DWT (partial load) container vessels instead of 30,000DWT (full load) and 50,000DWT (partial load) vessels.

2) Berth No.1 & 2

Based on the change of design vessels, the length of Berth No.1 & 2 shall be extended from 600 m to 750 m and terminal yard will also be widened accordingly.

3) Port protection Facilities

a) Outer Revetment

Based on the review results of demand forecast, required number and length of berths became 6 berths and 2,400m long (including space of barge berths) for container and 3 berths and 750m long for general cargo for Medium Term Development of target year 2020. As a result, total length of outer revetment (breakwater) has to be changed from 3,900m to 3,230m.

b) Sand Protection Dyke

Sand protection dyke should be constructed up to the seabed elevation of -5.0m CDL for 7,600m instead of seabed elevation of -3.0m CDL for 5,600m long.

4) Access Channel and Turning Basin

a) Access Channel

Based on the change of design vessel size, the width of access channel was modified as 160m with protection dyke and 210m without protection dyke instead of 130m, and the depth of access channel was deepened to -14m CDL instead of -10.3m CDL.

b) Turning Basin

The diameter of turning basin was determined for the length of design vessel of 100,000DWT as 660m (330m x 2) and the depth of turning basin should be the same with the depth of access channel of -14m CDL.

5) Port Service Road

Based on the change of terminal length from 600m to 750m and additional length of Public Related Facilities area of 250m, the length of port service road was modified from 630m to 1,000m and width of road was modified at 44m instead of 41m of original plan.

14.3 Additional Scope

1) Barge Berth

To cope with the requirement of domestic container traffic demand, it is necessary to arrange a dedicated barge berth within the international container terminal for the most economical transportation of inland and coastal waterway. The length of barge berth should be 200m for accommodating 3 to 4 barges at same time.

2) Public Related Facilities

The public related facilities such as buildings for Maritime Administration, Customs, Immigration, Quarantine and amenity for port workers, and a mooring facility for service vessels are not included in the Scope of Project of Decision by MOT. However, SAPROF study team recommends these basic public related facilities to be included in the scope of project to realize smooth and quick cargo flow in the newly constructed port.

3) Navigation Aid

a) Channel Buoy (20 sets)

The new channel will have a width of 160m which is a very restricted width for 100,000DWT container vessels, therefore, it is recommended to replace existing floating buoys to spar buoys which will move only very limited range and can show exact location of boundary of channel.

b) Light Beacon (4 sets)

Sand protection dyke becomes under water during high tide and couldn't see from small boats like fishing boats. In order to eliminate collision between small boats and the sand protection dyke, light beacons should be installed on the dyke at 2km intervals for warning.

c) Pilot Assistance System

In the limited width of channel, it is very important to know the accurate position of own vessel at real time. For that purpose, a handy display showing vessel position by GPS is very useful for pilot and during the berthing maneuvering the pilot should works outside of bridge, when if a handy display is available, maneuvering become easy for pilot.

14.4 Demarcation of Scope of Works for Public Sector and Private Sector

Based on the above discussion, the demarcation of scope of works for public sector and private sector is summarized in table below:

Table 14.1 Demarcation of Scope of Works for Public Sector and Private Sector

No.	Work Item	Demarcation	
		Public	Private
1	**Dredging**		
1.1	Vessel Channel	●	
1.2	Turning Basin	●	
1.3	Berth Area (Approx. 150,000m3)		●
1.4	Slope of Terminal Land Revetment		●
1.5	Service Boats Berth/Barge Berth	●	
2.	**Container Terminal**		
2.1	Land Reclamation w/t Soil Improvement and Embankment	●	
2.2	Berth Construction		●
2.3	Barge Berth		●
2.4	Yard & Road Pavement		●
2.5	Architectural Facilities		●
2.6	Utilities		●
2.7	Cargo Handling Equipment		●
3.	**Port Service road**		
3.1	Land Reclamation	●	
3.2	Road Pavement w/t Soil Improvement	●	
4.	**Outer Revetment (Breakwater)**	●	
5	**Sand Protection Dyke**	●	
6	**Public Related Facilities**		
6.1	Land Reclamation	●	
6.2	Service Boat Berth	●	
6.3	Road Pavement	●	
6.4	Buildings	●	
6.5	Utilities	●	
7	**Navigation Aid**	●	

14.5 Recommended Project Scope

The recommended scope of Lach Huyen Port ODA Project is as follows.

Table 14.2 Recommended Project Scope for Japan's ODA Loan

No.	Work Item	Description
1.	**Dredging**	
1.1	Access Channel & Turning Basin	Channel: Width 160m (with sand protection dyke) 210m (without sand protection dyke), Depth -14.0m CDL, Slope 1:10, Length 17.4 km, Turning Basin: Diameter 660m, Depth -14m CDL, Slope 1:10, V=31,000,000m^3 including sedimentation of 2,000,000 m^3 during capital dredging period of 3 years.
2.	**Navigation Aids**	Channel buoy: Spar buoy 20 sets, Light Beacons on Sand protection dyke: 4sets, Pilot Assisting System: 7sets
3	**Container Terminal**	
3.1	Land Reclamation	750mL x 749mW, Top EL +5.5m, V=2,956,000m^3 including port service road area of 200mW.
3.2	Soil Improvement	ALICC: 50mW x 920mL including barge berth area PVD: 564,000m^2 including port service road area
3.3	Retaining Wall	Wharf side: Steel Sheet Pipe Pile Wall, Length 750m, Top EL +5.5m South side: Rubble mound, Length 750m, Top EL +5.5m
3.4	Port Service Road	Asphalt pavement, Width 44m, Length 1,000m
4.	**Protection Facilities**	
4.1	Outer Revetment	Top EL of Coping Concrete +6.5m, Covered by Wave Dissipation Concrete Blocks, Soil Improvement: 65,600m2Length 3,230m
4.2	Sand Protection Dyke	Top EL +2.0m, Covered by Wave Dissipation Concrete Blocks, Length 7,600m
5.	**Public Related Facility**	
5.1	Land Reclamation	Area 132,000m^2, V=344,000m^3 Including soil improvement: PVD 21,300m^2
5.2	Harbor Crafts Berth	374mL x 30mW x -4mD, Sheet Pile Wall structure Dredging: V=104,000m3
5.3	Buildings	4,600m^2 for Port Administration, Customs, Immigration, Quarantine, Coastal Guard, Security & Amenity Space
5.4	Utilities	Electricity supply, Water supply, Fire fighting, Sewage system within boundary.

15. Preliminary Design

15.1 Design Criteria

15.1.1 Port Facilities

The following are the summary of design criteria recommended by JICA Study Team to apply to design work of the port facilities proposed in Lach Huyen Port Development Project.

1) Meteorological and Oceanographic Conditions

a) Tides

- HHWL: CD + 4.43m
- HWL: CD +3.55 m
- MWL: CD +1.95 m
- LWL: CD +0.43 m
- LLWL: CD+0.03 (observed on January 2, 1991)

b) Wave (Deep Offshore Wave)

- 50 Years Return Period of Wave

Wave Height	Hs = 5.6 m
Wave Period	T = 11.6 sec
Predominant Wave Direction	S to E

c) Design Seismic Coefficient for Quay wall Structure

- Horizontal Design Coefficient kh = 0.04g
- Vertical Design Coefficient kv = 0.00g

d) Wind Velocity

- Design Wind Velocity 60 m/sec
- Wind in Operation 20 m/sec

2) Subsoil Conditions

The design properties of existing subsoil are determined based on the subsoil data collected from each boring work at the relevant location of the proposed port facilities.

3) Design Conditions for Container Berth

(Designed by Private Sector under PPP Scheme)

4) Design Conditions for Container Barge Berth

(Designed by Private Sector under PPP Scheme)

5) Design Conditions for Harbor Crafts Berth

a) Design Vessel

Table 15.1 Dimension of Tugboat

		2,000PS	3,000PS	4,000PS
Length	Loa	28.1	31.8	36.2
	Lpp	24.2	28.0	31.5
Beam	B	8.2	9.0	9.8
Depth	D	3.5	3.6	4.4
Draft	d	2.7	2.7	3.2
Displacement Tonnage	DT	320	435	544

b) Geometry of Berth

- Berth Length 365 m
- Top Elevation at Cope-line of Berth CD +5.5 or +4.5m
- Planned Water Depth CD -3.6 m
- Design Water Depth CD -4.0 m

c) Loading Conditions

- Surcharge on Apron 10 kN/m^2
- Ship Berthing Condition Design Vessel 4,000PS Tugboat
  Ship Approach Velocity 0.3m/s
  Ship Berthing Angle 10°
- Load on Bollard 350kN Hawser pull capacity

d) Service Life:

Berth structure including the pile and beam is designed for a service life of 50 years for the quay wall.

15.2 Preliminary Design

15.2.1 Port Structures

1) Soil Improvement at Reclamation Area

In order to accelerate and complete the consolidation by reclamation fill during construction period, soil improvement is carried out by application of PVD method in combination with Preloading. PVD soil improvement work precedes the construction of berth structure so that the berth structure is precluded from any adverse effect which may be caused by possible occurrence of lateral swelling of subsoil mass subject to consolidation settlement under PVD preloading operation.

Other than PVD subsoil improvement, it is recommended that Cement Deep Mixing Method (CDM) is applied for the area immediately behind the container berth structure (container berth as well as barge berth) where earth retaining wall is constructed to sustain reclamation fill.

Among Cement Deep Mixing method (CDM), Low Rate of Replacement Cement Column Method (ALiCC) is proposed to apply to the back-of-berth area immediately behind the berth structure. This ALiCC method is practically applied to a 50m wide area behind the berth structure to obtain the following effects and objects for construction.

- To handover the reclaimed area immediately behind the berth to Private Sector for the succeeding construction of berth to initiate earlier as practically possible,
- To reduce active earth pressure working on vertical type of earth retaining wall installed immediately behind the open type of container berth structure, and

- To shorten overall working period in subsoil improvement work for the terminal construction by a combined application of PVD and ALiCC soil improvement method.

Low Rate of Replacement Cement Column method (ALiCC) is applied in the following schedule. The 20m wide rear zone adjacent to the reclamation area subjected to PVD method is provided as a buffer zone to sustain lateral swell deformation of subsoil mass which may be occurred during a process of consolidation under PVD preloading operation.

Table 15.2 Work Schedule of ALiCC at back-of-berth Area for 50m

	Front 30m Area	Back 20m Area
Objective Effect	1) Preclude Consolidation settlement 2) Reduce earth pressure on wall 3) Earlier handover working yard for berth construction	1) Preclude Consolidation settlement 2) Earlier handover working yard for berth construction 3) Sustain lateral swell movement of soil mass subjected to PVD method
Rate of Replacement (ap)	24%	51%
Diameter of Cement Treated Column	Dia. 1.0m x 2 shafts	Dia. 1.0m x 2 shafts
Column Arrangement	2.1m x 3.1m Square	1.0m x 3.1m Square

Source: JICA Study Team

2) Earth retaining Wall behind Container Terminal Berth

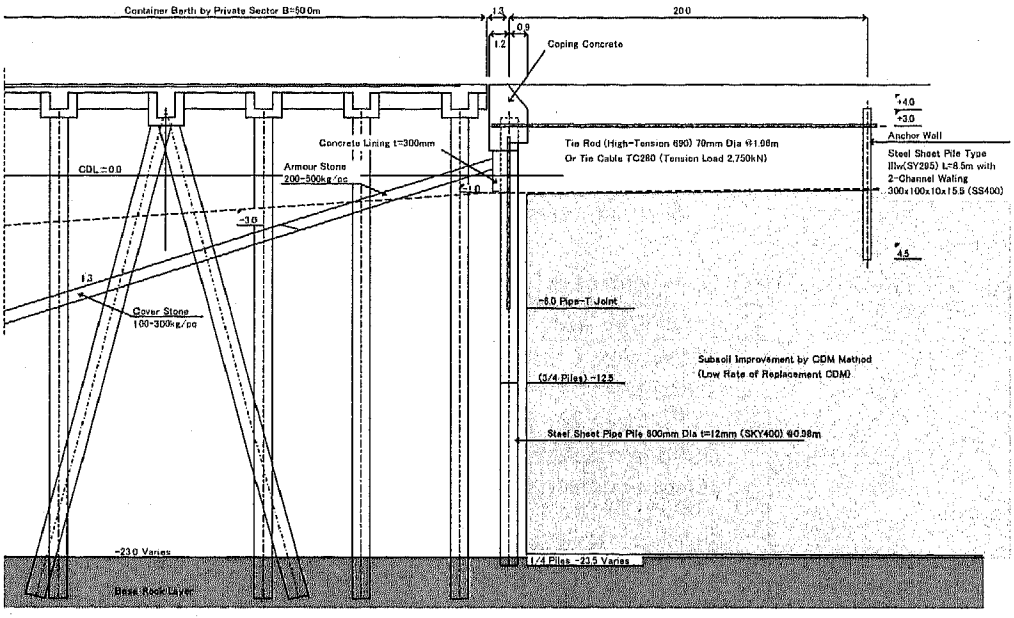
Container Berth as well as barge berth is constructed by Private Sector under PPP Program. In view of economy in construction, the container berth and barge berth proposed by METI 2010 Study is recommended for construction by Private Sector under PPP Program.

SAPROF Team studies the following two (2) types of earth retaining walls to construct by Public Sector along the rear face of berth structure by Private Sector:

- Earth Retaining Wall behind Container Berth Structure
- Ditto but for Barge Berth Structure

a) Earth retaining Wall behind Container Berth

Under the pre-requisite that 50 m wide container berth is constructed based on the conceptual design of berth proposed by METI 2010 study, SAPROF Team comparatively studies the two (2) alternative types of walls and Anchored Steel Sheet Pipe Pile Wall is recommended for earth retaining wall to be constructed along the rear face of open type of berth structure.

