Japan International Cooperation Agency (JICA)
Directorate General of Sea Transportation, Ministry of Transportation

No.

The Study for Development of The Greater Surabaya Metropolitan Ports in the Republic of Indonesia

GSMP

FINAL REPORT

Volume 2
Future GSMP Development

November 2007

ALMEC Corporation
Japan Port Consultants, Ltd

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DIRECTORATE GENERAL OF SEA TRANSPORTATION, MINISTRY OF TRANSPORTATION

THE STUDY FOR DEVELOPMENT OF THE GREATER SURABAYA METROPOLITAN PORTS IN THE REPUBLIC OF INDONESIA

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COMPOSITION OF GSMP REPORTS

Summary (English, Japanese and Indonesian)

Main Text

Volume 1: Existing Conditions and Issues

Volume 2: Future GSMP Development

The exchange rate used in the report is:

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a study on Development of the Greater Surabaya Metropolitan Ports and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. KUMAZAWA Ken of ALMEC Corporation, and consists of ALMEC Corporation and Japan Port Consultants, LTD. between November, 2006 and October, 2007.

The team held discussions with the officials concerned of the Government of the Republic of Indonesia 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 promotion of this project and 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 Republic of Indonesia for their close cooperation extended to the study.

November, 2007

EIJI HASHIMOTO,
Deputy Vice President
Japan International Cooperation Agency

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ABBREVIATIONS

ADB	Asian Development Bank
ADPEL	[*Administrator Pelabuhan*] Port Administrator
AIS	Automatic Identification System
AMDAL	[*Analisis Mengenai Dampak Lingkungan Hidup*] Environmental Impact Assessment
ANDAL	[*Analisis Dampak Lingkungan]* Environmental Impact Assessment
ASEAN	Association Of SouthEast Asian Nations
BAPEDAL	[*Badan Pengendalian Dampak Lingkungan*] Environment Impact Management Agency
BAPPEDA	[*Badan Perencanaan Pembangunan Daerah*] Regional Development Planning Agency
BAPPENAS	[*Badan Perencanaan Pembangunan Nasional*] National Development Planning Agency
BJTI	[*Berlian Jasa Terminal Indonesia*] Berlian Indonesia Terminal Service
BKSP	[*Badan Kerja Sama Pembangunan*] Development Coordinating Body
BOR	Berth Occupancy Ratio
BOT	Build Operate Transfer
BPJT	[*Badan Pengatur Jalan Tol*] Toll Road Regulatory Agency
BPPLS	[*Badan Pelaksana Penanggulangan Lumpur Sidoarjo*] The Board of the Sidoarjo Mud Control
BPPPWS	[*Badan Pengelolaan Percepatan Pembangunan Wilayah Suramadu*] Suramadu Bridge District Development Acceleration Management Board
BPPT	[*Badan Pengkajian dan Penerapan Teknologi*] Agency for Application and Assessment of Technology
BPS	[*Badan Pusat Statistik*] Central Statistics Bureau
BTP	Berth Throughput
CC	Container Crane
CCTV	Closed-Circuit Television (CCTV)
CD	Chart Datum
CDL	Channel Depth
CER	Capital Equipment Ratio
CFS	Container Freight Station
CHC	Container Handling Charges
CIQS	Custom, Immigration, Quarantine, and Security
CNOOC	China National Off-shore Oil Corporation
CPO	Crude Palm Oil
CSD	Cutter Suction Dredger
DGR	Directorate of Railways
DGST	Directorate General of Sea Transportation
DLKP	[*Daerah Lingkungan Kepentingan Pelabuhan*] Port Interest Area
DLKR	[*Daerah Lingkungan Kerja Pelabuhan*] Port Working Area
DMU	Diesel Motor Unit
DUKS	[*Dermaga Untuk Kepentingan Sendiri*] Private Jetty
DWT	Dead Weight Ton
EDI	Electronic Data Interchange
EIA	Envirmental Impact Assessment
EIRR	Economic Internal Rate of Return
EJGP	East Java Gas Pipeline
EMU	Electric Motor Unit
EU	European Union
FDI	Foreign Direct Investment

FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GIE	Gresik Industrial Estate
GKS	[GERBANGKERTOSUSILA] Gresik, Bangkalan, Mojokerto, Surabaya, Sidoarjo, Lamongan
GRDP	Gross Regional Domestic Product
GSMP	Greater Surabaya Metropolitan Ports
GRT/GT	Gross Register Tonnage / Gross Tonnage
ICOR	Incremental Capital Output Ratio
ICT	Information and Communication Technology
IEE	Initial Environmental Evaluation
IMO	International Maritime Organization
IRMS	Indonesia Road Management System
ISPS Code	International Ship and Port Facility Security Code
ITS	[*Institut Teknologi Surabaya*] Surabaya Institute of Technology
JABODETABEK	Jakarta, Bogor, Depok, Tangerang, and Bekasi
JAMALI	Java, Madura and Bali
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JICT	Jakarta International Container Terminal
KODECO	Korean Development Corporation
KPLP	[*Kesatuan Penjagaan Laut dan Pantai*] Coast Guard
LARAP	Land Acquisition and Resettlement Action Plan
LIS	Lamongan Integrated Shore
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LWS	Low Water Spring
MISI	PT. Madura Integrated Seaport City
MOT	Minister of Transportations
MSL	Mean Sea Level
NCP	New Container Port
NIP	Ngoro Industrial Park
NPV	Net Present Value
OD	Origin Destination
ORF	On-shore receiving facilities
PANTURA	[*Pantai Utara*] North Java Coastal
PELINDO	[*PT. Pelabuhan Indonesia*] Indonesian Port Corporation
PELNI	[*Pelayaran Nasional Indonesia*] National Shipping Lines
PERTAMINA	State-Owned Oil Company of Indonesia
PFCO	Port Facility Security Officer
PIANC	The Permanent International Association of Navigation Congresses
PIER	Pasuruan Industrial Estate Rembang
PLN	[*PT. Perusahaan Listrik Negara*] State-Owned Electricity Company
PPP	Public Private Partnership
PSC	Port Security Committee
KAI	[*PT. Kereta Api Indonesia*] Indonesian Railway Company
PUSTRAL	[Pusat Studi Transportasi dan Logistik] Center for Transportation and Logistics Studies
RKL	[Rencana Pengelolaan Lingkungam] Environmental Management Plan
RORO	Roll On Roll Off
RPL	[Rencana Pemantauan Lingkungan] Environmental Monitoring Plan

RTG	Rubber-Tyred Gantry
RUPS	Stakeholder Meeting
SIER	Surabaya Industrial Estate Rungkut
SPM	Single Point Mooring
SRRTS	Surabaya Regional Rail Transport System
SS	Suspended Solid
SSG	Ship to Shore Gantry Crane
STRAMINDO	Study on the Development of Domestic Sea Transportation and Maritime Industry in the Republic of Indonesia
SURAMADU	Surabaya – Madura
TGS	Total Ground Slot
THC	Terminal Handling Charge
TJP	PT. Trans Java Gas Pipeline
TKBM	[*Tenaga Kerja Bongkar Muat*] Cargo Handling Workers Cooperation
TPKS	[*PT. Terminal Petikemas Semarang*] Semarang Container Terminal Branch
TPS	[*PT. Terminal Petikemas Surabaya*] Surabaya Container Terminal
TSHD	Trailing Suction Hopper Dredger
VAT	Value Added Tax
VICO	Virginia Indonesia Company
VOC	Vehicle Operating Cos
VTS	Vessel Traffic Management System
YOR	Yard Occupancy Ratio
YTP	Yard Throughput

PART II

FUTURE DEVELOPMENT PERSPECTIVES

6 REGIONAL DEVELOPMENT PERSPECTIVE

6.1 Regional Development Plans

There are many kinds of development plans in the Study Area like plans for public and investments, plans for infrastructure and public utility development, plans for agricultural and other sectoral plans, and so on. However, the most integrated development planning system in Indonesia is the spatial plan (rencana tata ruang) in accordance with the relevant law (No. 24/1992). Spatial plans are formulated at various levels: national, island, province, metropolitan, city/regency, and further small districts when necessary while they are revised at certain intervals.

Although the Surabaya-centered metropolitan delineation or Gerbangkertosusila is a well-known concept, its independent spatial plan and an exclusively development coordinating body (like BKSP Jabotabek) have not been institutionalized. Therefore the provincial government coordinates this metropolitan management. For instance, the spatial plan for Gerbangkertosusila is included as part of the provincial spatial plan.

This section aims at showing related special plans in this study and identified future development direction. Since there is no specialized document and body for the metropolitan coordination, there are some discrepancies among the related plans. Some coordinating issues which are important to the Study are identified as detailed planning issues in the Study.

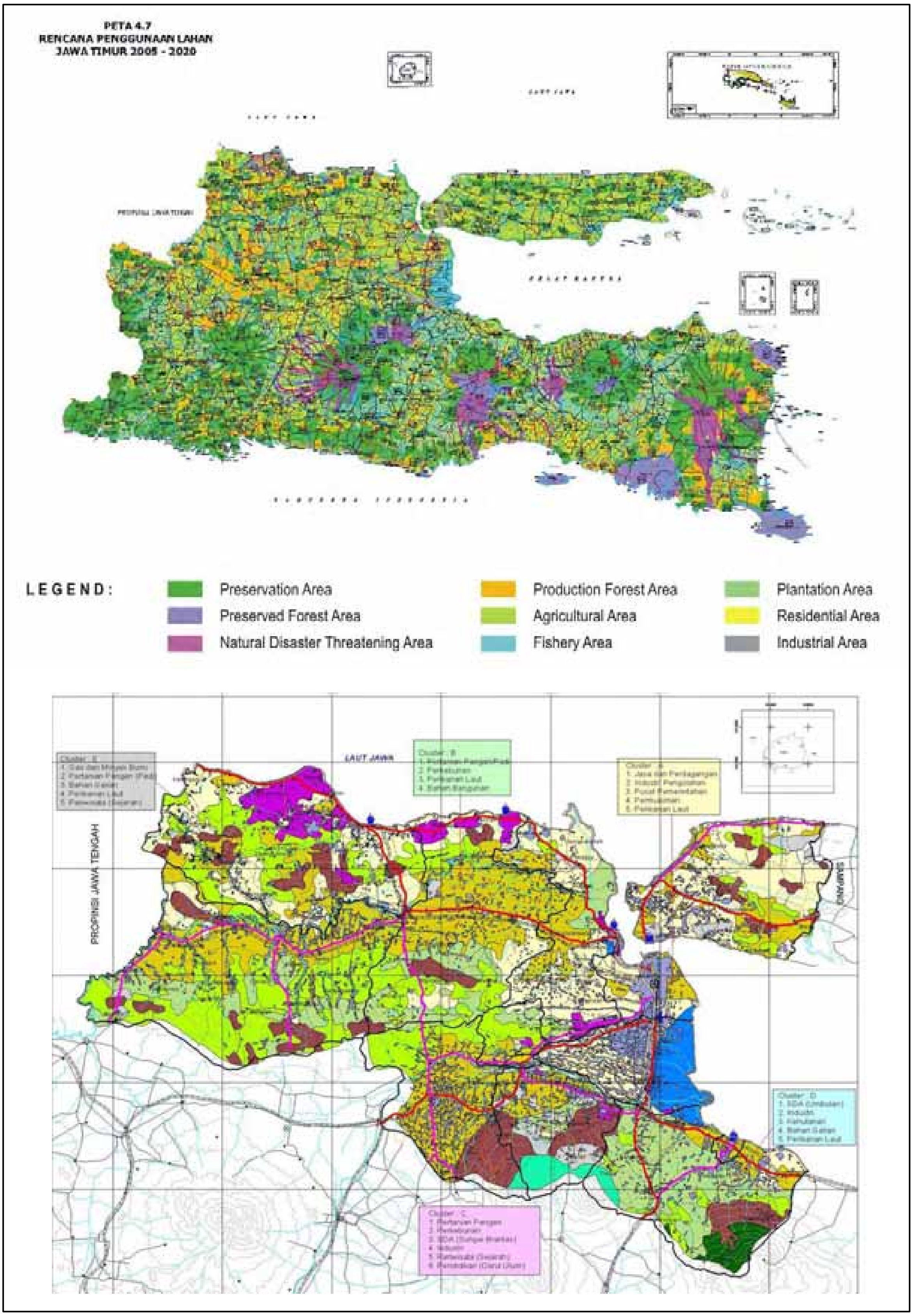
1) Spatial Plans

a. East Java Province

The province recently authorized the new spatial plan in 2006 with a planning range of 15 years. Thus, the target year is set as 2020. The document is composed of many plans to guide the province towards sustainable growth including future land use, infrastructure development, linkage of urban activity centers, etc. As important planning guidelines to the Study, the report introduces two land use plans: the overall provincial land use plan and the Gerbangsusila land use plan. (Refer to Figure 6.1.1)