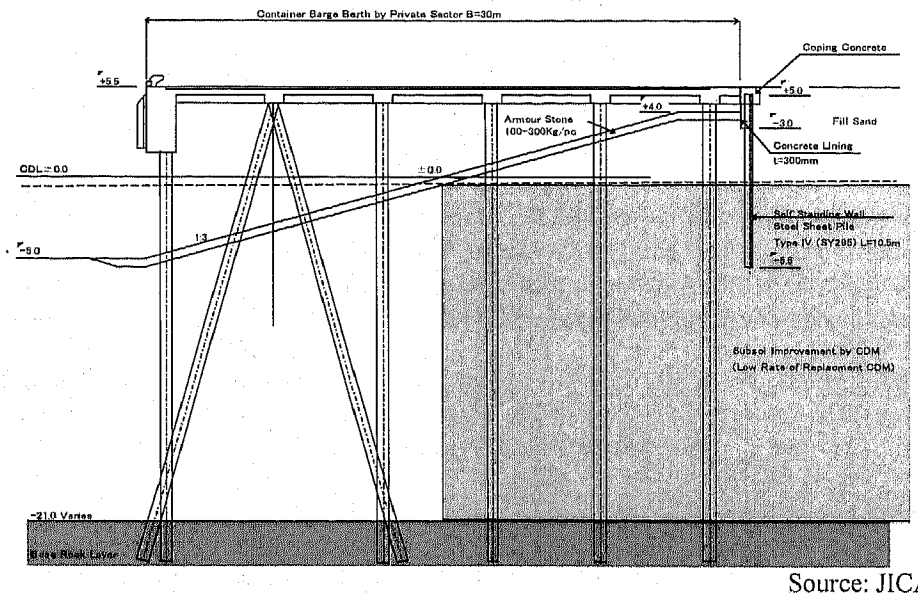


Source: JICA Study Team

Figure 15.1 Earth Retaining Wall behind Container Berth, Alternative A: Anchored Steel Sheet Pipe Piled Wall

b) Earth Retaining Wall behind Barge Berth

Three (3) alternative types of walls are comparatively studied and, under the pre-requisite that 30 m wide barge berth is constructed based on the conceptual design of berth proposed by MITI 2010 study for PPP Projects, Cantilever Type Self-standing sheet pile wall is recommend to construct as earth retaining wall for reclamation fill immediately behind the open type piled deck structure constructed by Private Sector.



Source: JICA Study Team

Figure 15.2 Earth Retaining Wall behind Barge Berth, Alternative A: Cantilever Type Self-standing Sheet Piled Wall

However, Anchored Steel Sheet Pile Wall type (Alternative C) is the one of suitable type of structure for barge berth as far as proper consent with private sector could be obtainable in the type of berth structure and the corresponding share in construction work and cost by private sector. Therefore, application of Alternative C and its demarcation of investment between public

and private should be determined in the detailed design stage for the Project.

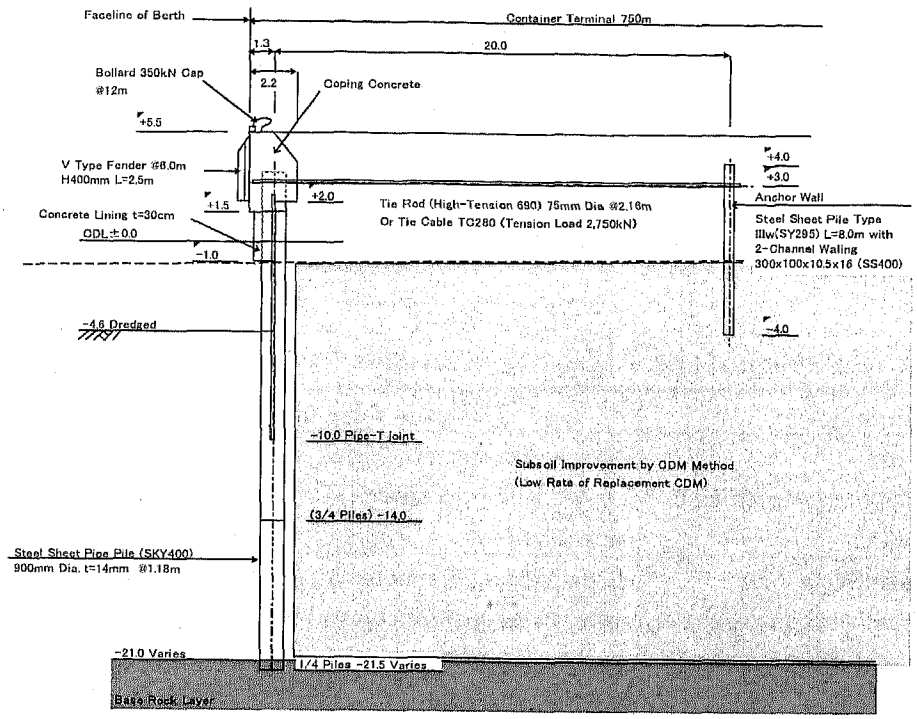
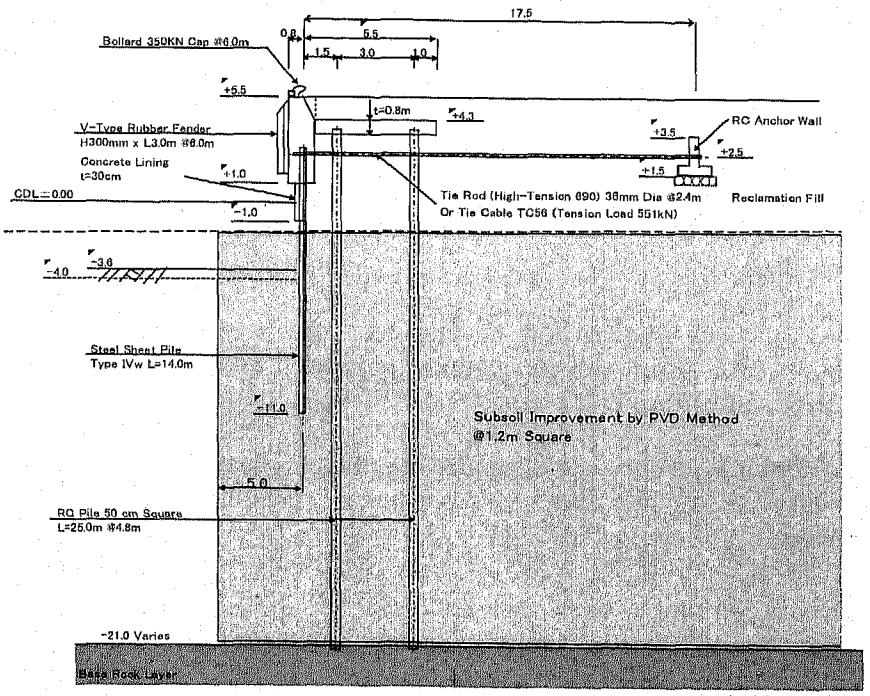


Figure 15.3 Earth Retaining Wall functioned as Barge Berth, Alternative C: Anchored Steel Sheet Pipe Piled Wall

3) Facilities for Public Related Area

a) Harbor Crafts Berth

Sheet pile wall construction with provision of earth pressure relieving platform is recommended to apply in view of weakness of clayey subsoil condition at the site.



Source: JICA Study Team

Figure 15.4 Typical Section of Harbor Crafts Berth

b) Pavement

Interlocking Concrete Block (ICB) of 6cm thick is applied for Harbor Crafts Berth area. Flexible type of asphalt pavement of 5 cm surface course is used for In-port Road at Public Related Area.

4) Other Designs for Major Port Facilities

The same structures as those designed for Medium Term Development Plan (Part-2 of this report) is applied to the works done by Public Sector for Implementation Plan as Japan ODA Loan Project as follows:

Table 15.3 Design of Other Major Port Facilities for Japan ODA Loan Project

Facility	Design of Structure	Remarks
1. Inner Revetment (South –side Temporary Revetment at Reclamation Area	Sloped Revetment covered by armour stones with provision of PVD subsoil improvement	Refer to Item 5) in Chapter 12.1.3
2. Outer Revetment A (West-side Seawall along Access Road Area for Initial Development)	L shaped wall on rubble mound with wave breaking work elevated CD+6.5m at cope-line with provision of PVD subsoil improvement	Refer to Item 4) in Chapter 12.1.3
3. Outer Revetment B (West-side Breakwater along Access Road Area for Medium Term Development Terminal Area)	L shaped wall on rubble mound with wave breaking work elevated at CD+6.5m at cope-line with provision of PVD subsoil improvement	Ditto
4. Training Dyke (Sand Protection Dyke extended from Outer Revetment B to CD-5.0m depth offshore	Non-permeable rubble mound with wave breaking work elevated to CD+2.0m	Refer to Cross Sections for seabed level GL-1.0 to -5.0m in Chapter 12.1.6
5. Pavement at Access Road	Asphalt pavement of 10cm thick surfacing Layer	Refer to Item 3) in Chapter 12.1.5

Source: JICA Study Team

16. Construction Plan and Cost Estimates

16.1 Construction Plan

In the initial phase of Lach Huyen Port development, the access channel will be dredged to accommodate 100,000DWT vessel, and the container terminal 1 and 2 and public related facilities as well as the port protection facilities will be constructed.

As for the container terminal yard, it will be handed over to the private contractor after the reclamation and soil improvement work is completed. The procedure of container terminal construction is shown in the flowchart below.

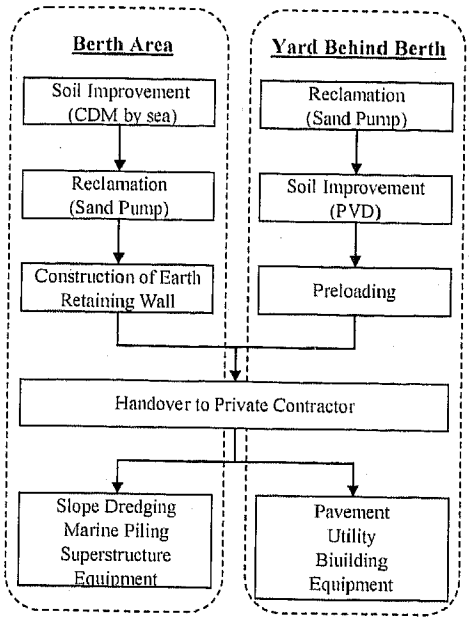


Figure 16.1 Flow chart of container terminal construction

16.1.1 Dredging of the Access Channel

The existing access channel with design depth of -7.2m CD and the width of 100m will be dredged to the elevation of -14.0m CD with the width of 160m and 210m by 2015. After 2015, maintenance dredging of the channel will be necessary. The total dredging volume is estimated around 32,300,000 m3. Japanese cutter suction dredger (CSD) of 6,000ps class shall be mobilized as well as the local dredger and/or barges. TSHD with hopper capacity of 10,000 - 20,000m3 may also be mobilized.

16.1.2 Dumping area for the dredged material

Since existing soil of the channel is not suitable as reclamation material, basically all the dredged material will be dumped in the dumping ground. As designated by Hai Phong PC, the dredged clay will be dumped in South Dinh Vu industrial zone. However, new offshore dumping site shall be studied for more economical and efficient dredging work. The reclamation schedule of South Dinh Vu industrial zone which is planned to be completed by 2013 shall be considered as well.

16.1.3 Soil Improvement by Cement Deep Mixing method (CDM)

In order to handover the berth area to private contractor as early as possible, it is recommended to apply cement mixing method for soil improvement at berth area. CDM barge equipped with twin-auger will lower down the auger until the design depth. After it reached the design depth, the auger will be pulled up while mixing the original soil with cement. The cement will be supplied from the silo barge moored alongside CDM barge.

16.1.4 Port Protection Facilities (Outer revetment and Sand Protection dike)

1) Outer revetment

The total length of outer revetment is 3,230m. The first 720m length of outer revetment will be reclaimed together with the terminal yard by sand pump, and the rest of the outer revetment of 2,510m length will be reclaimed after the terminal yard reclamation completed. The existing ground requires soil improvement by PVD method and preloading. The seabed will be excavated by long arm excavator to place core rubble and amour stone. Then capping concrete will be casted followed by the

installation of wave dissipating concrete blocks such as tetra pod. Installation of wave dissipating concrete blocks will be done by crawler crane on land.

2) Sand Protection Dike

The total length of training dike is 7,600m and it will be basically constructed by the marine work. The stone mound will be directly placed by the long arm excavator mounted on a barge and/or crane barge with orange bucket. Then wave dissipating concrete blocks and toe protection concrete blocks are installed. Installation of these blocks will be done by crane barge.

16.1.5 Public related Facilities

The proposed location of public related facilities is mostly on existing land in Cat Hai Island.

For the marine work part, the reclamation will be carried out in the same way as the terminal yard, and the original soil will be improved by PVD method followed by preloading. After preloading, steel sheet pile as well as RC piles will be driven by land piling machine along the quay line of harbor craft berth. In front of the sheet pile wall will be dredged to the elevation of -4.0mCD by grab dredger in order to secure draft for the service boats.

For the land work part, the existing ground will be paved and the building work will be carried out. The existing ground elevation is around +3.0～4.0mCD and therefore requires earth work to fill up to the design final elevation.

16.1.6 Material Availability

With reference to the sand for reclamation, minimum 250,000m^3/month is required in order not to cause delay or standby for reclamation and soil improvement work. There are estimate of around 53,000,000m^3 of the sand in Hai Duong District. The transportation of the sand is being carried out by small barges with the capacity of 300～500m^3. The mobilization of larger barges or vessels shall be considered for more efficient work.

Rock material for slope protection, outer revetment and sand protection dike can be found around project area, and most of the quarry is located along the river where is convenient for the transportation of the rock.

Other materials such as steel and cement can be found around the project area as well.

16.2 Cost Estimate

16.2.1 Scope of Cost Estimate

The following facilities / works are the scope of cost estimate:

- Temporary facilities for construction
- Earth retaining wall behind the berth
- Access channel dredging
- Reclamation works
- Port protection facilities including Inner Revetment, Outer Revetment and Sand Protection Dyke
- Soil improvement works
- Access road behind the Port
- Public related facilities

- Navigational aids

The following facilities / works are <u>not</u> included the scope of cost estimates:

- Container terminal including container berth, barge berth, apron / yard pavement, buildings and utilities
- Slope dredging underneath the berth
- Berth box dredging
- Dredging between the access channel and the berth box
- Cargo handling equipment

16.2.2 Basic Conditions of Cost Estimate

1) Exchange Rate

- VND 1 = JPY 0.00528
- USD 1 = JPY 89.60

(VND 1 = USD 0.000058928 = JPY 0.00528)

2) Assumed Price Escalation Rate

- Foreign currency portion: 3.1% per annum
- Local currency portion: 10.3% per annum
- Base year used in cost estimation: March 2010

3) Physical Contingency **5%**

4) Consulting Service

Consulting service is calculated based on the schedule of necessary man-power during the construction. Consulting service includes price escalation and physical contingency.

5) Land Acquisition

The cost for land acquisition is considered in the cost estimate. The necessary cost for land acquisition is summarized in Table 16.1.

Table 16.1 Land Acquisition Cost

Present Use	Area (m^2)	Compensation/support Cost (million VND)	
1. Unknown use land between residential building and VTS Station	7,200		237.6
2. Gov. facilities	N/A		
3. Bare ground along the coast with 5 graves	26,300	- Land:	867.9
		- 5 Graves:	34.5
4. Salt pan	N/A		
5. Aquaculture pond	64,700	- Land:	640.53
		- Bank creation:	25.0
		- Facilities:	1,220.8
		- Labor tool:	77.64
		- Fence:	20.0
		- Pond treatment:	97.05
		- Living facilities:	7.0
		- Aquaproduct:	679.35
		- Labor:	7,117
6. Forest	10,200	- Land:	67.32
7. Road	3,500		3,500.0
Total			**7,481.807**

Source: SAPROF Team

6) Assumed Administration Cost **5%**

7) Value Added Tax **10%**

8) Import Tax **10%**

9) Interest during construction (Assumed STEP Loan scheme)

- For Construction 0.2% per annum
- For Consultancy Service 0.01% per annum

10) Commitment Charge **0.1% per annum**

11) Unit Cost used in Cost Estimate

Unit costs of construction items in cost estimate are mainly based on prevailing regulations set by Central Government, Hai Phong City and the latest market price in Hai Phong City as of May 2010. As for the unit costs of materials imported from Japan are based on the market price as of April 2010. The site management cost and overhead and profit of the Contractor are considered in the unit cost.

12) Conditions for STEP application

a) Procurement Conditions

- Prime contractors are tied to Japanese firms. Joint ventures (JV) with recipient countries are also admitted on condition that Japanese firm is a leading partner and the total share of work of Japanese partners is more than 50 %.
- Sub-contractors are untied and opened to all countries

b) Country of Origin of Goods Procured under STEP

- Total cost of goods procured from Japan shall be no less than 30% of the total amount of contract(s) (except consulting services) financed by STEP loan.
- Each contractor should submit a declaration letter for the portion of goods procured from Japan

In the cost estimate, the following construction works / materials are considered to be procured from Japan:

- Channel dredging
- Steel Sheet Pipe Pile, Steel Sheet Pile, Tie Rod, Structural Steel,
- Cement Deep Mixing Method including ALiCC method.
- Mooring Bollards for the quay wall of public facility area
- Rubber Fenders for the qua wall of public facility area

13) Contract Package

The following contract packages for construction are considered in the cost estimate:

Package 1: Dredging of Navigation Channel

Package 2: Construction of Container Terminal, Port Protection Facilities and Public Related Facilities

Package 3: Consulting Services for Construction Supervision

16.2.3 Major Changes in Project Scope / Scale compared to Approved FS

The major change in project scale compared to the initial stage of the approved FS is summarized in Table 16.2.

Table 16.2 Comparison of Main Port Facilities between TEDI and Study Team

Facility / Items	Proposed by Study Team	Initial Stage of TEDI's F/S
Design Vessel	50,000DWT (Full), 100,000DWT (Partial)	30,000DWT (Full), 50,000DWT (Partial)
Container Terminal		
No. of Berth	2	2
Length of Berth	750 m	600 m
Depth alongside Berth	-14.0 m CDL	-14.0 m CDL
Crown Height of Berth	+5.5 m CDL	+5.5m CDL
Earth Retaining Structure	Steel Sheet Pipe Pile Wall	Rubble Mound
Reclamation Volume	2,955,483 m^3	2,636,000 m^3
Soil Improvement	ALiCC: 50mW x 920mL PVD: 564,000m^2	Sand Pile: 420,000 m^2
Port Service Road	Width: 44m, Length: 1,000m	Width: 41m Length: 630m
Access Channel Dredging		
Width	160.0 m / 210.0m	130.0 m
Length	17.4 km	14.0 km
Dredged Depth	-14.0 m CD	-10.3 m CD
Diameter of Turning Basin	660 m	560 m
Dredging Volume	32,300,860 m^3 (Including extra depth)	8,941,000 m^3
Port Protection Facilities		
Outer Revetment	Top elevation: +6.5m CDL Length 3,230 m	Top elevation: +5.5m CDL Length: 3,900 m
Sand Protection Dyke	Top elevation: +2.0m CDL Length: 7,600m	Top elevation: +2.0m CDL Length: 5,000m
Public Related Facility		
Land Reclamation	Area: 132,000m^2, V=344,000m^3 Soil improvement: PVD 21,300m^2	Area: 141,250 m^2
Harbor Crafts Berth	374mL x 30mW x -4mD Sheet Pile Wall structure Dredging: V=104,000m^3	Length: Approx. 270m
Buildings	4,600m^2 for Port Administration, Customs, Immigration, Quarantine, Coastal Guard, Security & Amenity Space	-
Utilities	Electricity supply, Water supply, Fire fighting, Sewage system within boundary.	-
Navigation Aids		
Channel Buoy	Spar buoy: 20 sets	-
Light Beacons	4 sets on sand protection dyke	-
Pilot Assisting System	7 sets	-
Extra Dredging		
Volume due to extra depth	1,262,600 m^3	-
Volume due to sedimentation	2,000,000 m^3	-

16.2.4 Result of Cost Estimate

1) Summary of Project Cost

The total project cost is computed as:

VND 12,561,058,322,289 for local currency portion,

and **JPY 27,131,642,178** for foreign currency portion.

This amount is equivalent to:

17,699,626,916,589 in VND

93,454,030,120 in JPY

As for the percentage of Japan portion, the total of "Construction Cost", "Price Escalation" and "Physical Contingency" are computed as follows:

Item	VND	JPY
Construction cost	6,782,536,322,839	22,028,165,322
Price Escalation	2,742,219,111,537	2,437,148,434
Physical Contingency	476,237,771,719	1,223,265,688
Total	10,000,993,206,094	(1) 25,688,579,443
Total in JPY		(2) 78,493,823,572
Percentage of Japan Portion		(1) / (2) **32.73 %**

The project cost is summarized in Table 16.4, the breakdown of the cost is shown in Table 16.5, and project cost by year is shown in Table 16.3, respectively.

Table 16.3 Cost by Year

Breakdown of Cost	Total (in million JPY)	Public Portion (in million JPY)	Others (in million JPY)
2010	80	80	0
2011	80	80	0
2012	11,948	10,254	1,694
2013	37,339	31,998	5,341
2014	30,408	26,070	4,338
2015	13,348	11,521	1,827
2016	202	197	5
2017	47	43	5
Total	**93,454**	**80,244**	**13,211**

Table 16.4 Summary of the Project Cost

Breakdown of Cost	Foreign Currency Portion (in million JPY)			Local Currency Portion (in million VND)			Total (in million JPY)		
	Total	Public Portion	Others	Total	Public Portion	Others	Total	Public Portion	Others
Package-1	16,473	16,473	0	2,093,062	2,093,062	0	27,525	27,525	0
Package-2	5,555	5,555	0	4,689,474	4,689,474	0	30,315	30,315	0
Price Escalation	2,437	2,437	0	2,742,219	2,742,219	0	16,916	16,916	0
Physical Contingency (5%)	1,223	1,223	0	476,238	476,238	0	3,738	3,738	0
Consulting Service	646	646	0	58,071	58,071	0	952	952	0
Land Acquisition	0	0	0	7,482	0	7,482	40	0	40
Administration Cost	0	0	0	503,327	0	503,327	2,658	0	2,658
VAT	0	0	0	1,504,659	0	1,504,659	7,945	0	7,945
Import Tax	0	0	0	486,526	0	486,526	2,569	0	2,569
Interest during Construction	477	477	0	0	0	0	477	477	0
Commitment Charge	320	320	0	0	0		320	320	0
Total	**27,132**	**27,132**	**0**	**12,561,058**	**10,059,064**	**2,501,994**	**93,454**	**80,244**	**13,211**

Table 16.5 Breakdown of the Project Cost

No.	Item	Unit	Quantity	Local Currency Portion (in VND)		Foreign Currency Portion (in JPY)		Remarks
				Unit Price	Amount	Unit Price	Amount	
I	Construction Expenses							
A	Package-1 (Dredging)				***2,093,062,015,200***		***16,473,438,600***	Public Portion
0	Temporary Facility				***34,851,216,000***		***0***	Public Portion
a	Temporary Yard	m2	8,000.0	4,356,402	34,851,216,000	0	0	
1	Dredging				***2,058,210,799,200***		***16,473,438,600***	Public Portion
a	Access Channel	m3	32,300,860.0	159,300	2,058,210,799,200	850	16,473,438,600	VN40:JP60
b	Wharf Slope Dredging	m3	567,514.0	N.A.	0	0	0	*Private Portion*
c	Berth Box	m3	54,553.0	N.A.	0	0	0	*Private Portion*
d	Between Channel and Berth Box	m3	98,142.0	N.A.	0	0	0	*Private Portion*
B	Package-2 (CT, Protection, Public Facilities)				***4,689,474,307,639***		***5,554,726,722***	Public Portion
0	Temporary Facility				***139,404,864,000***		***0***	Public Portion
a	Temporary Yard	m2	32,000.0	4,356,402	139,404,864,000	0	0	
1	Container Terminal				***79,073,459,100***		***2,350,001,970***	Public Portion
a	Berth Structure	L.S	1.0	N.A.	0	0	0	*Private Portion*
b	Earth Retaining Wall	m	750.0	103,054,818	77,291,113,500	3,027,009	2,270,256,750	
c	Earth Retaining Wall for Barge Berth	m	180.0	9,901,920	1,782,345,600	443,029	79,745,220	
2	Reclamation				***600,087,179,286***		***0***	Public Portion
a	Terminal Area	m3	2,955,483.0	203,042	600,087,179,286	0	0	
3	Port Protection Facilities				***2,473,677,207,710***		***0***	Public Portion
a	Inner Revetment	m	750.0	40,162,324	30,121,743,000	0	0	
b	Outer Revetment-A	m	720.0	193,692,006	139,458,244,320	0	0	
c	Outer Revetment-B	m	2,510.0	198,346,558	497,849,860,580	0	0	
d	Training Dike-1	m	3,110.0	119,133,461	370,505,063,710	0	0	
e	Training Dike-2	m	3,290.0	307,135,810	1,010,476,814,900	0	0	
f	Training Dike-3	m	1,200.0	354,387,901	425,265,481,200	0	0	
4	Soil Improvement				***1,004,710,309,560***		***2,100,315,625***	Public Portion
a	Terminal Area	m2	366,625.0	1,261,246	462,404,314,750	4,665	1,710,305,625	
b	Barge Berth Area	m2	5,000.0	3,373,909	16,869,545,000	78,002	390,010,000	
c	Inner Revetment	m2	4,550.0	2,324,418	10,576,101,900	0	0	
d	Outer Revetment A	m2	13,104.0	2,094,872	27,451,202,688	0	0	
e	Outer Revetment B	m2	52,459.0	5,019,258	263,305,255,422	0	0	
f	Access Road	m2	192,900.0	1,161,762	224,103,889,800	0	0	
5	Access Road behind Port				***62,027,985,000***		***0***	Public Portion
a	Access Road	m	1,000.0	62,027,985	62,027,985,000	0	0	
6	Public Related Facilities (CIQ)				***328,503,425,659***		***472,238,250***	Public Portion
a	Reclamation	m3	344,131.0	203,042	69,873,046,502	0	0	
b	Dredging	m3	103,897.0	223,127	23,182,225,919	0	0	
c	Quaywall	m	375.0	237,948,361	89,230,635,375	1,259,302	472,238,250	
d	Pavement	m2	40,300.0	1,071,745	43,191,323,500	0	0	
e	Building	L.S.	1.0	59,935,258,841	59,935,258,841	0	0	
f	Utilities	L.S.	1.0	28,349,124,722	28,349,124,722	0	0	
g	Soil Improvement	m2	23,600.0	624,653	14,741,810,800	0	0	
7	Navigational Aids				***1,989,877,324***		***632,170,877***	Public Portion
a	New Channel Buoys	nos	20.0	74,547,220	1,490,944,400	28,323,068	566,461,360	
b	Relpace Existing Buoy	nos	3.0	97,456,616	292,369,848	0	0	
c	Light Beacon	nos	4.0	51,640,769	206,563,076	4,531,691	18,126,764	
d	Pilot Assistance System	L.S.	1.0	0	0	47,582,753	47,582,753	
	Total Expense				6,782,536,322,839		22,028,165,322	
II	Price Escalation				2,742,219,111,537		2,437,148,434	Public Portion
III	Physical Contingency (5%)				476,237,771,719		1,223,285,688	Public Portion
IV	Consulting Service				58,071,069,646		645,546,327	Public Portion
V	Land Acquisition				7,481,807,000		0	Other Portion
VI	Administration Cost				503,327,304,137		0	Other Portion
VII	VAT				1,504,658,809,587		0	Other Portion
VIII	Import Tax				486,526,125,823		0	Other Portion
IX	Interest during Construction				0		477,285,786	Public Portion
X	Commitment Charge				0		320,230,622	Public Portion
	Total Project Cost				12,561,058,322,289		27,131,642,178	
	(In VND)				17,699,626,916,589			
	(In JPY)						93,454,030,120	

17. Project Implementation Plan

17.1 Project Implementation Schedule

Considering the standard process and steps necessary for the yen loan agreement, it is estimated that the construction work will commence from middle of the year 2012. As the construction work period required is estimated to be about 41months, the port operation can only be started earliest in July, 2015 as shown below.