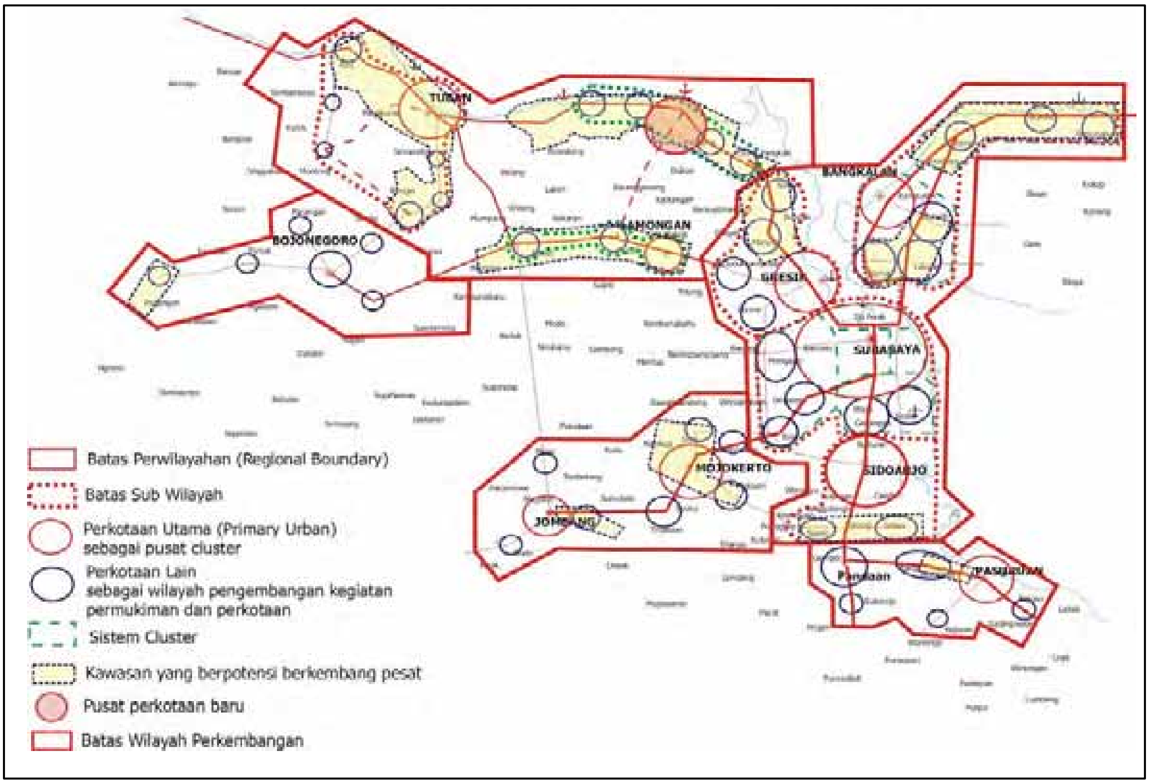
In the new spatial plan, the metropolitan concept of Gerbangkertosusila is somewhat evolved and expanded where the surrounding regencies of Tuban, Bojonegoro, Jombang and Pasuruan. This further expanded configuration is named “Gerbangkertosusila Plus”. (Refer to Figure 6.1.2)

Figure 6.1.1 Future Land Use Plans for East Java Province and GKS



Source: East Java Province

Figure 6.1.2 Functional Arrangement Plan for GERBANGKERTOSUSILA Plus



Source: East Java Province

b. Surabaya, Gresik and Bangkalan

With the Gerbangsusilo region, three participating governments of Surabaya City, Gresik Regency and Bangkalan Regency are more important than others since they contain some of the port development candidate sites in the Study. Therefore each spatial plan is further analyzed.

Surabaya City: The current spatial plan was authorized in 2006 with the target year of 2015. It was prepared based on previous planning documents, e.g., "Master Plan Surabaya 2000" prepared in 1978 and necessary coordination works. The future city structure is illustrated in Figure 6.1.3.

The spatial plan does not consider a scenario of substantial population growth. The spatial plan predicts a very moderate population growth up to 2015 or 2.7 million. The city population of 2.5 million is considered to be densely inhabited since the population density exceeds 100 persons per ha provided that wet lands are excluded. Instead, the spatial plan pays attention to its low and flat terrain conditions where 80 % of the city lands are located with less than 10 meters above sea level. Such low and flat lands are vulnerable against floods. To minimize natural disasters, the city administration plans to secure and expand parks and open space with an aggregated total of 245 ha. .

Surabaya City has a water territory of 22,600 ha which is administratively divided into four (4) zones. However, the east coastline is not suitable for trading due to swampy and shallow water configuration. Currently the lands are used for reservation land, fish ponds, recreational and residential uses. The water area from Suramadu Bridge to Tanjung Perak Port has been already developed, leaving a small undeveloped land (300 ha) to be simultaneously developed with the Suramadu project. Therefore Lamong Bay Zone (2,500 ha) is the last undeveloped area for trading for Surabaya City. The spatial plan includes a full-scale development of Lamong Bay Zone as a new international hub port.

Similarly, the spatial plan adopts a self-sustaining approach in industrial development. In addition to the accumulated areas, the plan intends to attract further industrial entities at Benowo, Tandas, Krembangan, Asemrowo, Sukomanunggal and Semampir. In order to maintain the urban environment, the city administration guides industrial developers to allocate 40% of developmental land for public and social purposes as well as to conduct environmental impact assessment before construction.

Gresik Regency: Gresik has operationalized its spatial plan since 2004 as a tool to guide development. Gresik has a long coastline of 140 km. The spatial plan intends to develop the coastal area for aquaculture and fishery industry and industrial lands although currently swampy coastal lands are vastly used for fish ponds.

Three (3) industrial lands occupying some coastlines are planned in the spatial plan:

i) Industrial development with an international port located at Manyar (2,000 ha)

ii) Industrial development at Menganti (700 ha)

iii) Industrial development at Driyorejo and Wringin Anom adjoining Sidoarjo Regency (1,251 ha)

Brackish and seawater aquaculture areas are vastly planned for shrimp and milkfish, totaling 20,985 ha with 17,045 tons. Some other species are also planned.

Bangkalan Regency: The currently applicable spatial plan was formulated in 1999, targeting towards 2009. Although the previous spatial plan was made in 1994 with a target year of 2004, it did not consider the Suramadu bridge project and its regional impact, and the existing one became necessary before 2004.

Taking the opportunity of the bridge project, the spatial plan prepares 15,000 ha for new development including 3,600 ha for industry, 5,680 ha for housing and 7,780 ha for public and social facilities. Those lands are mostly located between the bridge site and Kecamatan Bangkalan.

The spatial plan gives priority to Tanjung Bumi for a new port site. The coast area between Socah and Klampis is designated to be fish ponds and residential areas as they are.

Figure 6.1.3 Spatial Plan for Surabaya City

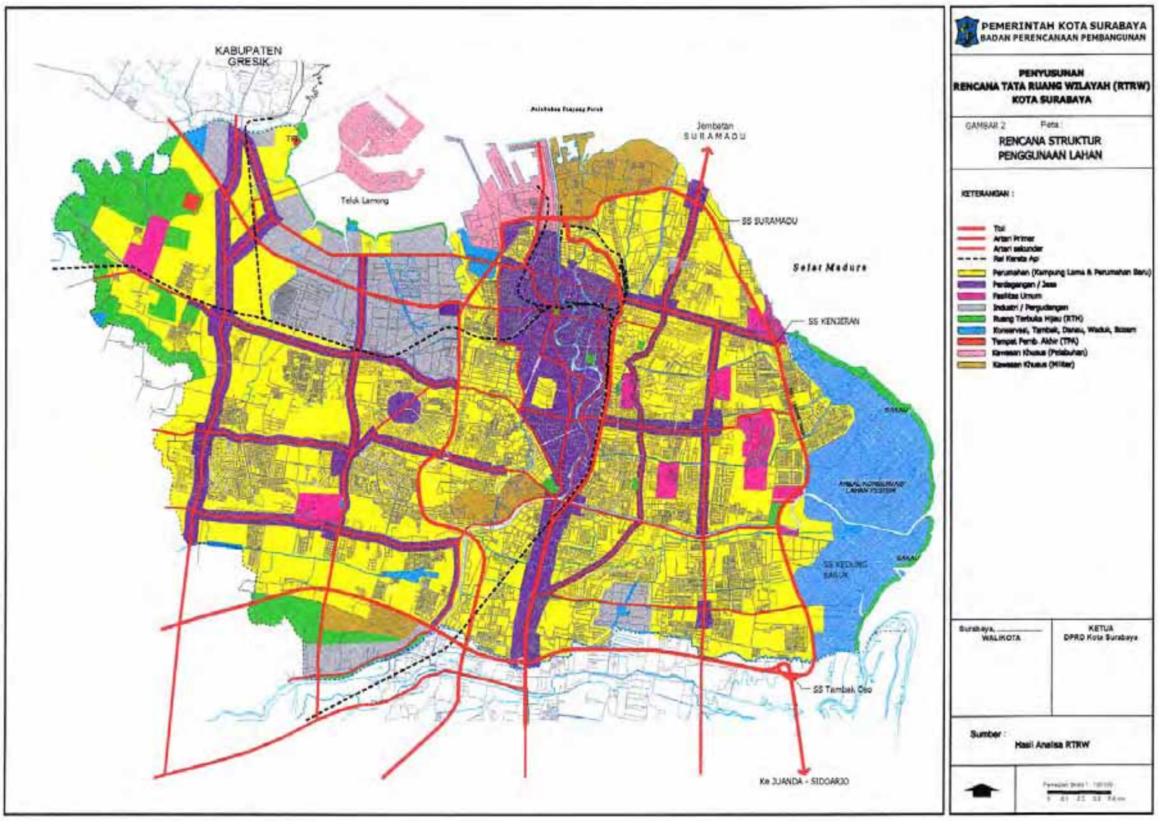
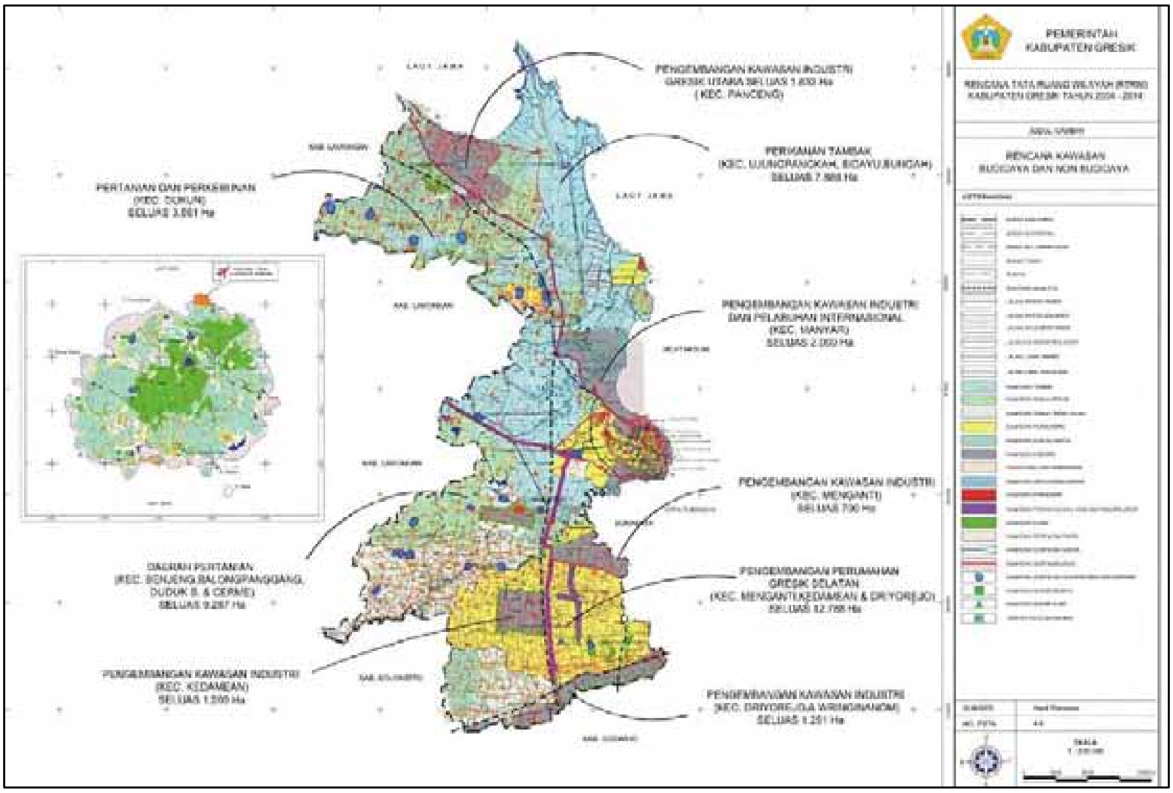
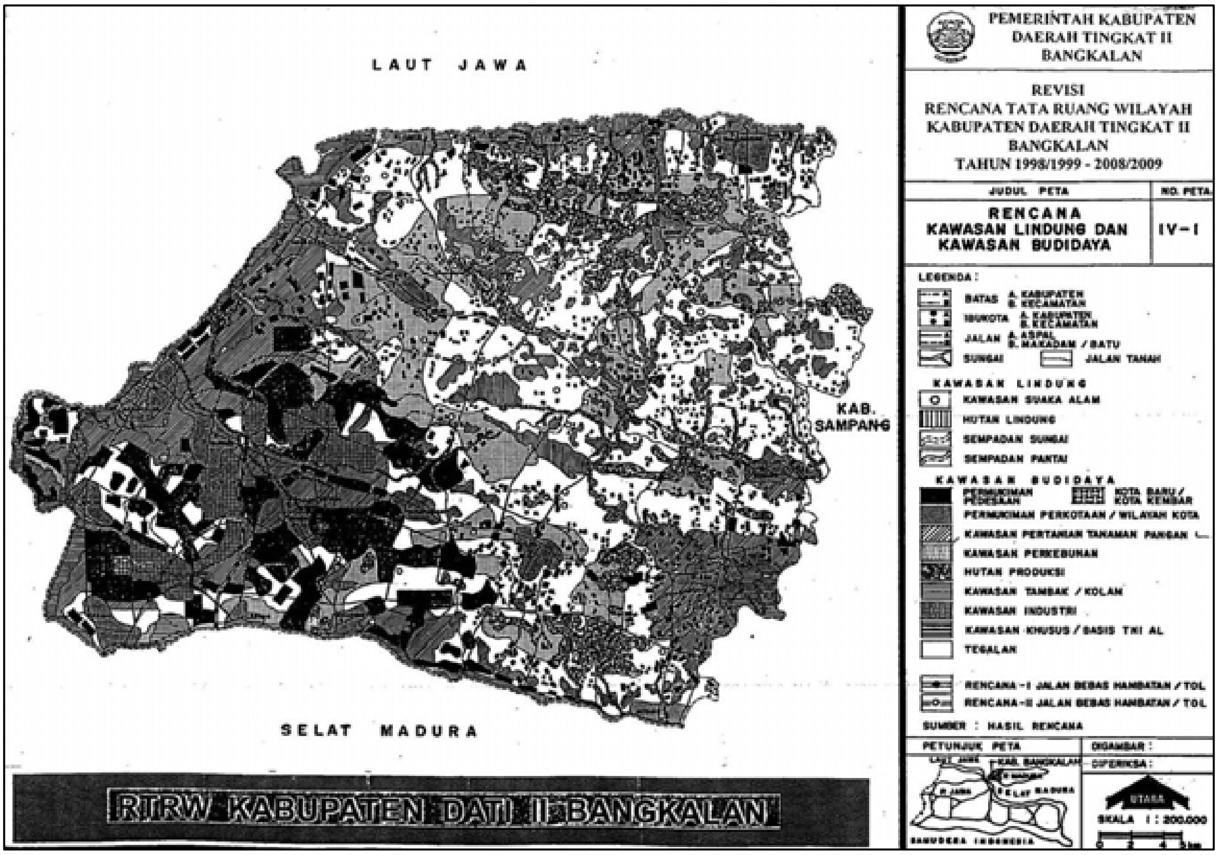


Figure 6.1.4 Spatial Plan for Gresik Regency



Source: BAPPECO and BAPPEDA of Gresik

Figure 6.1.5 Spatial Plan for Bangkalan Regency



Source: BAPPEDA of Bangkalan

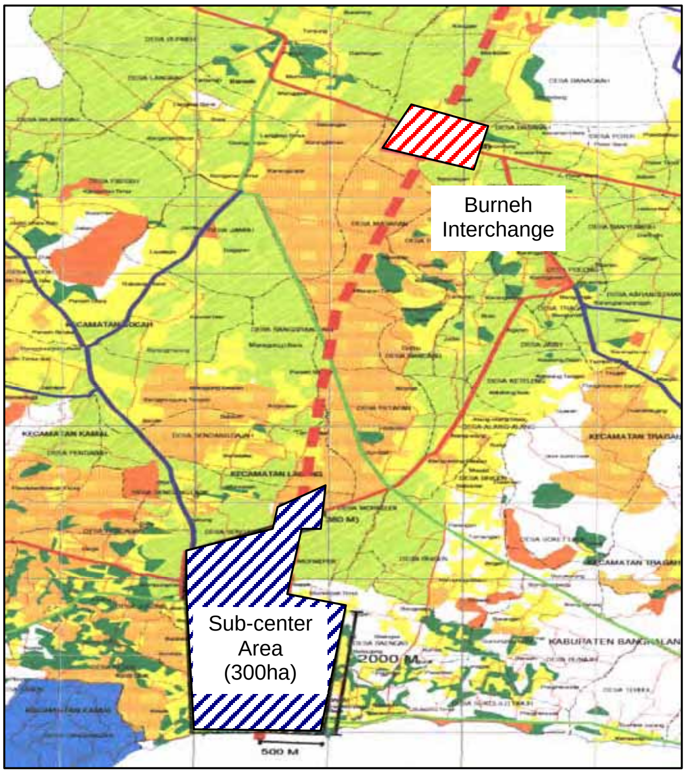
2) Suramadu Bridge related Development

The Suramadu bridge project is scheduled to open at the end of 2008. According to the East Java government, the central governments has organized preparatory meetings for a new organization in order to incorporate the impact of Suramadu bridge into regional development from a mid-to-long term viewpoint. It is a Suramadu Bridge District Development Acceleration Management Board (Badan Pengelolaan Percepataan Pembangunan Wilayah Suramadu: BPPPWS) to be placed directly under the President Office.

This new organization will undertake some regional development projects under the central government's initiative. According to the initial idea, at the inception, area-wide development at both the sides of the bridge, 300 ha each, will be done and thereafter a core development zone (600 ha) within the jurisdiction of Bankalan Regency will be selected for prioritized development. There is a possibility for the new board to coordinate infrastructure and public utility development such as roads, ports, electricity, water supply and disposal. In Madura Island, all those infrastructure and facilities are not sufficient and thus the development must be accelerated.

Regarding the bridge-end sub-centers, the site at the Madura side has been determined while the site at Surabaya is not delineated. Bappenas will authorize both the areas with development plans and then land acquisition will start in 2008.

Figure 6.1.6 Site for Sub-center Development at Madura Side



3) Large-scale Private Development

There exist many large-scale development plans in the Gerbangkertosusilo region. However some are only proposed while some others have become inactive particularly after the Economic Crisis in the late 1990s. This section introduces two (2) large-scale development plans considering possible significant impact on the future metropolitan ports system although both are still at concept level. They are (i) integrated industrial and urban development at the Madura west coast area, and (iii) Lamongan integrated shore base.

a. Integrated Industry and Urban Development at Madura West Coast

This is an integrated industrial and urban development at the west-south end of Madura Island which will benefit greatly from the operation of Suramadu Bridge. The bridge will be able to transform the land, currently rural areas, into prime lands for residential and industrial uses because of the proximity to Surabaya CBD within 30 minutes' drive.

For the project, a local developer established PT. Madura Integrated Seaport City (MISI) and got a development permit from Bangkalan Regency. According to DGST, the firm also got a permission to develop a special port which is limited for the users who locate within the project area.

Land use plan or other planning documents are not available except development images like the following figure.

Figure 6.1.7 Development Image of Madura Industrial Seaport City (MISI)

Source: PT. Madura Industrial Seaport City

Since the project is closely related with the scope of the study, the Team interviewed and exchanged opinions with Bupati, Bangkalan and the developer in March 2007. In conclusion, the Team's suggested points are summarized into two:

1. The Team observed that Socah District faces with the Madura Strait with good soil condition. Although the Madura Strait is an attractive channel, it requires sensitive management such as seaborne traffic management and hydraulic management. Therefore development method must be selected carefully not to damage or change the strait management.
2. A large and integrated development project should prepare a set of good development planning documents. Land value increase by the bridge project can be captured only when urban development is done orderly in compliance with a well designed development plan including road network plan, public utilities plan land use zoning plan, with sufficient social acceptance.

b. Lamongan Integrated Shore base

"Lamongan Integrated Shore base (LIS)" is a project to provide an international logistics center at Tanjung Pakis, Kabupaten Lamongan. The logistics center will serve the oil and gas industries which are operating in East Java. It will be equipped with ports and ships, general warehouses and explosive warehouses, workshops, ICT facility and network, vender stocking program, drilling chemical substance, clean water supply and customs office in order to enable efficient logistics operations with supply chain control. LIS applies the concept of "one-stop shopping hypermart" in its services. The oil and gas industries have a well-known alternative to reduce operation costs through shared facilities.

East Java Province is the third richest province in mineral resources in Indonesia. Tanjung Pakis is strategic in location since it is surrounded by oil and gas exploitation areas. Thus many PSC (product sharing contract) companies in the oil and gas field are possible users such as Medco, Kodeco, Exxon Mobil, EMP Kangran, Amerada, Hess, Lapindo Brantas, Petrochina and others. Those PSC companies use Singapore or Batam shore bases at present.

PT. LIS will be established by PT. Petrogas Wira Jatim (provincial government-owned), Kabupaten Lamongan and Eastlog Holding Singapore which holds a 45% equity with an initial investment of US$ 25 million. PT. LIS will initially develop a coastal land of 60ha and later the operation site will be expanded to 140ha.

LIS will function as oil and gas special supporting port. So far PSC companies operating in East Java have used many of public ports such as Tanjung Perak, Gresik, Banyuwangi, Bondong Fish Port, Tubang and even Tanjung Emas in Central Java, facing with many difficulties. For instance, chemical substances, industrial gas and explosive materials can not be stored in public ports. Fuel and water supply services are not satisfactorily available in those ports.

For such special port operation, the existing road from Manyar (Gresik) to Tanjung Pakis, 46 km long, is troublesome. It is desirable for LIS development to extend the Surabaya – Gresik Toll Road along the northern Java coastline.

This project, whether it will be implemented successfully or not, does not affect the study's scope. The project intends to construct a supporting port for the oil and gas industry without public use. If this supporting port would be operated, it could alleviate Tg. Perak's role as the present supporting port. The impact, however, would be marginal for Tg. Perak.

Figure 6.1.8 Location of Lamongan Integrated Shore Base

Source: JICA Study Team

4) Coordinating Issues for Metropolitan Ports System

Two issues are raised in after studying the above-mentioned spatial plans. They are (i) new international hub ports and (ii) industrial areas.

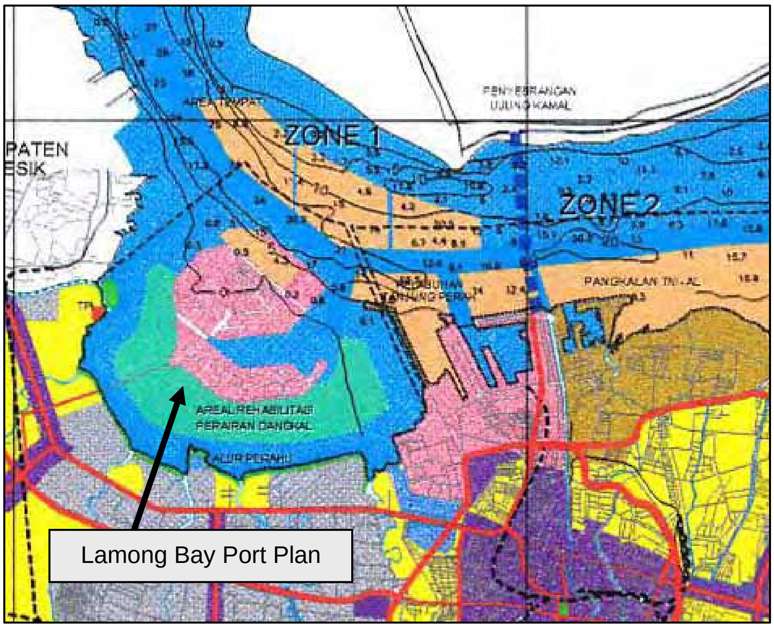
a. New International Hub Ports

The provincial spatial plan designates Tanjung Perak as an international hub, followed by 11 national ports including Gresik and Bawean in Gresik Regency, Tanjung Wangi in Banyuwangi Regency, Tanjung Tembaga in Probolinggo City, Pasuruan in Pasuruan City, Sapudi, Sapekan, Kalubut, Situbondo and Kangean in Sumenep Regency, and Paiton in Probollingo Regency. It also states that a new international hub will be developed between Lamong Bay and Gresik Port. But when its capacity is saturated, further new port will be constructed at the northern part of Bangkalan Regency from a mid to long-term viewpoint (Article 44, East Java Regulation No.2/2006). However the site location is not specified.

In line with the provincial spatial plan, the Lamong Bay port project was prepared among the relevant agencies and eventually its downsized plan from the initial idea of 400 ha reclamation to only 50 ha was approved by the provincial government. On the other hand, Surabaya City decided to put the initial scale of Lamong Bay port project (400 ha) in the spatial plan.

Therefore, it is important in the Study to design the role sharing between the proposed Lamong Bay port and the new third hub port from Tanjung Perak and Lamong Bay and to determine the new port site.