Below schedule is the earliest case with the following conditions;

(1) Minimum 250,000m^3/mth of the sand will be delivered to the site for reclamation.

(2) The CDM method (Cement Deep Mixing) will be applied for the soil improvement at berth area

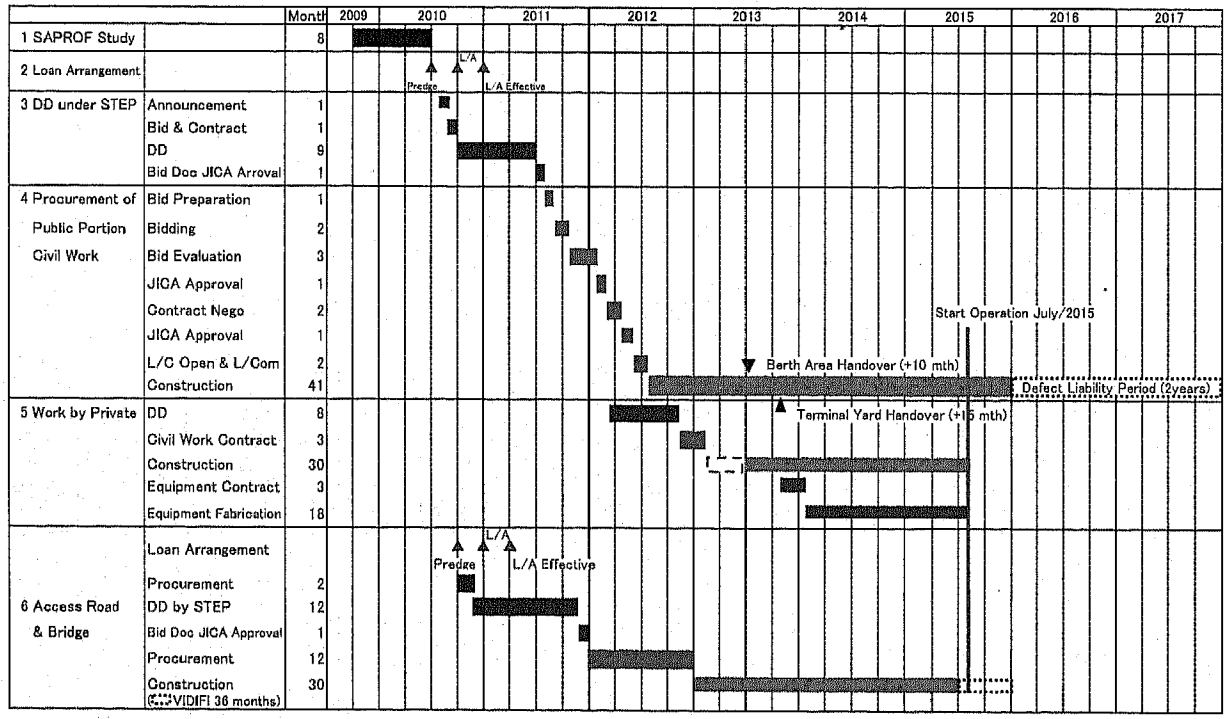
(3) The dumping location is secured during the whole construction period

In order to start the port operations as early as possible, following options were studied (Above implementation schedule is based on the Option-1).

- Option-1 (Original plan): Soil improvement by CDM and PVD method
- Option-2: Gradual opening of the terminal (i.e., start the operation of berth 1 first)

In case when oprion-2 is applied, the opening of the berth 1 will be April 2015, and berth 2 will be September 2015 respectively.

Table 17.1 Project Implementation Schedule



17.2 Organization Structure for Project Implementation

17.2.1 General

The port portion of this Project was determined to be implemented by PPP (public Private Partnership) framework by GOV that is the first experience in Vietnam for port development applying Japan's

ODA loan. Therefore, close coordination between the public portion and the private portion is essential and discussion on important issues including specification and allocation of responsibilities and risks of each side should be held among the stakeholders including MOT, VINAMARINE, VINALINES and other private parties in order to ensure such coordination.

17.2.2 Executing Agency

(1) Public Sector

a) Borrower: Ministry of Finance (MOF)

(For the Port Portion)

b) Line Agency: Ministry of Transport (MOT)
c) Project Owner: VINAMARINE
d) Implementing Agency: Maritime Project Management Unit 2 (MPMU II), VINAMARINE

(For the Road and Bridge Portion)

e) Line Agency: Ministry of Transport (MOT)
f) Project owner: Ministry of Transport (MOT)
g) Implementation Agency: Project Management Unit 2 (PMU 2), MOT

(For Land Clearance, Compensation and Resettlement)

h) Hai Phong People Committee

(2) Private Sector

(For the Port Portion)

a) Project Owner: VINALINES

17.2.3 MPMU II

MPMU II was established in accordance with the Decision 960/2002-QD-BGTVT dated April 4, 2002 of the Minister of MOT. The predecessor of MPMU II was Seaway Construction Unit I (SCU I) established in 1967 under Seaway Transportation Administration of MOT for the management and supervision of Hai Phong Expansion Project Then it became 213 Construction Unit under the Base Construction Administration of MOT in 1969 for managing the Ha Long Shipyard Construction Project.

Since then, MPMU II is ongoing to develop itself in the field of infrastructure construction and performed management and supervision of infrastructure construction in good results. All construction works and projects under management and supervision of MPMU II were highly appreciated by the State and the Employers as well and received diplomas of merit of the State and the Ministry concerned.

Among many infrastructure construction projects, MPMU II had managed and supervised the Cai Lan Port Development Project which was financed by Japan's ODA loan. MPMU II has now 41 professional personnel and of which 37 are university graduates.

17.2.4 Joint Coordination Committee (JCC)

In order to secure the smooth implementation and consistency between the two portion, the port portion and the road & bridge portion, MOT will establish a "Joint Coordination Committee (JCC)" which chairman will be the Vice Minister of MOT and assistant chairman will be deputy director of

Department of Planning and Investment (DPI) of MOT and representatives of relevant stakeholders, such as VINAMARINE, MPMU II, PMU 2, TEDI, VINALINES, MPI, MOF, Hai Phong PC, etc., will be the members of the JCC and they would hold the JCC periodically. JICA requested and MOT agreed that JICA representatives will take part in the JCC.

17.2.5 Organization Structure for Project Implementation

All works for implementation of the Project would be coordinated by the JCC. Figure 17.1 shows organization structure for Project implementation.

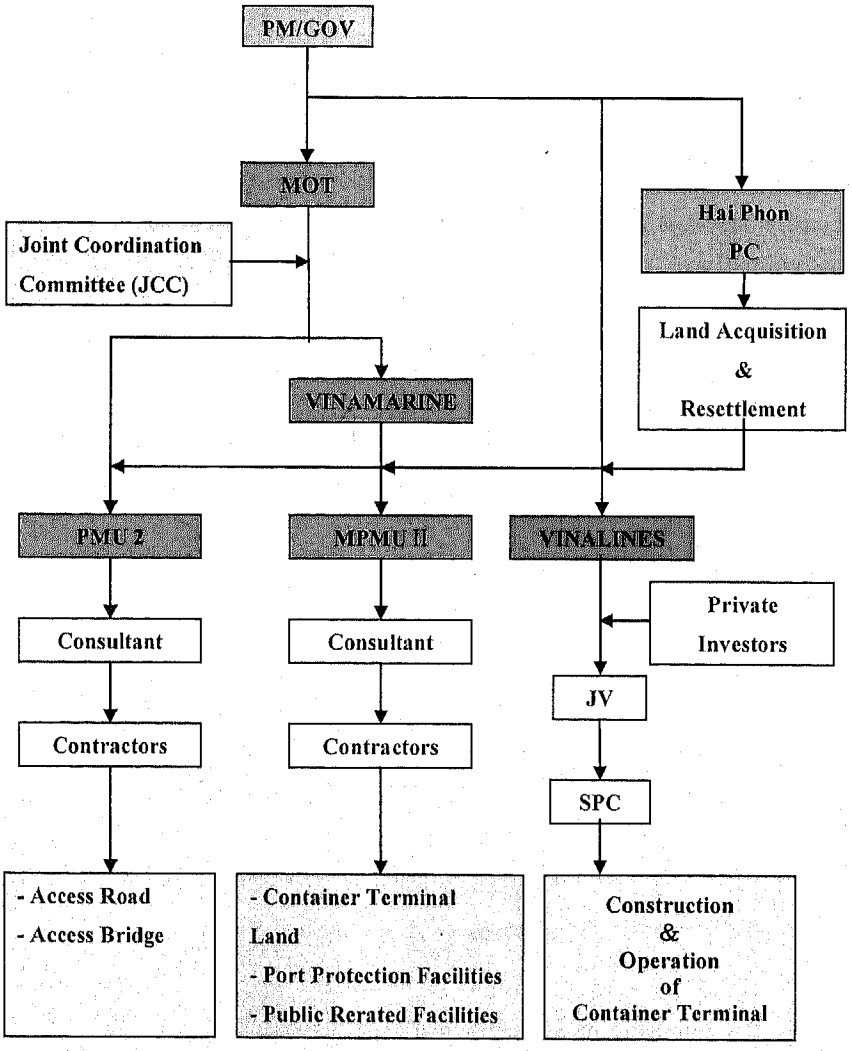


Figure 17.1 Organization Structure for Project Implementation

17.2.6 Organization Structure of SPC

1) Organization Structure

The Special Purpose Company (SPC) will be established as a 100% daughter of the JV company of VINALINES and operated as private company with profit-making obligations.

2) Human Resource need for SPC

Considering the roles of SPC, it suggests that new SPC before and after the commencement of the terminal operation will need approximately 200 and 500.

It should be made explicitly clear that the estimates for the number of necessary personnel for the SPC of the Berth No.1 & 2 remain tentative and that a final decision regarding employment falls entirely under the authority of the private investors.

17.2.7 Operation and Maintenance of Port Infrastructures

1) O & M responsible to Private Sector

The private sector, JV of VINALINES will invest for the construction of berthing structure, dredging in front of berth, road & yard pavement, buildings and utility supply system in the container terminal No.1 & 2. All of these facilities should be operated and maintained under the responsibility of SPC, private operation company under JV of VINALINES.

2) O & M responsible for Public Sector

After completion of reclamation and subsoil improvement of terminal land, 200m wide land behind the terminal and land for public related facilities, the O & M of these lands will be carried out by VINAMARINE or Hai Phong PC.

The Port Owner of VINAMARINE should be responsible for operation and maintenance of other infrastructures such as Navigation Channel, Outer Revetment, Sand Protection Dyke and Public Related Facilities. The maintenance of these infrastructures will be performed by VINAMARINE.

17.3 Financial Implementation Plan

17.3.1 Principal idea for Financial Implementation Plan

Public investment portion shall be mainly financed by Japan's ODA Loan. As indicated in Chapter 16, Japanese technology is indispensable to achieve the successful implementation of PPP scheme. Particularly, critical points are i) the construction method to complete the required work volume in the limited time and ii) the tight construction schedule management. Therefore STEP (Special Terms for Economic Partnership) condition should be applied.

STEP condition is as under;

Interest Rate:	0.2 percent per annum on outstanding balance (as for the cost of Consultant for Supervision: 0.01 percent per annum on the respective outstanding balance) Interest during the construction is also financed by ODA Loan, same as the other loans for Vietnam.
Repayment Period:	40 years including 10 years grace period
Coverage:	100 percent of the eligible finance portion
Commitment Charge:	0.1percent per annum on un-disbursed amount. Commitment Charge is also finance by ODA Loan, same as the other loans for Vietnam.
Currency:	Japanese Yen

The cost of Consultant for detailed design is covered by JICA Technical Assistance Grant* (*This arrangement is only applicable for STEP Loan).

Non-eligible for ODA loan is financed by the Government of Vietnam. Non-eligible portions of the Project are; 1) Administration Cost and 2) Tax and Duties. Although taxes and duties are exempted in accordance with the agreement between Vietnamese and Japanese Government, executing agency should pay the tax as a practice. Therefore the necessary budgetary arrangement is required.

Operation and maintenance cost should be responsible to the Government of Vietnam.

17.3.2 ODA Loan Amount and Annual Disbursement

Disbursement is made according to the progress of the Project. Annual disbursement and total amount of the loan for each eligible portion as well as the interest during construction and commitment charge to be financed by ODA Loan are as shown in Table 17.2.

Table 17.2 ODA Loan Annual Disbursement

Unit: Million Japanese Yen

	2010	2011	2012	2013	2014	2015	2016	2017	Total
Temporary Facility			999			237			1,236
Container Terminal				3,292					3,292
Dredging			4,034	12,851	13,662	4,847			35,394
Reclamation			1,265	3,069					4,334
Port Protection Facilities			2,086	5,521	6,089	6,157			19,853
Soil Improvement			1,578	4,570	3,919				10,067
Access Road behid Port				231	254				485
Public Related Facilities (CIQ)				2,109	957				3,066
Navigational Aids					766				766
Sub Total			9,962	31,643	25,647	11,241			78,493
Supervision Consultant			208	249	286	127	39	43	952
Total			10,170	31,892	25,933	11,368	39	43	79,445
IDC		0	10	52	110	147	158	0	477
Commitment Charge	80	80	75	54	24	6	0	0	319
Grand Total	80	80	10,255	31,998	26,067	11,521	197	43	80,241

17.3.3 Annual Budgetary Requirement

Annual requirement of Vietnamese Government for construction period is shown in Table 17.3.