Figure 6.1.9 Lamong Bay Port Plan in the Surabaya's Spatial Plan



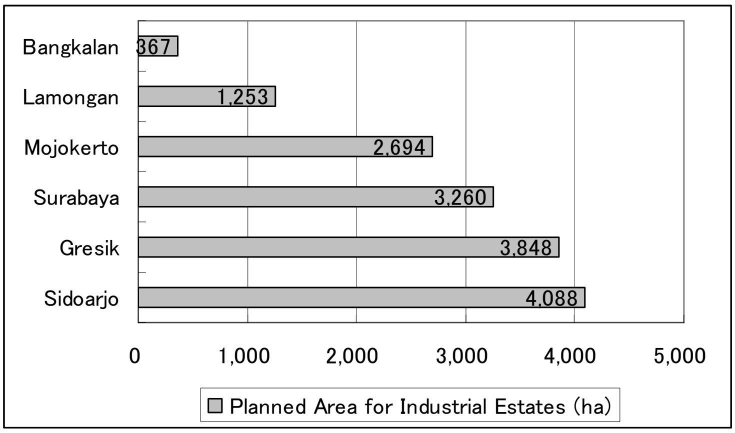
b. Industrial Development

Sluggish provincial economy is largely explained by inactive investment in the industry sector. To make the provincial economy robust, more industry estate development, logistics infrastructure development and attractive investment regime are necessary.

The East Java spatial plan works out future land use by type. It envisions that the GKS region will have a lot of industrial estates with 15,510 ha in total. Compared with the present accumulation of less than 3,000 ha, it seems ambitious. Although it is not always a problem, there are some discrepancies within the authorized spatial plans between province and city/regency. For example, Bangkalan Regency plans a new industrial land of 3,600 ha to absorb the impact of the Suramadu bridge project. But the province assumes only 367 ha in its future land use plan. It is questionable since Bangkalan, Madura could revive the Surabaya economy as a growth pole provided that Suramadu Bridge as well as a deep seaport forms a regional logistics corridor. (Refer to Figure 6.1.10)

Attractive industry estates particularly export oriented must be integrally developed with high-standard access roads and public utilities and with a good connection with international sea and air gateways. It is a planning issue to the Study to develop an integrated blueprint of an international hub port with attractive industrial development.

Figure 6.1.10 Future Industrial Estate Area in GKS



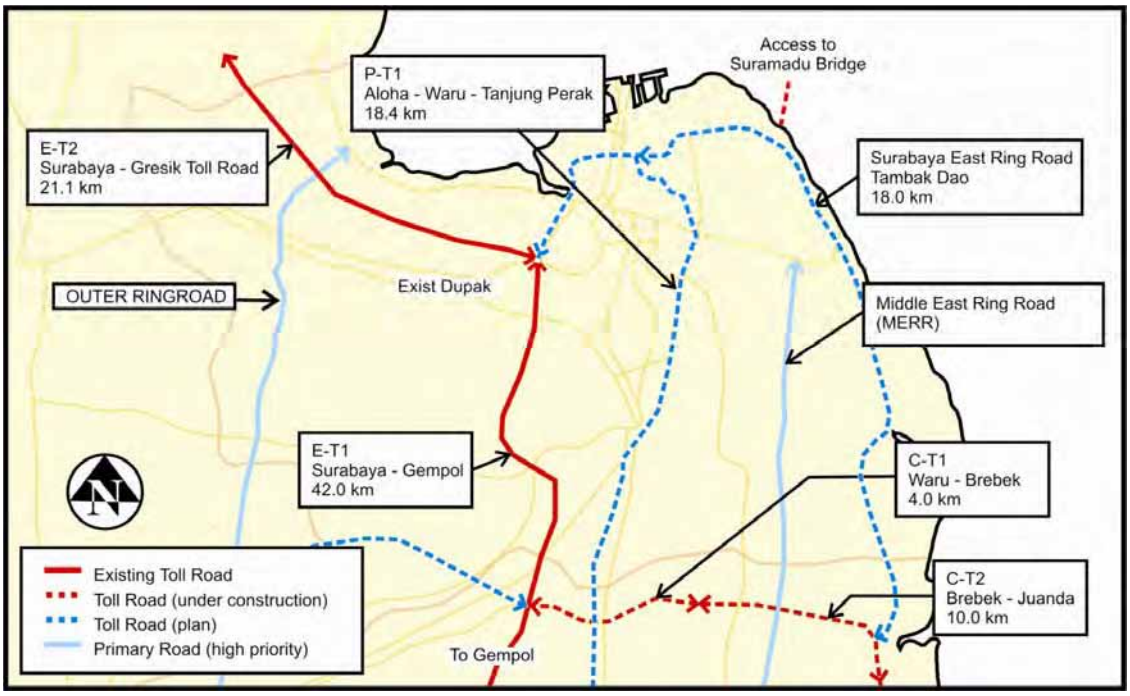
Source: Compiled data from East Java Spatial Plan

6.2 Regional Transport System Development

1) Toll Road

Existing and Planned Road Network in Surabaya: The network of existing toll road (Red Line), primary road (Light-blue Line), secondary road (Brown Line), toll road under construction (Red Dotted Line), planned toll road (Light-blue Dotted line) and planned primary collector road (Light Blue Line) are as illustrated in Figure 6.2.1.

Figure 6.2.1 Surabaya Major Road Network



Note: Project information compiled by JICA Study Team

Existing Toll Roads: The toll roads of Indonesia are operated and managed by PT. Jasa Marga (Persero) alone or by joint venture of them with other private investors. There are two (2) existing toll roads serving in and around Surabaya or a part of GKS at present. The one is Surabaya – Gempol Toll Road (Length: 42km) and the other is Surabaya – Gresik Toll Road (Length: 20km) which is operated by joint venture of PT. Jasa Marga with PT. Margabumi Matraraya.

The construction of Surabaya – Gempol Toll Road started in 1983 and completed in 1986 as the first toll road system in Surabaya. The section of Surabaya – Gempol Toll Road in Surabaya city has been under widening works from 2 lanes to 3 lanes at present to meet with ever increasing traffic demand. The outline of this existing toll road is as follow.

E-T1 Surabaya - Gempol Toll Road

Segment	Tanjung Perak – Gempol
Road Length	42.0 km
Developer	PT. JASA MARGA
Starting Year of Construction	1983
Planned Year of Completion	1986
Present Status	Widening works from 2 lanes/way to 3 lanes/way has been on-going along the segment in Surabaya city

Subsequent to the commissioning of Surabaya – Gempol Toll Road, the construction of toll road between Dupak – Tandes segment as a part of Surabaya – Gresik Toll Road has started and it was completed in 1993. The two other road segments Tandes – Kebomas (11.6 km) and Kebomas – Manya (5.0 km) has been constructed followed the completion of the first segment. These were completed in 1994 and 1996, respectively.

The outline of these toll roads stretching from Surabaya to Gresik are as follows.

E-T2 Surabaya - Gresik Toll Road (Phase-1)

Segment	Dupak – Tandes
Road Length	3.5 km
Developer	PT. JASA MARGA + PT. MARUGABUMI
Starting Year of Construction	1991
Planned Year of Completion	1993
Present Status	Completed and under service

E-T3 Surabaya - Gresik Toll Road (Phase-2)

Segment	Tandes - Kebomas
Road Length	11.6 km
Developer	PT. JASA MARGA + PT. MARUGABUMI
Starting Year of Construction	1992
Planned Year of Completion	1994
Present Status	Completed and under service

E-T4 Surabaya - Gresik Toll Road (Phase-3)

Segment	Kebomas - Manyar
Road Length	5.0 km
Developer	PT. JASA MARGA + PT. MARUGABUMI
Starting Year of Construction	1993
Planned Year of Completion	1996
Present Status	Completed and under service

Toll Roads under Construction: All toll roads are designed to have at least 2 lanes which are expandable to 3 to 4 lanes for each way. The design speed is 100 km per hour. Two (2) toll roads have been under construction since 2004. These are Waru – Brebek Toll Road and Surabaya Airport Toll Road. The outline of these two toll roads under constructions are summarized as follows with reference number used by the study team.

C-T1 Waru – Brebek Toll Road

Segment	Waru – Brebek Industrial Zone
Road Length	4.0 km
Developer	PT. CIPTA MARGA TANA
Starting Year of Construction	2004
Planned Year of Completion	2005
Present Status	80% of the works has been completed as of June 2007 and its completion is expected in 2008.

C-T2 Surabaya Airport Toll Road

Segment	Brebek – Juanda International Airport
Road Length	10.0 km
Developer	PT. CIPTA MARGA TANA
Starting Year of Construction	2005
Planned Year of Completion	2006
Present Status	30% of the works has been completed as of June 2007 and its completion is expected in 2009.

The Waru – Brebek Toll Road is designed to serve the transport of freight and workers to and from Brebek Industrial Estate in Sidoarjo and Rungkut in Surabaya. The Surabaya Airport Toll Road is connected with this Waru – Brebek Toll Road so as to serve the transport between the major trunk road namely Surabaya – Gempol Toll Road and Juangda International Airport of which new passenger terminal and airfreight handling facilities have commissioned on 15 November 2006 last year.

The Surabaya Airport Toll Road will be further extended and to form a part of Surabaya Eastern Toll Ring Road that is designed to connect Juanda Airport, Suramadu Bridge and Tanjung Perak through the eastern edge of Surabaya City in the future.

Toll Roads Ready for Construction in GKS: There are seven (7) toll road projects prepared for the implementation in and around Surabaya. These planned toll roads have been ready for its implementation by the toll road developers those who got authorization to develop the toll roads. However due to a delay of land acquisition and / or delay of funding, the construction works of these planned toll roads have not been started yet.

Figure 6.2.2 illustrates the network of toll roads that have been tendered and ready for implementation but no construction works have been started yet as well as the planned toll roads.

i) R-T1 Surabaya Central Toll Road (18.4 km)

ii) R-T2 Surabaya Mojokerto Toll Road (36.5 km)

iii) R-T3 Mojokerto – Kretosono Toll Road (41.0 km)

iv) R-T4 Gempol – Pasuruan Toll Road (34.5 km)

v) R-T5 Pasuruan – Probolinggo Toll Road (45.0 km)

vi) R-T6 Gempol – Padaan Toll Road (13.6 km)

vii) R-T7 Padaan – Malang Toll Road (37.6 km)

Figure 6.2.2 Planned Toll Road Network in GKS

The outlines of these seven toll roads that have been tendered and ready for implementation are as follows:

R-T1 Surabaya Central Toll Road

Segment	Aloha – Wonokormo – Tanjung Perak
Road Length	18.4 km
Developer	PT. MARGA RAYA JAWA
Feasibility Study	Completed
Environment Impact Study	Completed
Final Engineering Design	Completed
Land Acquisition Plan (From)	January 2003
Land Acquisition Plan (To)	December 2005
Construction Period Plan	2006 - 2008
Planned Year of Completion	2008
Estimated Traffic Volume	105,640 per hour at peak time
Estimated Investment Cost	Rp. 3,107 billion
Equivalent Amount in US$	US$ 345 million
Present Status	Land acquisition has not been progressed as scheduled and starting of construction cannot be determined at all.

R-T2 Surabaya - Mojokerto Toll Road

Segment	Waru - Mojokerto
Road Length	36.5 km
Developer	PT. MARGA NUJYASUMO AGUNG
Feasibility Study	Completed
Environment Impact Study	Completed
Final Engineering Design	On-going
Land Acquisition Plan (From)	2005
Land Acquisition Plan (To)	2006
Construction Period Plan	2006 - 2008
Starting Year of Construction	No construction works progressed
Estimated Traffic Volume	51,710 per day
Estimated Investment Cost	Rp. 2,231 billion
Equivalent Amount in US$	US$ 248 million
Present Status	Land acquisition has not been progressed as scheduled and starting of construction cannot be determined at all.