Table 17.3 Annual requirement of Budget

billion Vietnam Dong

	2010	2011	2012	2013	2014	2015	2016	2017	Total
Land Acquision Cost		7							7
Administratiion Cost		1	69	193	157	83	0	0	503
VAT		0	193	604	491	215	1	1	1,505
Import Tax		0	51	214	173	48	0		486
Total		0	313	1,011	821	346	1	1	2,492

17.4 Contract Packaging

Following two alternatives are compared regarding the contract packaging for the implementation of port portion of Project:

Alternative 1:

Package 1: Dredging of Navigation Channel

Package 2: Construction of Container Terminal and Public Related Facilities

Package 3: Construction of Port Protection Facilities

Alternative 2:

Package 1: Dredging of Navigation Channel

Package 2: Construction of Container Terminal, Port Protection Facilities and Public Related

Facilities

From the consideration of required performance qualification, construction cost, construction schedule, safety of work, responsibility for interface of works, bidding procedure, etc., **Alternative 2: Two (2) Packaging systems** is recommended.

In addition the consulting service for construction supervision for both constructions should be added as Package 3 as follows:

Package 1: Dredging of Navigation Channel

Package 2: Construction of Container Terminal, Port Protection Facilities and Public Related Facilities

Package 3: Consulting Services for Construction Supervision.

18. Financial and Economic Analysis

18.1 Financial Analysis

Financial analysis is made in order to confirm 1) the financial viability of public investment portion and 2) the financial affordability of private investment portion. Since the Project is designed as PPP concept, the financial arrangement is intended to fulfill the requirement of both public and private.

Public sector requires the reasonable return to cover the weighted average capital cost (WACC) in long term. 85.9 percent of the project is financed by ODA loan (STEP condition) and 14.1 percent is financed by the budget of the Government of Vietnam. The budget portion should have a reasonable return to cover the opportunity cost of the capital (15%). WACC is calculated as 0.32 percent.

Financial Internal Rate of Return (FIRR) of the public investment in the middle growth case is 1.24 percent, which is above WACC. It is considered that the public investment is financially viable.

Sensitivity analysis indicates that change of capital cost makes bigger impact on FIRR. Attention should be paid to management of the capital cost.

Private sector requires the return on their equity to cover at least the opportunity cost of the capital. 15 percent is considered as the opportunity cost. At the same time, private banks request the enough margins of the available cash to debt service. Average annual debt service coverage ratio (DSCR) should be bigger than 1.5

Return on Equity (ROE) of the private investment in the middle growth case is 16.2 percent, which is above the opportunity cost. Average DSCR for this case is 1.68, which is above 1.5. It is considered that the private investment is financially affordable.

Sensitivity analysis indicates the change of container handling charges makes bigger impact to ROE as well as the impact on public financial return. Attention should be paid to structure of container handling charges as well as sharing mechanism of the profit regarding berth operation.

Table 18.1 Summary of FIRR, ROE, DSCR Sensitivity Analysis

Case		ROE	DSCR	Public FIRR
Container Volume	High Gowth Case	18.2%	1.68	1.33%
	Middle Growth Case	16.2%	1.68	1.24%
	Low Growth Case	14.0%	1.66*	1.11%
Capital Cost (Public Investment)	Base Case +10 %	16.2%	1.68	0.74%
	Base Case +5%	16.2%	1.68	0.98%
	Base Case	16.2%	1.68	1.24%
Capital Cost (Private Investment)	Base Case +10 %	13.3%	1.53	1.21%
	Base Case +5%	14.7%	1.60	1.23%
	Base Case	16.2%	1.68	1.24%
Container Charges	85$	12.8%	1.44*	0.17%
	95 $ for 40 feet	16.2%	1.68	1.24%
	105$	19.5%	1.93	2.15%

*: Less than 1.0 for the first repayment year

18.2 Economic Analysis

18.2.1 Objectives and Methodology

The objective of the economic analysis is to appraise the economic feasibility for construction project of Lach Huyen Port Project, focusing on the International Gateway Port of Northern Vietnam in the target year 2020, from the viewpoint of the national economy.

Depend on deep-sea international container terminal development project, mother vessels in the trunk line can be accommodated with Lach Huyen Port. This causes transshipment (feeder transport system) will be avoided and larger vessels will be accommodated. The economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the feasibility of the project by extracting benefits of reduction of transport cost/traveling time through the trunk line system in Lach Huyen Port project.

18.2.2 Prerequisites of Economic Analysis

In order to estimate costs and benefits of projects, the following requisites are assumed for analysis.

1) Project Life

- Taking the depreciation period of main port facilities into account, the period of calculation for the economic analysis (project life) is assumed to be 30 years (2021-2052) after the completion of medium term port development project implementation

2) Foreign Exchange Rate

- Foreign exchange rate adopted for this analysis is US$1.00= JPY 89.60, VND1=JPY 0.00528 as of March 2010, the same rate as used in the cost estimation.

3) "With" Case

- "With" case scenario includes construction of Lach Huyen Port in medium term port development project (5 container cargo berths of totally 2,000m in length, 2 multi purpose berths of totally 750m in length, access channel of -14m in depth, sand protection dike, revetment, etc.) for project design target in 2020, also including Tan Vu-Lach Huyen Highway Project for access road and bridge to Lach Huyen Port for the project design target in 2020

4) "Without" Case

- No investment is made for the existing port after 2012. The forecast volume of cargoes is same as "With" case. In the one of the "Without" case, the handling cargo in Hai Phong and Cai Lan Port is transported on the existing feeder service routes. In the other "Without" case, the overflowed cargo more than the port capacity of Hai Phong and Cai Lan is assumed to handle in Hong Kong Port and is transported by land transport between Hong Kong Port and the Northern Vietnam area.

18.2.3 Cost of Projects

The items that should be considered as costs of the projects are Lach Huyen Port and Tan Vu-Lach Huyen Highway Project, maintenance cost and operation costs. The following cost components are employed in the economic analysis:

- Port and Access Road/Bridge construction costs: Estimated costs were converted to the economic costs (see Table 18.2). The construction costs of Access Road/Bridge are based on VIDIFI's F/S report.
- Annual maintenance costs: 1% of initial construction costs of ports and 0.5% of equipment procurement.
- Maintenance dredging cost: 3.44 million m^3 in 1'st year and 0.75 million m^3 after 2'nd year
- Management and operation cost: Number of staff is estimated 500 staffs for new Lach Huyen Port organization, 500 staffs for 5 container terminals and 1,350 staffs for 3 multi purpose berths in 2020. USD 11/TEU is estimated for container handling operation and USD 3/ton is estimated for general and dry bulk cargo handling operation.
- Refurbishment of equipment: every 15 years amounting a half of the capital cost.

Table 18.2 Economic Price of Project Costs for Medium Term Port Development Project including Access Bridge and Road (2020)

Constrcution	Economic Price (1,000USD)
2 Container Berth (-14m depth), Channel (-14m) & Dyke	864,695
Aditional 3 Container Berths & 3 General Cargo Berths for Medium Term Development (2020)	734,939
Access Bridge & Road	397,180
Total	*1,996,813*
Total O/M Cost (2011-2052)	**Economic Price (1,000USD)**
Maintenance Dredging	85,808
New Lach Huyen Port Management Body	107,160
O/M Cost for Container & General Cargo Berths	2,960,055
O/M Cost for Access Bridge & Road	63,737
Total	*3,197,134*

18.2.4 Benefits of Projects

Owing to the Lach Huyen International Gateway Port projects, Vietnam economy enjoys:

(1) Reduction of transport cost due to trunk line system by accommodation with mother vessel avoiding from the existing transshipment transport system

(2) Reduction of transport cost by accommodation with bigger container vessels

(3) No vessel waiting time for until the rising of the tide due to shallow channel

(4) Shorter transport service time

(5) Enhancement of transport reliability

(6) Promotion of logistics business

(7) Promotion of FDI businesses at the port and along the connecting highways

(8) Improvement of maritime transport safety

(9) Increasing employment and income regarding Lach Huyen Port Terminal

(10) Increasing employment and income regarding port related industry

(11) Increasing employment and income regarding Lach Huyen Port Terminal

(12) Increasing employment and income regarding Lach Huyen Port Terminal Construction

(13) Stability and development of regional industry

(14) Improvement of international competitiveness of industry

From various benefits of the Projects, items above (1) to (2) are adapted to EIRR analysis as direct economic benefits.

18.2.5 Economic International Rate of Return (EIRR)

1) EIRR Results

EIRR of the base case of the Lach Huyen Port project with Tan Vu-Lach Huyen Highway Project is estimated at 23.9%/annum. The rate exceeds the social discount rate or opportunity cost of capital in the Vietnam.

Accordingly, it can be concluded that the project is economically feasible.

2) Sensitivity Analysis

In order to examine the feasibility of a project when the given assumptions are changed, the following sensitivity analysis is carried out.

- Project costs increase by 10% and 20%, and
- Project benefits decrease by 10% and 20%

On the results of sensitivity analysis, Lach Huyen Port project can be concluded that the projects are economically feasible, even if the project cost is increased 20% and at same time, the benefits are decreased by 20% from the base case. (See Table 18.3)

Table 18.3 Sensitivity Analysis of EIRR for Medium-tem Development Project in 2020 (5 Container Terminals and 3 Multi Purpose Terminals)

		Benefits		
		Base case	10% down	20% down
Project Cost	Base case	23.9%	21.9%	19.7%
	10% up	21.9%	20.1%	18.1%
	20% up	19.7%	18.6%	16.6%

3) EIRR for Short-term Development Project (2 Container Terminals)

For reference, based on following components, the short-term development project (2 container terminals) is also considered for analyzing of EIRR.

The benefit concept of "With" and "Without" cases are same condition as economic analysis for

medium term project. The cargo handling capacities of 2 container terminals are assumed 890,000TEU per year. And the period of calculation for the economic analysis (project life) is assumed to be 30 years (2015-2046) after the completion of short-term port development project implementation.

EIRR for the Short-term Project (2 Container Terminals) is estimated at 14.3%/annum. Therefore, the project is economically feasible for both short-term and medium-term development project

Table 18.4 Sensitivity Analysis of EIRR for Short-term Development Project (2 Container Terminals)

		Benefits		
		Base case	10% down	20% down
Project Cost	Base case	14.3%	12.8%	11.1%
	10% up	12.8%	11.4%	9.9%
	20% up	11.1%	10.3%	8.8%

19. Performance Standard Indicators

There are several types of indicators to evaluate the performance of port activities that are widely accepted in the world port industry. These indicators are used to monitor the productivity, efficiency and cost competitiveness of the port.

As being rated as a world-class container port, it is recommendable to use following performance indicators as the minimum guidelines for measuring Lach Huyen port performance to be satisfied by January 2017 (within two years after commencement of Lach Huyen port operation).

Table 19.1 Performance Guidelines

	Measuring Item	Guideline
1	Berth Occupancy Rate	30%
2	Container Dwell Time	6 Days
3	Throughput	500,000TEU in 2016 750,000TEU in 2020
4	Maximum DWT of Vessels Docked at Berth One and Two	More than 50,000DWT vessels

JICA is going to review and appraise these performance indicators in 2017 in order to justify the government initiative to grant capital investment for upgraded deep-water container berths at Lach Huyen port.

20. Operations and Management Organization

Private enterprise participation in the port development, management and operations emerged as significant issues in the 1980s and is very common trend not only in the developing countries but all over the world, especially for the construction of a new large container port.

The primary reason of a proliferation of private sector participation in the port industry is financial constraints on the part of the public sector. Another advantage expected by the PPP in the port management and operations is to improve port productivity and to enhance handling efficiency in order to meet port customer's expectation.

An increase of private sector participation in the port operations, however, does not necessarily mitigate the responsibility of the public sector in the management and operations of the port. Rather it will require a more effective involvement to check the private sector activities that tends to focus on

the short-term revenue generation instead of long-term perspectives aiming at the growth of national economy through efficient and economical operations in the port.

Unrestricted PPP tends to ignore the public interests including environmental consideration and living condition of the people. Moreover it sometimes results in monopolization, which leads to high cost of service. A private monopoly is one of the more contentious issues to introduce port privatization.

As the landlord owners' function, the majority of the world port administrators engage in the development and maintenance of the basic port infrastructure such as anchorage, fairway channel, wharf, etc.

Another important role of the port administration in the port management is the obligation to protect the public interests. Since the port plays a significant role for development of the national economy, the administration must put an importance of maintaining the national port system as a part of effective nationwide distribution network.

Especially rapidly expanding economy such as Vietnam it needs an efficient, economical and effective distribution management, in which ports become a critical component of nation's total logistical transportation network.

Also the port land and facilities are a part of precious national assets. In this regard, government sovereignty, public interests and public ownership of port properties should clearly be identified and protected.

Under the guideline of GOV, VINALINES will team up with competitive private sector enterprise(s) to make up a joint venture company that will finance the projects for the infrastructures and superstructures at Lach Huyen Berth One and Two.

21. Collaboration between Public and Private Sector

In order to make the Lach Huyen port development plan more realistic and effective by taking advantage of public and private partnership, SAPROF team has proposed various recommendations e.g.

- Construction of a Port Administration Building that will house governmental agencies including CIQ (Customs, Immigration and Quarantine) offices, Maritime Administration, Maritime Safety Company, Pilot, Tugboat companies, etc;
- Providing a mooring facilities for Port Service Area for tag boat, pilot boats and other small crafts;
- Constructing a 750M berth for a 50,000 DWT ship for full load and a 100,000 DWT ship for partial load;
- A 160M width –14M CDL for access channel for the passage of above sized vessels;
- Reclamation and Soil Improvement should be borne by the public investment.

For the success of this PPP project, a close well-devised work plan is decisively indispensable for both public and private sectors. Possible contention from the private side may include:

(1) A concrete timetable and commitment by the government on the completion of works of the following components;
   - Land Reclamation and Soil Improvement
   - Access channel dredging
   - Cat Hai Bridge and Port Access Road

A synchronized coordination between public sector and private sector is a key for success of this project.

(2) An introduction of Berth Three and Four should be adjusted in order to ensure sound throughput growth at Berth One and Two. The insistence by the private investors of first two berths is that unless the container volume at Berth One and Two exceeds certain planned level, at least of 60% of 810,000TEU or otherwise subject to negotiation with JV operation company, the government should not commence construction of Beth Three and Four;

22. Mitigation Measures for Environmental Impacts

22.1 Natural Environment

1) Construction Stage Mitigation Measures

a) Sourcing of materials for construction of port facilities

The proposed construction plan for the project duly confirmed that the procurement of all required natural resources for construction could be supplied by legally certified suppliers located close to project site in Hai Phong and nearby Hai Duong areas. In this regard it is noted that some of those areas mentioned in the EIA Report (Appendix 1) for souring of construction materials like sand are located far away from the project site (the proposed locations for souring of sand at Son Lo, Vit Tri and Phu Tho are located very far at upstream Red River reaches of Hanoi) and it is not necessary to go this far to procure materials required for construction works.

b) Dredging and dredged material management

Maintenance dredging works for the existing approach canal to the Hai Phong port has been done periodically over a long period of time and hence Hai Phong port has a lot of experience in dredging and dredged material management disposal in the area planned for the port construction works. In this regard also locations suited for disposal of dredged materials have been agreed upon among all relevant stakeholders. Among those locations the planned South Dinh Vu (Nam Dinh Vu) reclamation area is the largest and easily accessed coastal area with capacity to receive even up to 50 million m3 of dredged material. The quantity of dredged material, though not significantly contaminated and could be regarded as natural dredged material, is quite large in the order of 30 million m3 principally due to access canal deepening requirement. Still it is less than the available capacity of 50 million m3 in the South Dinh Vu Area. Accordingly it is proposed to dispose the entire dredged material derived by this project in this easily accessed Nam Dinh Vu area.

Still due to some unknown constraints during detailed engineering more alternative sites for the disposal of dredged materials may be required to be investigated including potential sites for offshore disposal if such large quantity of dredged material could not be disposed in a timely manner in Nam Din Vu area. In such a case environmental effects and mitigation measures for other locations and means of disposal like offshore disposal shall be studied as component of change in design of dredging works of the detailed engineering design and the relevant additional (supplementary) EIA Report shall be formulated for approval by MONRE prior to the start of construction works.

c) EHS aspects of construction works

Due diligence to ensure implementation of necessary environment, health and safety (EHS) measures in integral manner during the execution of the construction works by the construction contractor need not be overemphasized considering also the location of the construction works in offshore area. Contactor as the first priory shall ensure the safety of his construction works and

workers with strictly in compliance with "Safety First" concept that would also include mandatory use of necessary safety gears (personal protective equipment/PPE) by the workers. Moreover, all wastes generated due to the construction works including living wastes generated by the work force has to be managed sanitarily and treated as appropriate and disposed in such a manner so as not to cause water pollution and in the sensitive offshore area of the construction site located near Cat Ba Island (protected national park and ecotourism area) and also to ensure the cleanness of the work environment, which is also important to mitigate any disease and health issues in the work force attributed to unsanitary or unhealthy environmental condition.

Moreover, contractor shall conduct (may be obliged to conduct) periodic regular environmental monitoring in both on-land area of Cat Hai Island (ambient air quality and noise monitoring, in particular monitoring of suspended particulate matter/dust in ambient air of construction site and its vicinity) and offshore area of the construction site at Lach Huyen Estuary (estuarine sea water environmental quality monitoring) by using the services of an independent reputed organization to conduct all such environmental monitoring related sampling and analysis work.

In this regard, the required environmental monitoring plan is basically incorporated on a preliminary basis in the approved EIA Report. Still, the monitoring plan proposed in the EIA Report is quite similar and not clearly delineated between the monitoring requirement for construction and operation stages of the project, which would be different from each other. Accordingly, the required environmental monitoring plan clearly delineated between the construction and operation stages of the Project needs to be formulated during the detailed engineering and the required environmental monitoring requirement during the construction stage of the project will be duly included in the technical specifications and contract tender documents in accordance with relevant contract packages.

2) Operational Stage Mitigation Measures

Comprehensively, the required overall environmental mitigation measures could be categorized as EHS (environment, health and safety) of port operational management.

a) Port operational safety

Concerned to direct port terminal operation, overall operational safety including the safety in cargo handling work and work force, in particular with respect to the handling of container cargo, is the most important aspect to be duly followed by port authority. In addition navigational safety of ship maneuver and berthing is the important aspect of near-shore safety of ships and vessels around the coastal waters of the port area. Moreover, the necessary facilities and resources to deal with emergency situation like vessel accidents, vessel drifting, and fires including accidental oil spills need to be incorporated and ready for action at short notice as the emergency management system of the port operation. These are in fact essential technical requirement to be met for effective port operational management.

The present in this port development plan up to the year 2020 is confined to handle only container and general cargo. So no oil terminals to handle large quantity of oil as cargo (oil tanker vessels) and also significant noxious liquid cargo in bulk form (chemical tanker vessels) that would correspond to also generation of significant wastes corresponding the Annex I and Annex II of MARPOL 73/78 of IMO would be involved. Accordingly, potential oil spill emergency is expected only in very rare instance.

In this respect, even in future, provision of oil terminal facility in such a sensitive coastal water environmental area located in the vicinity of a number of protected and ecotourism oriented terrestrial and marine environmental areas of both national and international importance, namely, Cat Ba Island cum Lan Ha Bay and Ha Long Bay need to be carefully investigated along with alternative sites elsewhere since the risk of ecological damage caused by potential accidental (and

large-scale) oil spill consequent to oil tanker vessel accidents to the protected coastal marine environment (and also to tourism) could be very severe even with the provision of all the necessary facilities to handle potential oil spill as significant component of emergency management system of port operation.

b) Port waste management

Considering the proximity of the port to Cat Ba Island located basically at a distance in the range of only about 1 to 3 km away from the port across the Lach Huyen Estuary, minimization of waste generation at source in the first place consequent to the operation of port terminal and related facilities such as warehouses and cargo handling works (in particular potential excessive dust generation consequent to the handling of general cargo need to be controlled since container cargo is in packed form within containers and hence regarded as clean cargo) and effective management of all wastes generated both consequent to port operation and ship berthing activities is utmost important. In this respect the necessary waste reception, treatment and disposal systems shall be incorporated as integral component of the port design. The necessary port waste management facilities are included in the approved EIA Report.

The effective operation of all relevant waste reception facility in the port shall be complemented with an effective surveillance system to mitigate illegal dumping of wastes by ships and vessels (with high levy as fine to deter illegal dumping) within the port waters and its vicinity.

The waste management system for the port operation would also include effective management of periodical maintenance dredged materials. Periodic maintenance dredging would be necessary in the access channel to ensure continuity of design navigation depth. As far as possible near-shore disposal as practiced currently in the existing Hai Phong Port will be continued. Moreover, other potential beneficial uses such as ecological restoration of coastal areas of Bach Dang Estuary also recommended to be given due consideration. In this respect feasibility of creation of mangrove vegetation at the rear side of the port terminal facing the Nam Trieu Estuary using the maintenance dredged material as soil conditioner as a means of ecological enhancement in the surroundings of the newly created port is recommended to be studied after commencement of port operation.

The above environmental protection and mitigation measures focused on the EHS of overall port operation shall be complemented with the implementation of regular periodical port environmental monitoring focused at least as the first priority on the monitoring of surrounding estuarine coastal port water environment of Lach Huyen Estuary including the coastal area of Cat Ba Island facing the port.

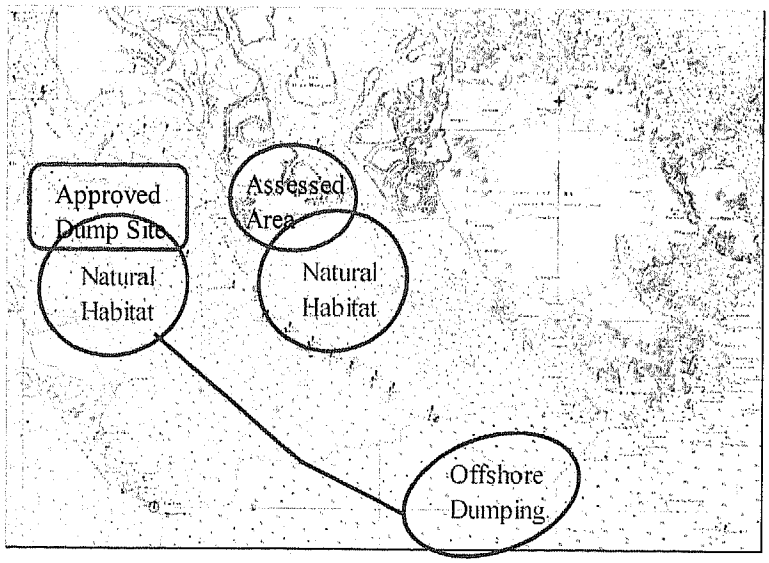


Figure 22.1 General Location of the Potential Mitigation Measures

22.2 Social Environment

1) Significant Aspects of Preparation Stage of the Project

Land acquisition and safeguard policy for coastal fishing activities are two primary social impacts to be addressed. Based on the discussion with MPMU II, some public facility area (presently salt pan and road) proposed by the SAPROF can be avoidable. Summary of the mitigation measures for the land acquisition is shown in Table 22.1. As there are some gap between JBIC Guideline/WB OP 4.12 and Vietnamese safeguard policy, it is recommendable to refer the resettlement policy framework (RPF) of "Northern Delta Transport Development Project", which is ongoing project by MOT supported by the World Bank. Though the RPF is different donor project, it is reasonable to refer the RPF due to the consistency of ODA projects' safeguard policy in the same region and same ministry as well as the original reference of the JBIC Guideline. In addition, the safeguard policy should also cover the safeguard measures for potentially affected coastal fishermen. Due to the lack of legal status for the coastal fishing activities, it is hardly to compensate under the present legal framework in Vietnam. However with the definition of WO OP4.12 (article 16), it is not necessary to compensate by money but support for livelihood recovery or vocational training for job transfer. It is actually preferable to provide prolong solution rather than pinpoint money solution. Based on the local communities' demands, vocational training for the new job opportunities is preferable for the sustainable solution in the communities.

Table 22.1 Summary of the Expected Impacts and Recommended Mitigation Measures

Present Use	Area (m^2)	Recommended Mitigation Measures
1. Unknown use land between residential building and VTS Station	7,200	There are no sign of land use at this moment so that it is recommendable to acquire the land either it belongs to public or private. The compensation shall be settled by the compensation policy of Hai Phong City (Decision No 130/2010/QD-UBND)
2. Gov. facilities	13,600	It is recommendable to continuously utilize the existing facilities (border control and the VTS station) without major change in facilities and properties. In case of need for land acquisition, it shall be followed by the Decision No 130/2010/QD-UBND.
3. Bare ground along the coast with 5 graves	26,300	This portion is necessary to be acquired for the public facilities. At this moment, there are no sign of land use except 5 graves. 5 graves shall be relocated by the full support of responsible authorities following Decision No 130/2010/QD-UBND.
4. Salt pan	1,500 **Reduced to 0**	It is recommendable to avoid the land clearance since this portion could be avoidable by the rearrangement of the public facilities. VINAMARINE/MPMU II are also agreeable to avoid the land clearance of the salt pan.
5. Aquaculture pond	64,700	This portion is necessary to acquire the land for the public facilities. At this moment, there are no sign of aquaculture usage. The aquaculture ponds belong to the border control office. The compensation shall be settled by Decision No 130/2010/QD-UBND.
6. Forest	10,200	This portion is necessary to acquire the land for the public facilities. The forest belongs to the local community and there are no sign of the environmentally essential species. The compensation shall be settled by Decision No 130/2010/QD-UBND.
7. Road	4,300 **Reduced to 3,500**	Due to the VINAMARINE/MPMU II's preference and possibility of the design arrangement, one of two roads could be avoidable to aquaculture. As a result the necessary land acquisition could be reduced to 3,500m^2. Although both roads will be cut off by the Tan-Vu – Lach Huyen Highway, it is required to maintain the function of the existing two roads connecting between Cat Hai TT and Got harbor. Such counter measures shall be prepared by the responsible implementation agency of the highway.

2) Significant Aspects of Construction Stage of the Project

1) Labor safety and community health, 2) Socio economic impacts, and 3) Coastal Fishing are three primary impacts to be addressed.

1) Considering the labor safety, proper training and management is essential. As the responsible agency for the project implementation, MPMU II shall include the supervisory mechanism to ensure the contractor's EHS training and enforcement on the ground in the EMP.

As for the control of the transmittable diseases, proper supervision and collaboration with contractors for the health care training are recommendable. Since the self protection is the most effective measures to control such diseases, periodical and continuous efforts to maintain the workers' and local

communities' awareness are recommendable. Control of the physical contacts between immigrant workers and locals, such as workers' township, would be another recommendable option to reduce the risk.

2) It is highly recommendable to control the expected sharp inflation of pricing in the Cat Hai island. In order to maintain the affordability of goods for the local communities, it is recommendable to monitor the price indexes and affordability/income level of the local communities. Such monitoring result shall be shared among MPMU II and local authorities to consider necessary measures if it is necessary. Physical separation between local communities and workers community would be a solution for the initial stage by means of sufficient goods supply in the workers' township.

Follow-up for the resettlement would be another important matter in the construction stage. Due to no requirement for the residential resettlement, follow-up for livelihood support should be focused. Although MPMU II is not responsible for the implementation of the safeguard policy, it is recommendable to include a mechanism to check the appropriate implementation of such policy in EMP. If it is necessary to improve such safeguard measures, MPMU II shall coordinate responsible authorities to ensure the effective implementation as the responsible agency for the project implementation.

3) In order to monitor unexpected negative impacts on fishing communities, it is recommendable to conduct periodical sample survey including the fish yield and income level of the project affected fishermen. If it is necessary to provide additional support based on the sample survey result, responsible authorities shall consider modification of the safeguard policy for coastal fishing or additional counter measures such as encouragement of job transfer. In the case of necessity to improve the safeguard policy for the coastal fishing, MPMU II shall coordinate responsible authorities to improve the modified policy as the responsible agency for the project implementation.