R-T3 Mojokerto – Kretosono Toll Road

Segment	Mojokerto - Kretosono
Road Length	41.0 km
Developer	PT. MARGA HANURATA INSTRINSIC
Feasibility Study	Completed
Environment Impact Study	On-going
Final Engineering Design	On-going
Land Acquisition Plan (From)	2006
Land Acquisition Plan (To)	2007
Construction Period Plan	2007 - 2009
Starting Year of Construction	No construction works started
Estimated Traffic Volume	20,660 per day
Estimated Investment Cost	Rp. 2,211 billion
Equivalent Amount in US$	US$ 246 million
Present Status	No sign of starting construction works

R-T4 Gempol – Pasuruan Toll Road

Segment	Gempol - Pasuruan
Road Length	34.5 km
Developer	PT. JASA MARGA
Feasibility Study	Completed
Environment Impact Study	Completed
Final Engineering Design	2006
Land Acquisition Plan (From)	2005
Land Acquisition Plan (To)	2006
Construction Period Plan	2007 - 2008
Starting Year of Construction	No construction works started
Estimated Traffic Volume	18,170 per day
Estimated Investment Cost	Rp. 1,800 billion
Equivalent Amount in US$	US$ 200 million
Present Status	No sign of starting construction works

R-T5 Pasuruan – Probolinggo Toll Road

Segment	Pasuruan - Probolinggo
Road Length	45.0 km
Developer	PT. BUKKAKA TEKNIK UTAMA
Feasibility Study	Completed
Environment Impact Study	Completed
Final Engineering Design	2006
Land Acquisition Plan (From)	2006
Land Acquisition Plan (To)	2007
Construction Period Plan	2008 - 2009
Starting Year of Construction	No construction works started
Estimated Traffic Volume	10,500 per day
Estimated Investment Cost	Rp. 3,314 billion
Equivalent Amount in US$	US$ 368 million
Present Status	No sign of starting construction works

R-T6 Gempol – Padaan Toll Road

Segment	Gempol - Pandaan
Road Length	13.6 km
Developer	PT. MARGA BUMI ADHIKARAY
Feasibility Study	Completed but under reviewing
Environment Impact Study	Completed but under reviewing

Final Engineering Design	
Construction Period Plan	2006 - 2008
Starting Year of Construction	No construction works started
Estimated Traffic Volume	22,030 per day
Estimated Investment Cost	Rp. 526 billion
Equivalent Amount in US$	US$ 58 million
Present Status	No sign of starting construction works

R-T7 Pandaan – Malang Toll Road

Segment	Pandaan - Malang
Road Length	37.6 km
Developer	PT. SEDCO INSTRINSIC NUSANTARA
Feasibility Study	Completed
Environment Impact Study	Completed
Final Engineering Design	On-going
Land Acquisition Plan (From)	2006
Land Acquisition Plan (To)	2007
Construction Period Plan	2007 - 2009
Starting Year of Construction	N.A.
Estimated Traffic Volume	N.A.
Estimated Investment Cost	Rp. 2,851 billion
Equivalent Amount in US$	US$ 317 million
Present Status	No sign of starting construction works

As shown in the above tables most of the toll development project that have been licensed to the toll road developers have not been able to start its construction works as schedule proposed at the time of bidding for public call on investment proposal of each toll road. The major reason of this delay of implementing proposed project is a delay of land acquisition.

Toll Road under Planning: There are two toll road development projects which have been under preliminary planning stage. One of the toll roads under planning is designed to connect Juanda International Airport and the Suramadu Bride along the eastern coast of Surabaya City as well as Tanjung Perak or it can be named Surabaya East Ring Road. The other toll road under planning is the outer ring road designed to connect Gresik and Surabaya - Mojokerto Toll Road and forming the ring road at the western edge of Surabaya City. This road can be named Surabaya Western Ring Road. The outlines of these toll roads are as follows.

P-T1 Surabaya Eastern Ring Road

Segment	Tambak Dao (Near Juanda Airport) – Tanjung Perak
Road Length	18.0 km
Developer	Tender Under Preparation
Feasibility Study	Not Yet
Environment Impact Study	Not Yet
Final Engineering Design	Preliminary plan
Land Acquisition Plan (From)	N.A.
Land Acquisition Plan (To)	N.A.
Construction Period Plan	No definite plan yet
Starting Year of Construction	No definite plan yet
Estimated Traffic Volume	N.A.
Estimated Investment Cost	Rp. 5,030 billion
Equivalent Amount in US$	US$ 560 million
Present Status	This road is planned to ease the traffic burden in the center part of Surabaya City and connecting Surabaya with Madura through Suramadu Bridge effectively.

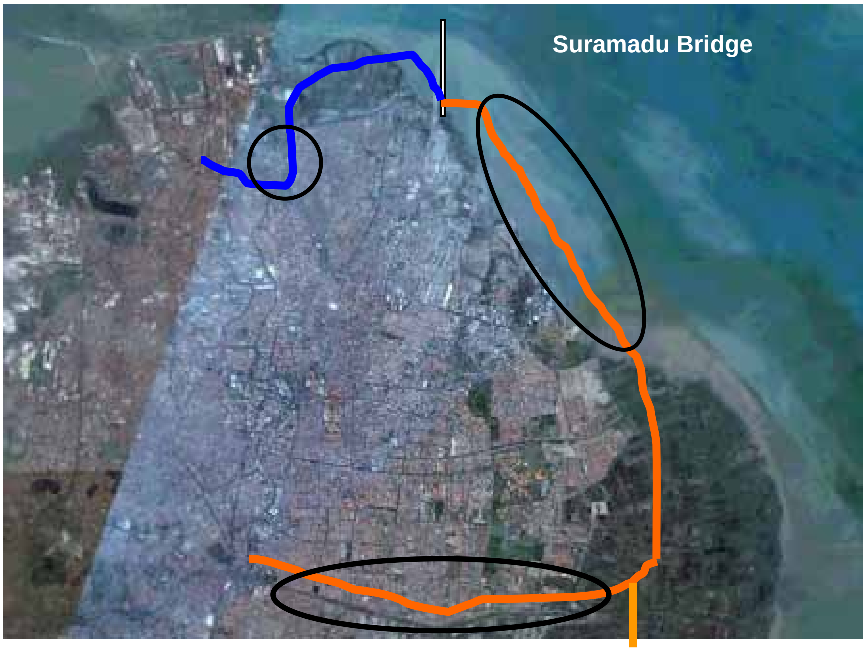
P-T2 Surabaya Western Ring Road

Segment	Gresik - Mojokerto
Road Length	20.0 km
Developer	No tender preparation yet
Feasibility Study	No study has been done yet.
Present Status	This road is planned to ease the traffic burden in the center part of Surabaya City and connecting Mojokerto with Gresik.

Priority Road Segment: The access road connecting with the road network of Surabaya City and the approach to the Suramadu Bridge in Surabaya side forms a part of Surabaya Eastern Ring Toll Road as illustrated in Figure 6.2.2. The detail development plan of access road or road connecting with Suramadu Bridge and the road network in Surabaya City has not been studied and determined in details. However, as Suramadu Bridge is expected to be completed by or around the end of 2008. These access roads should be planned and realized meeting with the completion of Suramadu Bride.

Figure 6.2.3 illustrates the proposed basic alignment of the Surabaya East Ring Toll Road.

Figure 6.2.3 Aerial View of Planned Route for Surabaya Eastern Ring Road



Note: The road segment indicated by black circle is planned to be realized by elevated road along the existing creak or canal passing through very congested residential area or some hundred meters off-shore from the eastern sea coast.

The priority segment of Surabaya East Toll Ring Road is a part of segment between Suramadu Bridge and Tanjung Perak which is shown in blue line in Figure 6.2.3. However, the land acquisitions for this section of the toll road seems not easy or suggests a need of considerably long time to complete the necessary acquisition of land for needed right-of-way because of its crowdedness and number of population to be relocated along the planned road alignment. However, unless this section of toll road is completed otherwise the smooth traffic flow to and from Suramadu bridge from Tanjung Perak cannot be expected as the existing road connecting these two locations is narrow and frequently jammed due to a mixture of traffic of container loaded trucks and motorbikes.

The timing of completion of Surabaya Western Ring Road should be studied since this road will form an important access to the new port being realized shortly in Lamong Bay.

Principal of Implementation Plan of Toll Roads in Surabaya City: The right of way for the access road connecting with Suramadu Bridge at Madura Island side has been already acquired and developed as a part of the bridge construction plan. Around 11.0 km of right-of-way with sufficient width between the base of Suramadu Bridge in Madura Island side (Kamal) and Burneh at 4 km east of Bangkalan has been already secured and most of the part has been already graded to be ready for the construction of high grade road. As the land acquisition in Madura side is rather easy when it is compared with the same in Surabaya side and the physical conditions for the development of access road there has no reason to hinder such road development.

On the contrary, the access road development at Surabaya side in connection with Suramadu Bridge is rather difficult to tackle with because of difficulties to acquire land through very congested residential area of Surabaya as mentioned above. At the beginning of commissioning of Suramadu Bridge the traffic demand especially the freight movement would concentrate at the northern tip of Surabaya City between Tanjung Perak and Suramadu Bride. Benteng Bridge is filled with the residence or small size houses and the existing road is quite narrow experiencing traffic jam even at present as shown in Figure 6.2.4. The relocation of houses to secure the right of way having enough width for construction of toll way system seems quite difficult in this area.

Figure 6.2.4 Road Passing Through Residential Area (Tj. Perak – Suramadu Bridge)

Source: JICA Study Team

It is anticipated that the acquisition of land for the right-of-way will take time to complete in such a crowded residential area in Surabaya in normal sense of planning. However, the completion of this access road should be expected at the simultaneous time of the completion of Surabaya Bridge or say by the end of 2008 or so. The road alignment plan should carefully be done taking into consideration of minimum requirement of land acquisition process and its needed period. One of the solutions to tackle this challenging issue is to consider the use of existing canal as much as possible. Fortunately, in this area, some canal runs since around 100 years ago. Figure 6.2.5 shows a view of possible canal on which an elevated toll road can be built without higher land acquisition cost but with acceptance of residents along the canal.

Figure 6.2.5 Canals Passing Through Surabaya City along SEER Route

Source: JICA Study Team

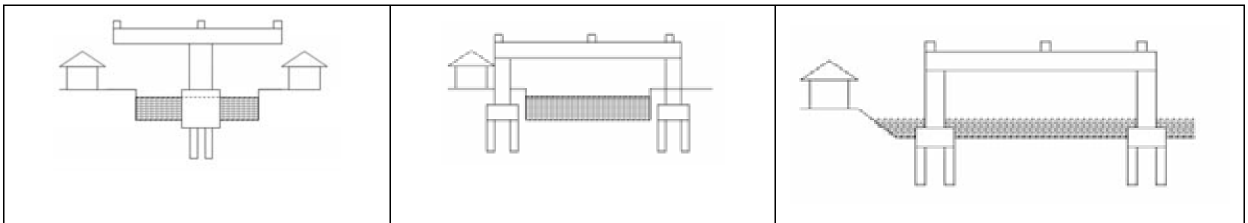
The access road connecting with Suramadu Bride directing to the east and south from the location of inter-change of Suramadu Bridge at Surabaya side is a major part of planned Surabaya East Ring Toll Road. The planned alignment of this toll road is set along the eastern shore of Surabaya City. However, the area along the shore line has been inhabited by a considerable number of residents since long time ago as well and it seems not easy to relocate such residence to secure the right of way along the shoreline as well.

One of the solution to minimize the land to be acquired and number of relocation of houses or farmland along the shoreline is to plan the alignment of this toll road off the sea shore. The soil condition of eastern sea shore of Surabaya is quite soft and it requires a long friction piles to sustain the elevated road system so far. This condition is the same even at off shore from the coast line. The average water depth along the eastern coast of Surabaya city is less than 1 meter even 200 meter far from the eastern seacoast as well.

If it is so, the elevated highway on the sea a little bit off shore from the coast line is possibly constructed. Fortunately, the water depth along the eastern sea coast is rather shallow therefore the elevated road off shore can be constructed without much cost and construction time because this system will eliminate any need of land acquisition so far.

The road engineering will be possible to solve two typical problems for toll road construction as mentioned above by constructing elevated highway along or over the alignment of canal or along the sea coast where the water depth is shallow as indicated in Figure 6.2.6.

Figure 6.2.6 Conceptual Typical Section of Elevated Road



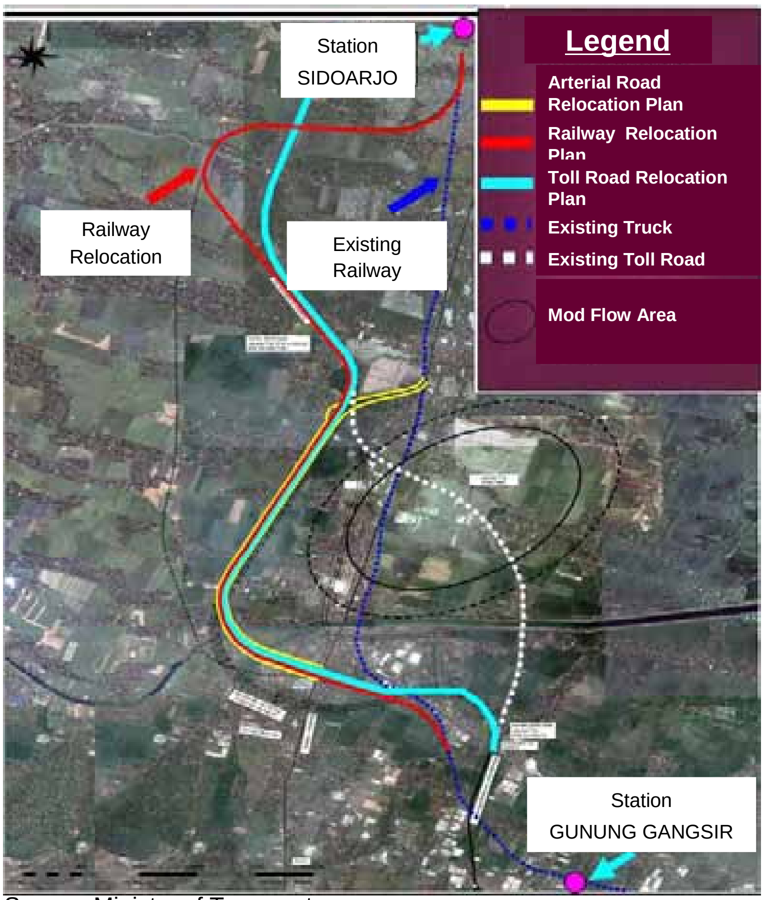
Road on Canal	Road Over Canal	Along Sea Coast

Source: JICA Study Team

Detour of Road due to Mudflow Disaster: The southern part of Surabaya – Gempol Toll Road between Sidoarjo – Porong segment has been closed because of Sidoarjo mudflow disaster since May 2006. In November 2006, the accumulation of mud caused a serious damage to the gas pipeline passing through in amid of this mudflow affected area and the gas supply has been suspended since then. This accident has been hindering substantially the economic activity especially in the manufacturing sector in general and light industrial sub-sector in particular as this uncontrollable mudflow occurred in a amid of area where the light industries are concentrated.