3) Significant aspects of operation stage of the project

For the consideration of the social environmental impacts during the operation stage, monitoring the implemented safety guard measures in the previous stages would be the primary matter in this stage. As a part of environmental management plan (EMP) and responsibility of the implementation agency, MPMU II shall supervise VINALINE and other private operators to ensure the EMP including the proper implementation and follow-up of the safe guard policies.

23. Navigational Safety and Vessel Traffic Control

23.1 Natural Environment

About the wind condition, the frequency of the wind velocity more than 10m/sec is 2.26%. The prevailing wind direction in the category 10-15m/sec is SSE (37%) and East (24%). Although frequency of strong wind more than 10m/sec is rare, in case of East wind, the vessel drifts to the side end of the channel due to receiving the wind from the side. It is possible to affect to the vessel maneuvering.

About the current condition, the survey in January 1987 that average current speed is 0.3 – 0.5m/sec. It is not so serious to large vessel. But, due to the effects of wind and wave generated flow, the current velocity becomes the maximum speed of 1.0 to 1.2m/sec (2.3knots) at flood as well as ebb tide and may reach to the greatest speed at 1.5 to 1.8m/sec during ebb tides at the river estuaries. It is expected that current direction is alongside the river. It is expected that the influence by current is small because the vessel receives current from head on or following.

About the wave condition, according to the wave height at Hon Dau Station (2006 – 2008), the wave height that is less than 1.0m occupied 91.4% of occurrence. The category wave height 0.5 - 1.0m occupied 47.1% of occurrence. In this category, the wave in the East occupied 54.6%. It is not so

serious maneuvering for a large vessel.

About fog frequency in Hai Phong, the fog occurrence concentrates in winter season from December to April. The average frequency of foggy day is 21.2 days annum and 6.5 days in peak month of March. Although it is not high frequency in average, it is possible to be in fog when the vessel is passing the channel. Accordingly, it is indispensable to know its definite position, clearance to the side end of the channel, other vessels location, etc.

23.2 Vessel Traffic Environment

According to the calling vessel record of Hai Phong Port in 2006, 2,960 vessels entered to Hai Phong Port, and the maximum number of the vessel was 277 in month (August and October). The number of the vessel in 2nd and 16th in August on each hour, the maximum number of the vessel is at most 4 vessels. Accordingly, it is expected that the conflict with other vessel is relatively small. But the handling cargos and calling vessels are more and more increase in Vietnam. It is necessary to evaluate about efficiency of the vessel traffic in prospective cargo volume.

23.3 Activity of Fishing Boats

The fishing activities is catching small fishes by the fixed shore net, the throwing net, the setting bait net and so on around shallow water area. There is no large fishing boat that is catching fishes by the trawl net. Basically the fishing boats operations are not carried out in the channel, if they were to work in the channel, the Maritime Administration would instruct directly them to go out from the channel by their boat. Accordingly, it does not affect to the vessels that are passing the channel. However, it may have a risk that capsizing of the fishing boats that is operated on close to the channel.

23.4 Navigation Assistance

1) Pilot

There are 39 pilots in Hai Phong area (as of April 2010). The pilot who is able to maneuver to 100,000DWT container ship is the Premier Class (currently 7 pilots available).

2) Tug Boat Assistance

In the current situation, there is only one 3,200HP tug boat in Hai Phong Port.

Under 5m/sec wind, the force of wind is estimated 25.1ton, this force is less than the usual tug power (85% of maximum power), one tug boat is enough under this wind condition. However, under 10m/sec wind, the force of wind is estimated 100.3ton, it is required three tugs. In addition, under stronger wind, it is required additional tug. Actually, a large container ship expects to have the thruster with almost the same power as a large tug boat. Accordingly it is possible to reduce the tug boat, however tug boat is insufficient for the large container ship in the current situation.

3) Vessel Traffic Control

Planning of vessel's berth and un-berth schedule is made by Maritime Administration after consulting with port operators and pilots. Basically it does not occur that berthing vessels and un-berthing vessels exist at the same time. However, it is allowed vessel's passing in some areas for passage allowance. Although VTS exists in Hai Phong (east part of Cat Hai) at present, VTS system has just been installed and it is used on trial. It has two radars and AIS monitor and some communication devices. However, since the north part of chart data is old, the radars have not been operated in the current situation. VTS operators are able to know about vessel's location and moving by the vessel notice position and AIS monitor. The operator not only monitors vessels but also gives instructions to vessels when some vessels are close each other.

4) Buoys in the Lach Huyen Channel

Along the current Lach Huyen channel, 26 buoys are set on both sides about every 1,600m.

23.5 Requirement of Function in Lach Huyen Channel

1) Buoy in Lach Huyen Channel

A beacon has the role of indicating a boundary, but it also serves as an obstacle to vessels in operation. The passage for a 100,000 DWT class container ship along a designed channel with a breadth of 160m is considered to be a narrow channel with a restricted navigable area of water. In the restricting water area, it is expect that the beacons become obstacle to vessels in operation. Accordingly, beacons are arranged one after the other at one side.

Table 23.1 shows the specification plan of the buoy. The type of existing buoys is the floating buoy, however the floating buoy moves easily by wind and current. In addition, as water depth will be deeper in the future (-14 m), the moving range of the buoy will be wider than the present. Accordingly, it proposes the Spar Buoy that is able to designate specific position of side edge of the channel.

Table 23.1 Specification Plan of Buoy

Specification		Example
Type	Spar Buoy	Spar Buoy
Light Source / Power	LED / Solar Cell	Height: abt.21.0m
Flashing	Synchronized	Focal Plane Height: abt.7.6m
Luminous Range	more than 4nm	Weight: abt.5.8t

Table 23.2 Cost of Installation / Replacement of Buoy (Approx.)

Description	Nos. of Buoy	Cost
Total Cost of Installation / Replacement of Buoy	23	JPY 508,311,158 USD 5,673,116

2) Light Beacon on Training Dike

The training dike is planned at a position 1,000 m from the edge of the channel (approximately 7.6 km long). The water depth in fairways other than the Lach Huyen channel is very shallow and passage of a large vessel is impossible. However, use of the fairway by small craft and boats may be considered. Against the height of the training dike, i.e., CD + 2.0m, the water depth at high tide is CD + 3.55m, so the training dike could be submerged and becomes invisible during high tide, thus beacons suggesting the positions of the training dike are necessary.

Table 23.3 Specification Plan of Light Beacon on Training Dike

Specification		Example
Type	Light Beacon	Straight Light Beacon 5m Type
Height of Light	more than 5m	Height: abt.5.43m
Light Source / Power	LED / Solar Cell	Height of light: abt.2.25m
Luminous Range	more than 5km	Weight: abt,395kg
Installation Interval	2,000m	

Table 23.4 Cost of Setting on Light Beacon (Approx.)

Description	Nos. of Unit	Unit Price	Total
Install of Light Beacon	4	JPY 4,240,672 USD 47,329	JPY 84,813,448 USD 946,579

3) Installation of Pilot Assistance Device

In a narrow channel, it is extremely important to instantaneously identify the accurate position of the own vessel within the channel, deviation from planned course, leeway angle, and clearance from the side edge of the channel when the vessel approach to the berth, or carrying out berthing/un-berthing operations. In this situation, basically, the pilot operates on the bridge wing outside the wheelhouse. In such a case, the pilot cannot see information of the equipment inside the wheelhouse. Accordingly, it is necessary for the pilot who maneuvers the vessel to have an information-assisting system capable of enabling him to acquire correct position, deviation, lee-way, distance to the side end of the channel, and the distance to the berth etc.

Proposed in Table 23.5 is a pilot information-assisting system.

Table 23.5 Proposal for Pilot Assistance System

Function of Pilot Assistance System	
Device / Chart	Personal Computer / ECDIS
Ship's Location	GPS
GPS / AIS Data	Use Pilot Cable of AIS device
	Display vessel wake on screen
Other function	Display vessel information (velocity, lateral speed, leeway angle etc.) on screen
	Display other vessel that has AIS device on screen etc.

Table 23.6 Cost of the Pilot Assistance System (Approx.)

Description	Nos. of Unit	Unit Price	Total
Pilot Assistant System	7	JPY 6,000,000 USD 66,964	JPY 42,000,000 USD 468,750

Note: including installation / instruction

23.6 Problems to be solved

(1) The full load draft of a planned 50,000DWT container ship is considered to be approximately 12.7m, and the partial load (80% of full load) draft of a planned 100,000DWT container ship is considered to be approximately 11.8m. Therefore, it is hard to think that the vessel can proceed in the channel with a sufficient under-keel clearance. Under such a condition with a small under-keel clearance, the maneuverability of the vessel is significantly deteriorated due to shallow water effects.

The approach run of the vessel to the Lach Huyen container terminal is featured by a progressive speed reduction as the vessel approaches the berth to the extent that the final speed becomes as slow as 2 or 3 knots. As the vessel's speed decreases, the impacts of wind, waves, and tidal currents increase, making maintenance of vessel's position significantly difficult. Further, on the berth front, turning motions are required, and strong impacts of wind and tidal currents such as drift currents are received.

It suggests that there is a need to judge whether or not ship-handling safety when a 100,000DWT container ship received by this port for the first time can be well verified through, for example, a

ship-handling simulator for the entire process of proceeding in the narrow and shallow channel, berthing and un-berthing operations, while receiving shallow water effects, and influences of winds, waves, and tidal currents, and successfully and safely making the final approach to the berth. By making use of the results of verifications, there must be discussions on the required tug assistance for the safe passage of the vessel through the channel, and berthing and un-berthing ship handling, as well as the acceptable limits of critical wind speed, etc.

(2) Operational records for 2006 show that the maximum number of vessels entering the port classified by time belt is four or thereabouts at maximum, and the number of vessels leaving the port is about two. It is therefore considered that there would not be much of a restrictive influence on vessels leaving the port when a large container ship enters. However, that the volume of cargo in North Vietnam is increasing year by year, and in association therewith the number of large vessels entering the port is also tending to increase.

When using the Lach Huyen container terminal, negative effects such as the need to reduce vessel's speed within the channel, and the required turning motions at the berth front with a consequential longer time occupying the channel must be taken into account as factors extending the waiting times of other vessels. It is, therefore, desired that a study be conducted on operational efficiency, paying due account to a future increase of vessels entering the port.

(3) No fishing operations are carried out within the channel, but in waters near the channel, some fishing operations are conducted, and fix shore nets are arranged in waters in the vicinity. It is feared that these small fishing boats would be vulnerable to the effects of big waves produced by large container ships (effects of ship motions) when they proceed, resulting in the small fishing boats capsizing. Furthermore, when the berth is extended in the future, we are concerned about the mooring effects caused by the motions of a moored vessel and effects of cargo operation.

It is desired that studies be carried out in the future on the effects of the motions of a large vessel and resultant waves produced when a large vessel is proceeding in the channel.

24. Conclusion and Recommendation

24.1 Demand Forecast and Port Development Scale

The estimated container cargo volume are 3.59 million TEU in 2015 and 5.08 million TEU in 2020 and the general cargo and bulk cargo volume are 11.2 million ton in 2015 and 12.9 million ton in 2020 for Northern Vietnam. These cargoes should be shared by Hai Phong port, Cai Lan port and Lach Huyen port. As a result, the container volume and general & bulk cargo volume for Lach Huyen Port are estimated as 2.23 million TEU and 2.38 million ton respectively in 2020.

In order to handle these cargoes in Lach Huyen port in 2020, the **five (5) container berths** (L=375m x 5, D= -14m CDL) and **three (3) multi-purpose berths** (L=250m x 3, D= -13m CDL) need to be constructed.

24.2 Container Berth No.1 & No.2 Development by 2015

In the frame work of Medium Term Development Plan of Lach Huyen Port for target year of 2020, the first two (2) container berths has been decided to be implemented by VINALINES as a Project Owner by the Prime Minister Decision dated April 11, 2007 and MOT Decision on December 22, 2008. Therefore, this Initial Development Plan for the target year of 2015 is prepared for the first two (2) container berths development and other related port infrastructure development.

The scale and scope of container berths development was reviewed by SAPROF study and following modifications on original plan were proposed:

(1) The design container vessel sizes should be 50,000DWT (full load) and 100,000DWT (partial load) instead of 30,000DWT (full load) and 50,000DWT (partial load).

(2) According to the above modification for vessel sizes, total length of berths No.1 & 2 should be extended from 600m to 750m.

(3) The terminal yard area should be enlarged from 36ha to 45ha.

(4) Quay Gantry Cranes should be large-size one suitable for 100,000DWT container vessels.

(5) Barge berths for domestic waterway traffic should be constructed in the north-eastern part of terminal.

(6) The construction of terminal land reclamation and soil improvement should be carried out by the public sector instead of VINALINES.

24.3 Vessel Access Channel

In the original plan, the dimensions of vessel access channel were one way traffic system, 130m in width, -10.3m CDL in depth and 1:10 of side slope, however, SAPROF study recommended following modifications:

1) Dimension

a) The width of channel should be 160m for the portion protected by the sand protection dyke and 210m for the portion without sand protection dyke, suitable for 100,000DWT container vessels in accordance with the guidelines of PIANC.

b) The depth of channel should be -14m CDL from initial stage since there is high possibility that mother container vessels more than 50,000DWT (4,000TEU) of international trunk route of Asia – North America (Trans Pacific) will call Lach Huyen Port directly and the international gateway port should be able to accept such mother vessels at any tidal conditions.

2) New Navigation Aid

a) Channel buoys should be replaced from the existing floating buoys to Spar Buoys which will not move around like a floating buoy and be able to show exact position.

b) Light beacons should be installed on the sand protection dyke to show the existence of obstacle for fishermen.

c) A pilot assistance system which could display own ship position at real time should be provided to the pilot office.