The relocation of toll road and railway has been under planning. The probable alignment of relocated road and railway are as illustrated in Figure 6.2.7. The coordinating body for urgent restoration of infrastructure and all measures to fix the mudflow or further inundation of this area has been established in April 2007 which is directly attached to the Presidential Office. The preparatory work including the coordination of various ministries and agencies concerned to subject infrastructures has started quite recently. The outline of the relocation plans for toll road and railroad are as follows.

Figure 6.2.7 Toll Road Realignment due to Mudflow



Source: Ministry of Transport

The detailed implementation plan of relocation of toll way has not been know yet. The new toll road section is planned to be relocated 3.5 km west from the outer dike and its length would be around 12 km. Assuming that the total length of toll road to be relocated is around 12 km and the unit cost per km is around Rp. 72 billion or US$ 8 million per km, the total cost for the relocation of toll is around Rp. 864 billion or US$ 96 million. The closure of a part of Surabaya – Gempol toll road at the end most south portion has been compelling to shoulder the extra time (around 2.5 hours) and transport cost (In an average, 20% more than that of before incident) to the shippers and business entities substantially especially the manufacturers located in the PIER where the Japanese manufactures are concentrated (27 Japanese companies).

The railroad those affected by mudflow are located at km 33+400 – km 34+000. The total length is around 600 meter between Tanggulangin – Porong line. The number of trains pass this section is 46 per day. The relocation of railroad is planned on west side of mud flow center by distance of 4 km as well. The total length of new railroad is around 18 km. The cost for relocation of railroad (18 km) is estimated at around Rp. 450 billion or US$ 50 million. Rp.

100 billion or US$ 11.0 million has been allocated from supplemented national budget and the remaining will be arranged from the budget of Ministry of Transport.

2) Arterial Roads

Table 6.2.1 shows the route of AP(Primary Artery) and K1(Primary Collector) road serving the East Java and falls under the administrative category of national road.

The improvement, widening and maintenance of these arterial roads is needed to function as primary collector road in GKS, however, such plans should be prepared taking into consideration of the implementation schedule of various toll roads planned to be constructed along the same or similar alignments and segments. A part of segment of national road between Kamal – Sumenep in Madura, Kamal - Burneh has been already under preparation to construct a 3 lanes/way access road connecting with Suramadu Bridge at Madura side. The acquisition of land for right-of-way has been completed and the land along the planned alignment has been already graded.

Table 6.2.1 List of Arterial Road (National)

No.	Route	Function	Class
1	Surabaya – Lamongan –Tuban - Rembang	AP	II
2	Surabaya – Pasuruan – Probolinggo – Situbondo - Banyuwang	AP	II
3	Surabaya - Melang	AP	II
4	Surabaya – Mojokerto – Jombang – Kertosono – Caruban – Madiun – Ngwai - Mantingan	AP	II
5	Kamal – Bangkalan – Sempang – Pamekasan - Sumenep	AP*1	III A
6	Gresik – Sedang - Tuban	K1	III A
7	Mojokerto – Mojosari - Gempol	K1	III A
8	Probolinggo – Lumajang – Jember - Banyuwangi	K1	III A
9	Tulungagung – Lumajang – Jember - Banyuwangi	K1	III A
10	Jarakan – Panggui - Pacitan	K1	III B
11	Glonggong - Pacitan	K1	III A
12	Wonorejo – Lumajang – Kepenjen - Tulungagung	K1	III A
13	Tulungagung – Jarakan – Panggui - Pacitan	K1	III B
14	Malang - Kepanjen	K1	III A
15	Tulungagung – Kediri - Kertosono	K1	III A
16	Caruban – Madiun – Maosati - Ngawi	K1	II
17	Widang – Bojonegoro – Padangan – Ngawi - Mediun	K1	III A

Note:
1. Kamal – Sumenep is the arterial road in Madura Island.

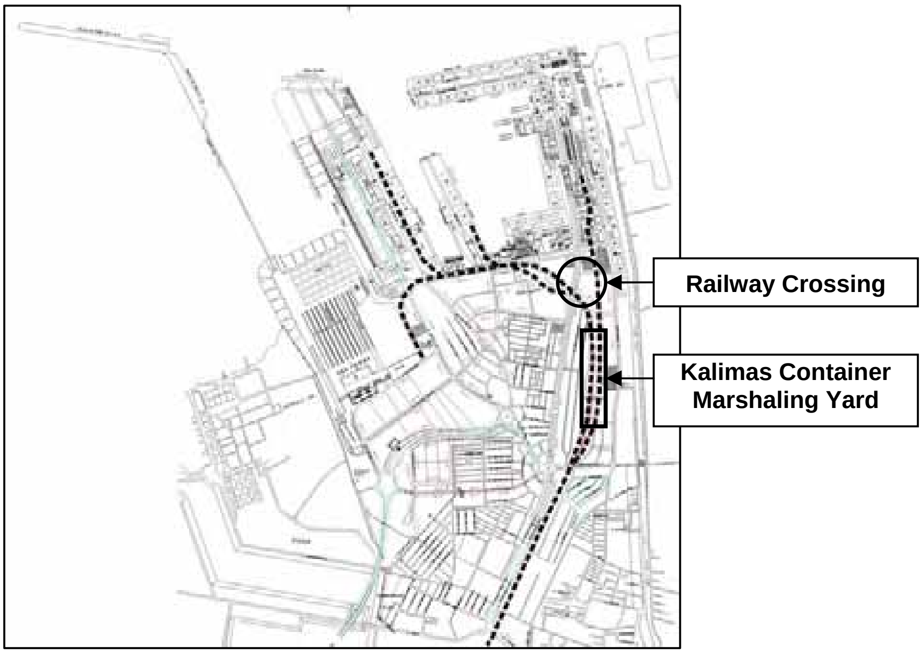
3) Railway Network

Intra-regional Freight Rail: Railway transports cargo to Tanjung Perak through two ways. For container haulage, rail service is extended to Kalimas Station and then containers are transferred by truck. For other cargoes, Pasarturi Station works as a transfer point between rail and truck. The central container handling station is located at Pasarturi in Surabaya City. In Gresik, there is no branch line connecting to Gresik Port; however, some large industrial cargo shippers have siding lines such as Semen Gresik and Petrokimia.

Port Branch Line: There exist the railway tracks in the premises of Tj. Perak Port as illustrated in Figure 6.2.9. According to PT. KAI, this branch line is under rehabilitation and expansion to double-track by the Directorate General of Railways, MOT in 2007. After its completion, PT. KAI plans to revive the operation of freight train to deal with the container traffic in Tj. Perak port i.e. the berth of Nilam, Berlian and TPS.

Railway Freight Marshaling Yard: Kalimas Station should be reformed as a container freight train marshaling yard and station. The land area of Kalimas Station has an ample space to create a modern railway container freight marshal yard. The location of Kalimas Station and its area spreading between Jl. Tanjung Perak Timur and Jl. Kalimas Baru and north of Jl. Sisingmangaraja is as indicated by rectangular in Figure 6.2.8. All container designated to be transported by rail can be drawn to this area by shanty locomotive then arranged for long-distance railway hauling using container handling equipment such as stacker or RTG. This space is quite enough to arrange several train composed on 20 – 30 freight car designed to carry 40' container.

Figure 6.2.8 Railway Tracks in Tj. Perak



Source: JICA Study Team

Figure 6.2.9 shows the rehabilitation and extension works for double tracking of railway branch line directing toward Tj. Perak Port that cross the Jl. Tanjung Perak Timur and Barat. The location of these photographs is indicated by circle in the above figure.

Figure 6.2.9 On-going Rehabilitation Works of Railway Track along Jl. Tanjung Perak

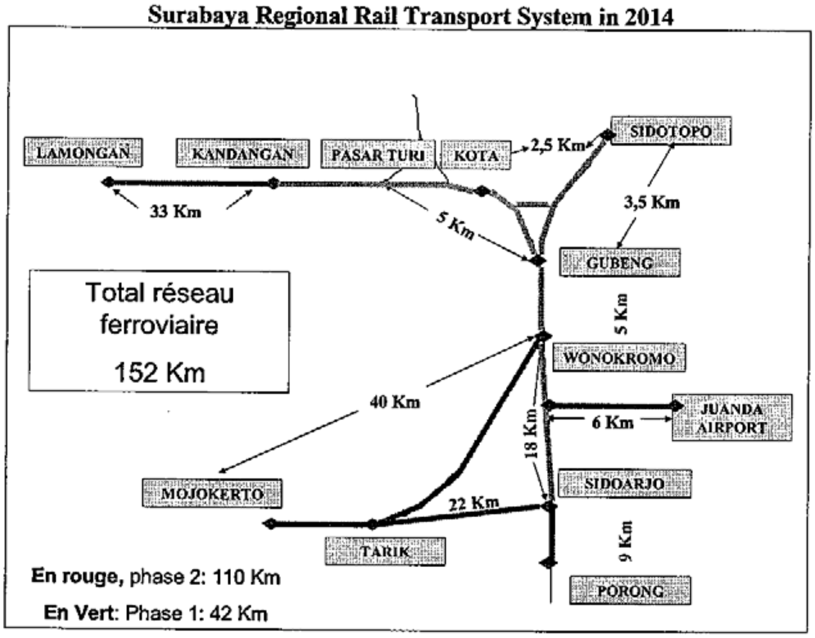
		
To the East	To the West	To the East from Center

Source: JICA Study Team

Railway Development Plan in Surabaya Metropolitan Area: The French railway engineering consultants, SNCF International, has conducted a preliminary feasibility study on the development of railway network system in Surabaya City in one year time (April 2006 – April 2007) upon request of Ministry of Transport of Indonesia (DGR: Directorate of Railways, MOT) with a financial assistance of the Ministry of Finance and Industry of France (DGPTE: Direction Generale du Tresor et des Politiques Economiques).

The proposed diagram of this urban and regional railway system of 154km length in total is planned to be developed in two stages namely Stage-1 by 2010 (Length: 42km) and Stage-2 by 2014 (Length: 110km). Figure 6.2.10 illustrates the brief network of proposed railway system.

Figure 6.2.10 Surabaya Regional Rail Transport System (SRRTS) in 2014



Source: Study of the Regional Rail System for Surabaya, East Java, SNCF International, Summary Report

The main aim of the development of SRRTS are the provision of mass transit system or urban commuter train service in Surabaya so as to ease traffic congestions of Surabaya City and to rationalize the transport economy of Surabaya City and its suburbs.

The railway track designed for this project is of double track and most of the segment passing through the Surabaya City is elevated to avoid level crossing. However, the segments stretching to the outside of the Surabaya City are the eastern part of Java North Line and the Java South Line. Therefore, a careful review on the design concept and preliminary design on the part of elevated section should be carried out since several toll road development projects adopt elevated road that may cross with elevated track for railway operation.

However, this railway project does not consider much about freight transport using the same track under planning. Therefore, the coordination among freight train operation plan and toll road development plan should be carried out prior to execution of the detailed engineering study for the implementation of this railway project.

Table 6.2.2 Feature of SRRTS Project

Stage-1		
Double track link	Pasarturi– Gubeng (5km) Kandangan – Sidoarjo (18km)	Main railway network (36km) Service track (6km) Total 42 km in Stage-1
Train	840 passengers per train at 90km per hour at 20 minute head at peak time and 40 minutes at off-peak time	Diesel Motor Unit (DMU) 18 units
Stations	10 stations	Renovation of existing stations
Target Passenger Volume	17 million per year in 2010	
Stage-2		
Double track link	Lamongan – Kandangan (33km) Sidoarjo – Porong (9km) Wonokromo – Mojokerto (40km) Waru – Juanda Airport (6km)	Total railway network (110km)
Single track link	Sidoarjo – Tarik (22km)	
Train	840 passengers per train at 120km per hour	Electric Motor Unit (EMU) 29 units
Target Passenger Volume	40 million per year in 2010	52 million in 2020

Source: Study of the Regional Rail System for Surabaya, East Java, SNCF International, Summary Report

The estimated total capital investment cost of the SRRTS project is around US$ 1.1 billion and its breakdown is as shown in Table 6.2.3.

Table 6.2.3 Estimated Initial Capital Investments for SRRTS

Item	Total in US$ Million
Preparation	7.5
Land Acquisition	7.5
Civil Engineering Works	372.8
Track Woks	183.8
Signaling	135.0
Telecommunication	17.3
Electrification	67.5
Rolling Stocks	372.0
Total	1,163.4

Source: Study of the Regional Rail System for Surabaya, East Java, SNCF International, Summary Report

The current major issue of this commuter train project to be tackled with is designing of appropriate institutional setup to operate and manage this railway transport service and funding of the project. At this moment, the funding scheme of the project is not clear and no sufficient commitments of potential financial institutions have been secured yet.

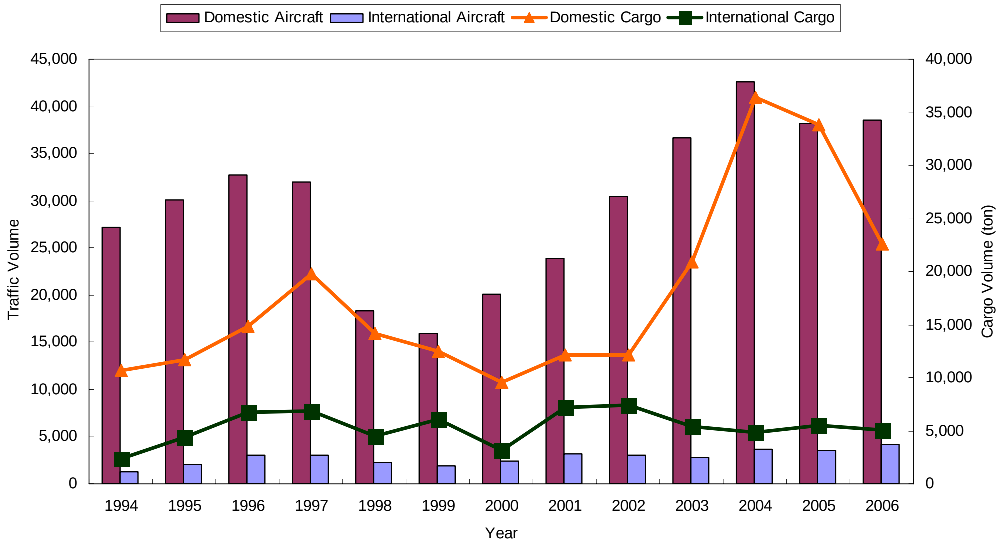
4) Airport

Juanda International Airport is the major international airport of East Java and located at the south of Surabaya City in Sidoarjo Regency. The construction works for modernization and expansion of the Juanda International Airport has taken around 3 years and it was completed in 6 November 2006 with the financial assistance of Japanese government.

Juanda International Airport was renewed and started it operation on 15 November 2006. The total area is 4,773 hectares and situated at 2.74 meter high from sea level. The airport has one runway of 3,000 meters and possible to receive B747 class aircraft. The total area of passenger terminal is 30,100 square meters and has a service capacity of 8.1 million passengers and 45,000 tons of cargo freight per year. The airport is currently served by 11 domestic airways and 7 international airways for 730 domestic flights and 101 international flights per week, respectively. The airport is connected with 15 cities and 7 countries at present. The distance of access road from Surabaya is 20 km.

Figure 6.2.11 illustrates the changes of international and domestic passenger and freight traffic from 1994 to 2006.

Figure 6.2.11 Change of Outbound Air Freight



Source: Angkasa Pura I, June 2007

The volume of outbound passenger and freight is almost the same of inbound passenger and freight. As shown in this figure Juanda International Airport plays an important role for the domestic air freight. The annual handling volume of domestic airfreight has reached almost 75,000 tons in 2004 with strong and quick recovery since 2000 or adversely economic effect of Asian financial crisis. The annual handling volume of international airfreight has not been changed much but maintaining at around 10,000 tons. Since the number of international flight has been low still at around 5,500 a year, the cargo volume is limited to around 13,000 tons only.

However, it is foreseeable that the feature of products manufactured in GKS would change from rather traditional or low-tech industrial products to somewhat more high-tech products in the future following the trend of trade of industrial manufactured products in the world. This would be accelerated because of the provision of appropriate transport infrastructure such as modern cargo freight handling facilities in Juanda International Airport and land transport access to and from the airport by completion of airport toll road.

As the provision of smooth transport flow and close connection of seaport, airport and industrial estates is imperative to reinforce the industrial performance and activities of GKS, the transport network should be structured and realized in such development context.

6.3 Channel Constraints and Allowable Port Development

1) Hindrances of the Present Access Channel

a. Hindrances of the Present Access Channel

There are mainly four kinds of hindrances for safe and efficient ship operations in the present Surabaya Access Channel as shown in Table 6.3.1 and Figure 4.1.2.

Shallow Water: The most fundamental issue is the lack of water depth along the Access Channel for large vessels. The existing Surabaya West Access Channel has a natural water depth of about 9.5m and a bottom width of about 50m. It is planned by Pelindo III to dredge the channel every four years to a depth of 10.0m. This maintenance dredging was carried out in 1996, 2002 and 2005 by Pelindo III. The actual dredged depth was 10.5m and width of 100m, and the volume dredged in 2005 was 687,000 m^3.

There are two areas to be aware of on this regard; one is the entrance and exit of the Outer Channel, where water depth is usually less than 10m. The other is hard shoals in the Inner Channel in front of PT. Smelting Pier, which possibly consist of weathered lime stones, for which some marks are indispensable to indicate the locations of the deadlocks. The former can be dredged by a trailing suction hopper dredger (TSHD) and the latter by a cutter suction dredger (CSD).

The planned water depth, for example, of the existing Surabaya Container Terminal (TPS) in Surabaya Port is 12m. Therefore, the depth and the width of the existing channel are insufficient for safe and efficient operations of the present port. There have been strong requests for improvement of the channel conditions by major port users.

It is apparent that maintenance dredging is necessary. The quantitative dredging plan, however, will be proposed at a later stage of this Study after additional site surveys and analyses have been conducted.

Table 6.3.1 Main Hindrances of Present Surabaya Channel

Type	Phenomena	Specific Location
1. Shallow Water	Sedimentation Natural shoal	Entrance and corner of West Access Channel (Depth<10m) Hard rock In front of PT. Smelting Pier (Depth < 4.7m)
2. Obstacles	Sunken ships	At both entrance of the Access Channel In Anchorages of Tg. Perak (24 wrecks)
3. No Anchor Area	Gas pipeline Power cables	Along west side of the channel to Gresik Across the channel from PLN to Madura Island
3. Prohibited Area	Oil field Old mine fields	North coast of Madura Island in the Java Sea Beside the East Channel in the Bali Sea

Source: JICA Study Team

Obstacles: There are 10 sunken ships and obstacles at the entrance channel around Buoy Nos. 5, 7 and 4. In the anchorages at Tg. Perak Port, there are 24 wrecks, which are relatively small size. Collision with these obstacles can be avoided by careful maneuvering of ships, although they reduce efficiency of overall ship operations in the port.

No Anchor Area: In the present Surabaya Channel, there are two areas where anchoring is prohibited, i.e. for protection of the gas pipeline and the power cables. The former is a serious disadvantage for port planning on the west side of the channel. The latter is a recurring issue for Surabaya Port, for being cut sometimes by drifting ships with anchors. At this moment, there is no choice but to abide by these rules.

Prohibited Areas: There are two water areas where no unauthorized ships can enter. One is the oil field, which impose the limit of port development, for example, of Tg. Bulupandan Port to the east side. The other is the northern side of the East Channel, because of a former mined area. In fact, most of the shallow swampy areas along the both sides of the Surabaya Channel are still designated as “Former Mined Areas.” It is necessary to check and sweep the mines before any construction works can be executed.

Hindrances by New Gas Pipelines: There are two new undersea pipelines, of which alignments have been approved by the Indonesian Government. Details of the projects are reported in Section 5.4 3). It is apparent that the pipeline will become a serious factor to hinder operations of ships and development of port facilities specifically at the offshore area of the West Channel, where anchoring shall be prohibited, and ships may face difficulties to stop drifting under strong current and wind. Existence of a dangerous underwater pipeline will be a constraint for construction of port facilities and dredging of the channel and basins.

b. Past Dredging Plan Study

In the past, an important study was carried out for estimating volumes of sedimentation and necessary dredging at the Surabaya West Access Channel, which was conducted by a Dutch consulting firm, i.e. MH-Detec, in 2001.

The study was performed based on the data of bathymetric surveys before/after dredging in 1996, and an analysis was made to assess the sedimentation volume by siltation. They calculated the necessary dredging volumes of maintenance dredging as well as initial capital dredging for the three cases of dredging depth, i.e. LWS -12m, -14m and -16m.

The dredging works are supposed to be executed by means of a locally available trailing suction hopper dredger (TSHD) with a hopper capacity of 3,000m3 at the outer channel and a cutter suction dredger (CSD) with 1,000kW cutter head power and a power pump power of app. 7,000kW for the excavation of bedrock in the inner channel area.

The result of assessment of dredging volume and execution time is summarized in Table 6.3.2. The DETEC study concluded that the “most reasonable” water depth is 14m with a channel width of 200m.

The review and verification of this dredging plan will be done on the next stage of this Study based on additional site surveys and analyses.

Table 6.3.2 Estimate of Necessary Dredging Volume and Execution Time

Kind of Work	Item	Planned Channel Depth: D*		
		D = 12m	D = 14m	D = 16m
Initial Capital Dredging	Dredging Volume (million m^3)	8.1	19.3	33.4
	Execution Time (week)**	22	53 ***	94
Annual Maintenance Dredging (million m^3/yr)	Diffuse Settling	2.0	2.4	3.2
	Slumping / Turbidity Flow	0.3	0.55	0.9
	Bottom Transport (sand)	0	0.05	0.1
	Total	2.3	3.0	4.2

Note: * Width of the planned channel is 200m.
** Necessary time to dredge by a 3,000m^3 TSHD. For example, it takes one year for the case of ***.
Source: MH-Detec (2001) “Upgrading of the Surabaya Access Channel”

c. Studies in the Improvement of Access Channels

“FS on Development of Lamong Port East Java” in 1997 recommended a new seaport to be developed at the Lamong Bay by means of reclamation of more or less 500 ha. It is planned that the reclamation lands are divided into several districts including port and terminal, industrial, commercial, residential and recreational use. The FS also recommends access channel improvement to be widened to 200 meters and deepened to 13 meters.

The DETEK report in 2001 recommends deeper access channel improvement of 14 meters with the same widening of 200 meters to allow two-way seaborne traffic.

According to the PELINDO III Master Plan 2025, seaport pool arrangement will be done for ship safety during the period 2001-05. This is a follow-up arrangement to the activities conducted between 1998 and 1999 RKAP, including installation of large and small lighted buoys and salvaging ship frames. (Page V-78)

According to the PELINDO III Master Plan 2025, the Surabaya West Access Channel will be improved in two phases: widening to 200 meters and deepening to -11m LWS by 2010 and further widening to 240 meters and deepening to -13m by 2025. (Page V-85)

2) Hydraulic Characteristics of Madura Strait

It is a prerequisite to try to carefully scrutinize and reveal the nature of the Madura Strait in order to understand the physical characteristics of the water areas from the technical point of view, and apply the result to planning of port infrastructure and access channels. One method is hydro-morphological approach.

There could be a relationship between water depth, H, and width, B, of a channel under the dynamic equilibrium state:

$$y = a\,x^{-b} \qquad (1)$$

where $y = H / Ho$ and $x = B / Bo$. The constants Ho and Bo are reference depth and width, respectively. a and b are parameters. This equation implies “Conservation Law of Hydraulic Sections” in a continuous channel under a certain flow condition.

Actual data taken from the Navigation Chart in the Madura Strait, i.e. Admiralty Chart Nos. 975 and 921, are applied to this equation as shown in Figure 6.3.1. Ho and Bo are chosen at Tg. Sawo-Ujung Slempit Section. B is the variable showing the width of surface water between the contours of CDL 0 or between CDL 0 and the submerged training wall. The cross section is modeled by a trapezoidal profile as shown in the Figure. The variable H is represented by the height of trapezoid, i.e. Hmax.

A total of 21 sections are sampled and their r.m.s. approximation results in the diagram shown in Figure 6.3.2. The parameters are:

$$a = 1.16 \text{ and } b = 0.814 \text{ with a correlation coefficient } R^2 = 0.967, \qquad (2)$$

which means that the above equation (1) can be applied to the Madura Strait very closely and successfully and it is to herein as “the Hydraulic Rule of the Madura Strait.”