3) Measures against Sedimentation

a) The sand protection dyke should be constructed up to seabed elevation of -5.0m CDL for 7,600m long.

24.4 Public Related Facilities

The public related facilities such as buildings for Maritime Administration, Customs, Immigration, Quarantine and amenity for port workers, and a mooring facility for service vessels are not included in the scope of Project. However, SAPROF study team recommends these basic public related facilities to be included in the scope of Project.

The proposed scales of public related facilities are ①Land reclamation: 344,000 m3, ②Dredging in front of berth: 104,000 m3, ③Service boats berth: 375m L x 30m W x -4m D, ④Pavement: 121,000 m2, ⑤Buildings: 4,600 m2 and ⑥Utilities and Others: 1 set.

24.5 Implementation Schedule

GOV wants to complete the construction of container Berth No.1 & 2 by the end of 2014 and commence operation from beginning of 2015, however, considering the standard process and steps necessary for the yen loan agreement, it is estimated that the construction work will commence from middle of the year 2012. As the construction work period is required about 41 months, the port operation can only be started in July 2015. However, if it is accepted to start operation of berths one by one, the 1st berth can start operation in April 2015 and the 2nd berth can be started in September 2015.

It should be noted that above implementation schedule is prepared based on the assumption that all procurement process proceeds without any delay.

24.6 Contract Packages

Considering the required technical qualification for each main work, interface between each work, financial scale of each work, smooth and quick implementation of work, etc., the packaging of contract for the port portion of ODA Project is recommended to be divided into two (2) packages as follows:

- Package 1: Dredging of Navigation Channel
- Package 2: Construction of Container Terminal, Port Protection Facilities and Public Related Facilities.

In addition to above 2 construction packages, the consulting service of construction supervision for both constructions should be added as Package 3.

- Package 3: Consulting Services for Construction Supervision

24.7 Port Management Unit (PMU)

It is strongly advisable to enhance and improve port management capability that is essential for accomplishing a sustainable development of Lach Huyen Port .In dealing with a lack of effective port management system in the current administrative framework and looking for great growth opportunities of the Lach Huyen port, a Port Management Unit (PMU) which will bear broader responsibilities and duties over port operations is recommended to be set up under the supervision of VINAMARINE.

24.8 Detailed Design Stage

In addition to ordinary scope of Detailed Design, following issues are recommended to be studied and surveyed.

a) Dredged Material Dumping Site

At present the dumping site for dredged material is planned in South Dinh Vu area because this area is nearest candidate site among the dumping sites already approved by Hai Phong P.C. in EIA report. However this dumping site requires constructing a temporary dyke which is very costly and the dumped soil land shall be improved with huge cost before using there for IZ development since the dredged material is not suitable for reclamation.

Comparing with south Dinh Vu site, the future expansion site of Lach Huyen Port for "Natural habitats restoration" or Lach Huyen offshore area for "Offshore dumping" will be better candidate sites from the viewpoint of beneficial or/and economical options for long-run (Figure 24.1). Therefore, it is recommendable to conduct a feasibility study on alternative measures for

sustainable dredged material management as soon as possible. If it's technically and economically feasible for such measures for the initial operation and/or construction of the proposed new port, it is also recommendable to conduct an EIA for such option(s) and acquire approval from EIA authorities concerned before bidding for selection of dredging contractor(s) for each construction and operation stage.

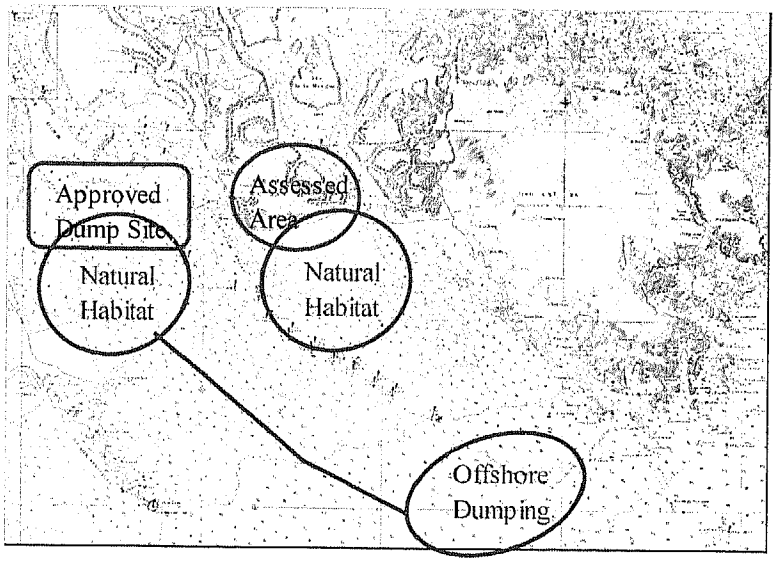


Figure 24.1 Candidate Site for the Sustainable Mitigation Measures for Dredged Material

b) Ship Maneuvering Simulation

This Lach Huyen Channel is one way, width of 160m with sand protection dyke and 210m without sand protection dyke and length of approx. 18 km. For the partial loaded 100,000DWT container vessel, the navigation in this channel is not easy when marine conditions and climate conditions are not favorable. In order to know the limit natural conditions and suitable tug assistance, therefore, the ship maneuvering simulation is recommended to be conducted during detailed design stage.

24.9 Construction Stage

a) Maintenance Dredging Plan

In order to establish a reliable maintenance dredging plan, check surveys on actual sedimentation phenomena and marine conditions should be carried out at every three (3) months during capital dredging period and mathematical sedimentation analysis should be conducted by the Consultant.

24.10 Operation Stage

a) Operation and Efficiency Indicators

In order to evaluate the efficient utilization of the facilities constructed in this ODA Project, following operation and efficiency indicators should be checked in 2017, after 2 years from the commencement of Lach Huyen Port operation.

Table 24.1 Performance Guidelines

	Measuring Item	Guideline
1	Berth Occupancy Rate	30%
2	Container Dwell Time	6 Days
3	Throughput	500,000TEU in 2016 750,000TEU in 2020
4	Maximum DWT of Vessels Docked at Berth One and Two	More than 50,000DWT vessels

24.11 Natural and Social Environment Consideration

The desk review of the Approved EIA and the comprehensive study of "The Preparatory Survey on Lach Huyen Port Infrastructure Construction in Viet Nam" by SAPROF study team concluded that the potential impacts on natural and social environment of the SAPROF's change in port design would not be significant compared to the TEDI's port design except the management of the maintenance dredging material in the long-run. In addition, some potential impacts, which were not addressed in The Approved EIA, and insufficiency of the baseline survey on natural environment were identified the SAPROF experts.

The summary of the environmental impact assessment relevant to the SAPROF's change in port design are shown below:

Table 24.2 Summary of the SAPROF Port Design and Identified Potential Impacts

Item	SAPROF' Design	Potential Impacts
EIA of the SAPROF Port Design		
1. Design vessel for container berth	Fully loaded 50,000DWT vessel Partial loaded 100,000DWT	• No significant impacts are expected.
2. Extension of channel Long, Width and Depth	160m to 210m wide, -14m deep below CDL	• Due to the sufficient capacity of disposal site, no significant impacts are expected for the initial dredging though there is significant increase in volume. • Due to the higher requirement of maintenance dredging, alternative and sustainable solution(s) shall be critically needed.
3. Extension of sand protection dyke	Applying till -5m	• Based on the results of the sedimentation simulation model, no significant impacts are expected. However due to the difficulties to simulate the detailed/localized phenomena, continuous monitoring will be required. • Based on the results of the oil spill simulation model, fewer impacts were shown. However due to the complex environment of the study area, both The APPROVED EIA results and this SUPPLEMENTAL EIA results may contain some errors. Evaluation of the simulation model and further consideration is recommendable in the following ADDITIONAL EIA.
4. Public related facilities and	1) Land reclamation 2) Service boats berth,	• Due to the least land use activities in the land clearance area, no significant impacts are

Item	SAPROF' Design	Potential Impacts
service/common berth	3) Port Admin. Bld., 4) Amenity Bld. 5) Pavement	expected. However, timely implementation of the land acquisition including grave resettlement and land acquisition shall be essential to meet the critically scheduled project implementation.
Identified Potential Impacts		
5. Insufficiency of the ecological baseline survey	Recommending additional ecological monitoring at widely allocated additional monitoring points	• Because of the single ecological baseline survey in close area, it is hardly to evaluate the potential impacts in the region by season. Additional ecological survey at additional monitoring points is recommended in the following ADDITIONAL EIA.
6. Impacts on coastal fishing	Recommending development of a safeguard policy and reasonable care for project affected people	• Though the Approved EIA evaluated minimal impacts on the coastal fishing activities, SAPROF study has confirmed the regular fishing activities in the project area. Consideration for the loss of the coastal fishing activities and limited capability to adapt the expected new job opportunities were confirmed in the potentially affected communities.

Development of the Hai Phong International Gateway Port will definitely enable the economic development of the northern Viet Nam, but the identified impacts on natural and social environment shall be addressed in the following ADDITIONAL EIA, required by the effective regulation on environmental protection, to achieve such potential impacts with smart ways. In accordance with Article 13 of Decree No.80/2006/ND-CP and Article 6 of Decree No.21/2008/ND-CP Amending Article 13, b/ of Decree No.80/2006/ND-CP, it is required to prepare the Additional EIA report. The ADDITIONAL EIA requires covering:

a/ Changes in the project's content,

b/ Changes in the natural environmental conditions and economic and social factors up to the time the additional environmental impact assessment report is made,

c/ Changes in environmental impacts and measures to minimize negative impacts,

d/ Changes in the project's environmental management and monitoring program, and

e/ Other changes.

As the official agreement between JICA and the Government of Vietnam recorded and signed in the minutes of discussion in March 2010 on the Lach Huyen International Gateway Port Development, the necessary additional survey on natural environment and a baseline survey on coastal fishing followed by the completion of the ADDITIONAL EIA and acquisition of the appraisal of the ADDITIONAL EIA shall be included in the detail design of the new port development supported by JICA. In order to meet the tight construction schedule, the approval of the ADDITIONAL EIA must be acquired before the completion of the following detail design.

24.11.1 Natural Environment

1) Baseline Environmental Condition Surveys in Preparation Stage of the Project

The baseline environmental surveys done at the project site and its surroundings are regarded as

adequate as the minimum requirement for the purpose of the approved EIA Report (2008). Still the important limitation of the survey is that it was done only once (in May 2006) and hence cannot be regarded as fully representative to account for seasonal variation. Accordingly, during the detailed engineering stage ecosystem surveys with at-least 2 times of sampling as appropriate to account for the 2 predominant dry and rainy seasons is recommended.

2) Significant aspects of operation stage of the project

The port shall be equipped with operational waste reception, treatment and disposal facilities as appropriate to manage all wastes generated both due direct port operation and wastes disposed by ships and vessels. Moreover, an emergency management system to effectively deal with potential emergency situation like accidents, fires and oil spills shall be in place with capability to activation at short notice. Port operational agency shall be obligated to conduct regular periodical environmental monitoring with priority focus on the estuarine coastal water environment.

24.11.2 Social Environment

1) Significant Aspects of Preparation Stage of the Project

Land acquisition and safeguard policy for coastal fishing activities are two primary social impacts to be addressed. Though there will be minimal impacts from the land clearance and little difficulties to complete the land acquisition as long as the responsible authorities follow the DRAFT land acquisition plan prepared by MPMUII, on time delivery of the necessary land is critical to meet the tight construction schedule. It is highly recommendable for MPMU II and VINAMARINE to continuously communicate with the PC of Hai Phong, the representative of the responsible authority, for securing the on time delivery.

Consideration of the fishermen should be also seriously addressed by the responsible authorities-the PC of Hai Phong with the active contribution by the MPMU II and VINAMARINE. Due to the lack of the legal framework for the fishing activities, the safeguard policy in "Support" for the recovery of livelihood defined by law on land and its relevant regulations shall be referred to develop a "New safeguard policy" for PAP, who are not covered by the law on land including fishermen. As there are some gap between JBIC Guideline/WB OP 4.12 and Vietnamese safeguard policy, it is recommendable to refer the resettlement policy framework (RPF) of "Northern Delta Transport Development Project", which is ongoing project by MOT supported by the World Bank.

Though the identified impacts may not be serious issues at the initial stage of the project implementation, such issues may possibly turn critical abstraction in the future. Historical records proved that the PROACTIVE actions to solve the hidden/potential impacts with REASONABLE manner are likely to avoid the potential further loss of POST-Actions such as delay of project implementation and higher costs of compensation with further social disturbance.

2) Significant Aspects of Construction Stage of the Project

Considering the labor safety, proper training and management is essential. As the responsible agency for the project implementation, MPMU II shall include the supervisory mechanism to ensure the contractor's EHS training and enforcement on the ground in the EMP.

As for the control of the transmittable diseases, proper supervision and collaboration with contractors for the health care training are recommendable.

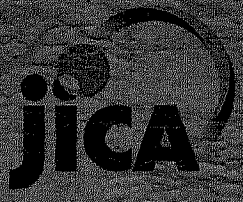
In order to maintain the affordability of goods for the local communities, it is recommendable to monitor the price indexes and affordability/income level of the local communities. Such monitoring result shall be shared among MPMU II and local authorities to consider necessary measures if it is necessary.

Due to no requirement for the residential resettlement, follow-up for livelihood support should be focused. Although MPMU II is not responsible for the implementation of the safeguard policy, it is recommendable to include a mechanism to check the appropriate implementation of such policy in EMP.

In order to monitor unexpected negative impacts on fishing communities, it is recommendable to conduct periodical sample survey including the fish yield and income level of the project affected fishermen. In the case of necessity to improve the safeguard policy for the coastal fishing, MPMU II shall coordinate responsible authorities to improve the modified policy.

3) Significant aspects of operation stage of the project

As a part of environmental management plan (EMP) and responsibility of the implementation agency, MPMU II shall supervise VINALINE and other private operators to ensure the EMP including the proper implementation and follow-up of the safe guard policies.


JICA