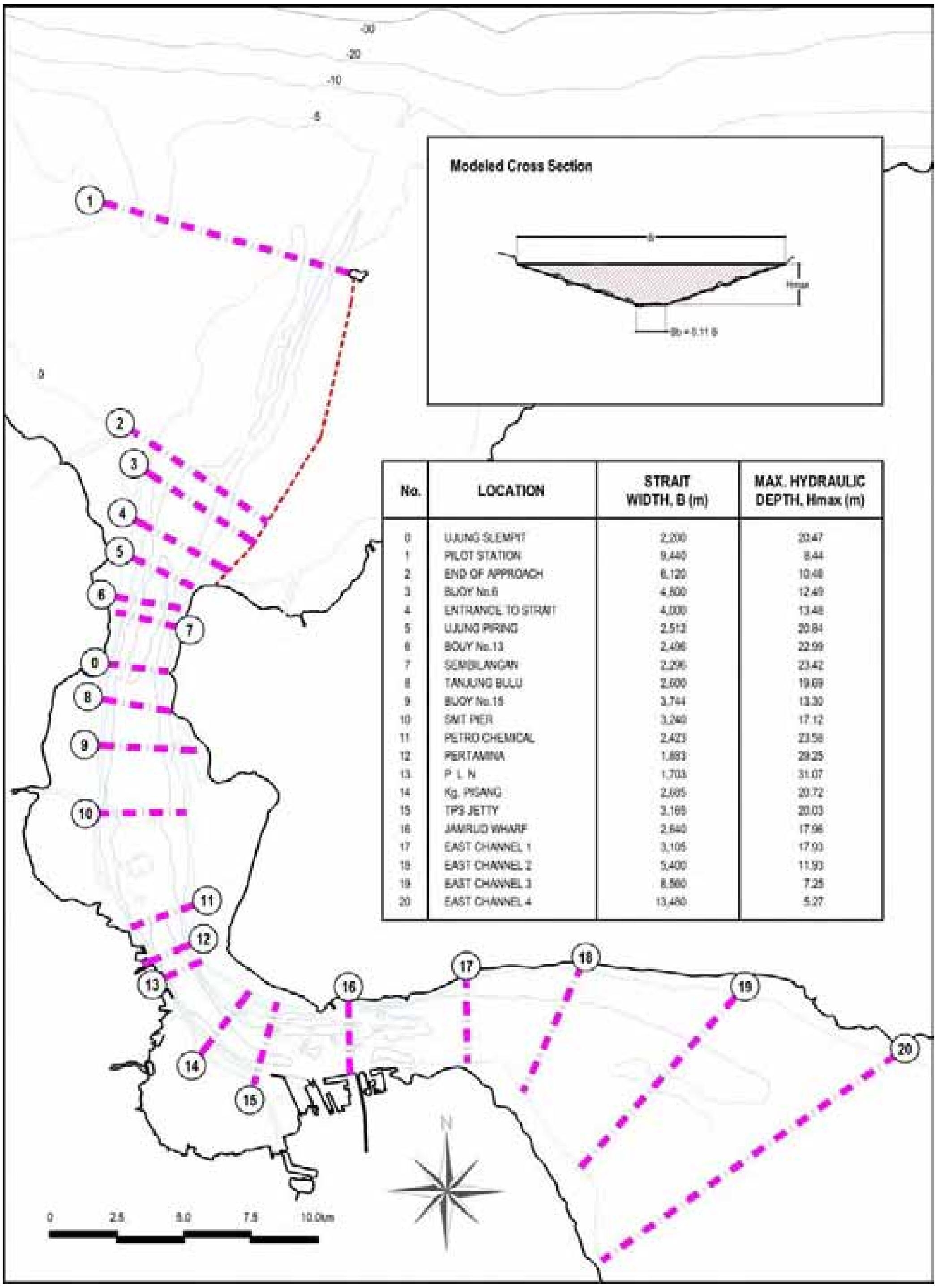
The above rule suggests the following important understandings:

i) If a water depth, for example 15.0m, should be maintained, the width of the channel shall be narrower than approximately 3,900m.

ii) If the present width or depth of the Strait were changed artificially, for example by reclamation or dredging at a water area to construct for example a wharf or a basin, it might result in a change in depth and width at not only the same section but also other sections downstream and upstream.

iii) The shallow swamp areas, of which elevation is higher than CDL 0 but submerged during high tides, do not affect the above relationship significantly as far as the maximum hydraulic depth at the center of flow is interested.

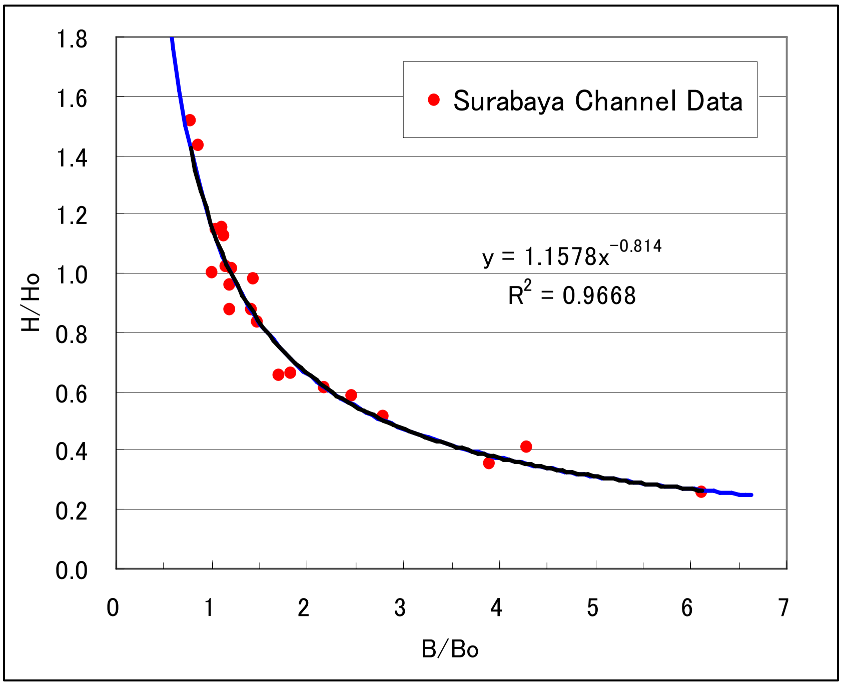
Figure 6.3.1 Analysis of Hydraulic Cross Sections in Madura Strait



No.	LOCATION	STRAIT WIDTH, B (m)	MAX. HYDRAULIC DEPTH, Hmax (m)
0	UJUNG SLEMPIT	2,200	20.47
1	PILOT STATION	9,440	8.44
2	END OF APPROACH	6,120	10.48
3	BUOY No.6	4,800	12.49
4	ENTRANCE TO STRAIT	4,000	13.48
5	UJUNG PIRING	2,512	20.84
6	BOUY No.13	2,496	22.99
7	SEMBILANGAN	2,296	23.42
8	TANJUNG BULU	2,600	19.69
9	BUOY No.15	3,744	13.30
10	SMT PIER	3,240	17.12
11	PETRO CHEMICAL	2,423	23.58
12	PERTAMINA	1,893	29.25
13	P L N	1,703	31.07
14	Kg. PISANG	2,695	20.72
15	TPS JETTY	3,169	20.03
16	JAMRUD WHARF	2,640	17.96
17	EAST CHANNEL 1	3,105	17.93
18	EAST CHANNEL 2	5,400	11.93
19	EAST CHANNEL 3	8,560	7.25
20	EAST CHANNEL 4	13,480	5.27

Source: JICA Study Team

Figure 6.3.2 Correlation between Depth and Width of Madura Strait



Source: JICA Study Team

3) Allowable Port Development Patterns

a. Master Plan of Port Development in the Madura Strait

There is a Master Plan of development of the ports in the Madura Strait which was authorized by MOT in 2003. The plan covers eight points along the coast on the both sides of the Strait. The areas to be developed are defined as shown in Figure 6.3.3.

It is characteristic that all the points are planned to be developed by reclamation of shallow water areas with piers and basins. The total area to be reclaimed amounts to more than 5,300ha.

The above concept shall be carefully reviewed from the technical viewpoint of Conservation Law of Hydraulic Section.

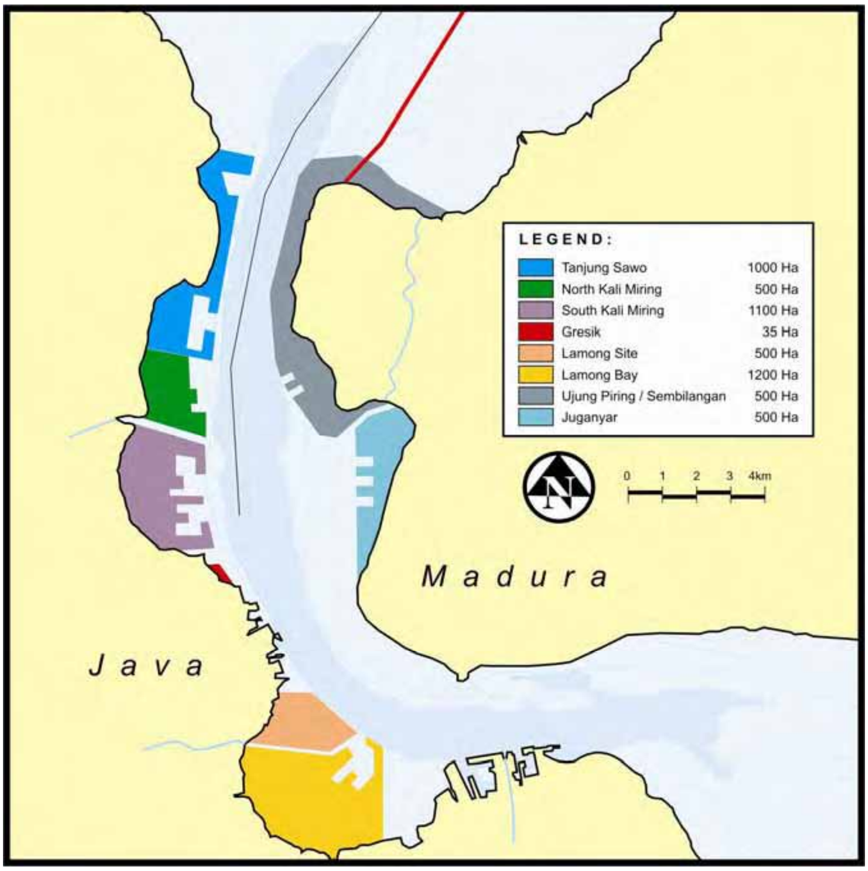
b. Development Plan of Port City at West Madura

In expectation of completion of Suramadu Bridge, the south west coastal area at Kab. Bangkalan in Madura Island is planned to be developed as an industrial port area by PT. Madura Industrial Seaport City (MISI). The preliminary plan shown in Figure 6.3.4 was approved by the local government in 2007.

This plan is characterized by construction of port facilities along the coastline of Juganyar – Socah - Tg. Tanjungang – Kamal and their hinterland development.

It is noted that basin dredging to be accompanied in front of the new port, where the water depth is mostly shallower than CDL 0, may cause a drastic change in the channel depth in front of Gresik area.

Figure 6.3.3 Master Plan of Port Development in the Madura Strait



Source: Pelindo III

Figure 6.3.4 Madura Industrial Seaport City Plan

Source: MISI

4) Relevant Port Plans

a. **Lamong Bay Port**

The Lamong Bay Port Project was originally formulated in 1997 by PELINDO III and has been articulated by the Indonesian government as one of the most important port projects at Teluk Lamong (Lamong Bay) in Surabaya Port. The port plan was formulated based on the required water depth of 14m, and an assumption that the West Access Channel will be maintained well for the operations of the port by the government. The project was already authorized by the East Java Province and the Indonesian government up to a reclamation area of 50 ha. In this project, critical factors for early implementation are doable PPP arrangement and urgent improvement of the access channel.

Table 6.3.3 Features of Lamong Bay Container Terminal Project

Subject	Item	Figure	Remarks
Basic Planning Conditions	Target Year Container Throughput Design Ship	2015 1 mill TEU Not mentioned	First Phase
Planned Berthing Facility	Berth Length x Width	1,280 m x 40m	Depth: 14m *
Planned Trestle	Length x Width x No.	260m x 12m x 3	
Planned Basin	Width (Depth)	Not mentioned	
Planned Yard and Equipment	Container Yard and Gantry Crane + RTG	50 ha Not mentioned	Including 242m x 1,216m = 29.4 ha
Planned Access Path	Causeway Offshore Bridge	2,686m x 21.5m (3x84m) x 21.5m	
Access Channel	Depth and width	To be Studied	West Surabaya Ch.
Natural Design Conditions	Ground Level (above CD) Design Soil Conditions Design Dock Structure	Not mentioned	
Project Cost	Civil Work +Contingency + Land + IT+ Super Str,	Rp. 2,551 bilion (US$ 275 milion)	Channel dredging by GOI
Project Return	Economical Financial	Viable Marginally viable	F/S is to be reviewed

Source: KKPPI "Information Memo - Lamong Bay Container Terminal" 2006 (Memorandum for the Indonesia Infrastructure Conference and Exhibition)

* DGST "Tanjung Perak Port Development at Lamong Bay" 2005

Figure 6.3.5 Layout Plan of Lamong Bay Container Terminal Project

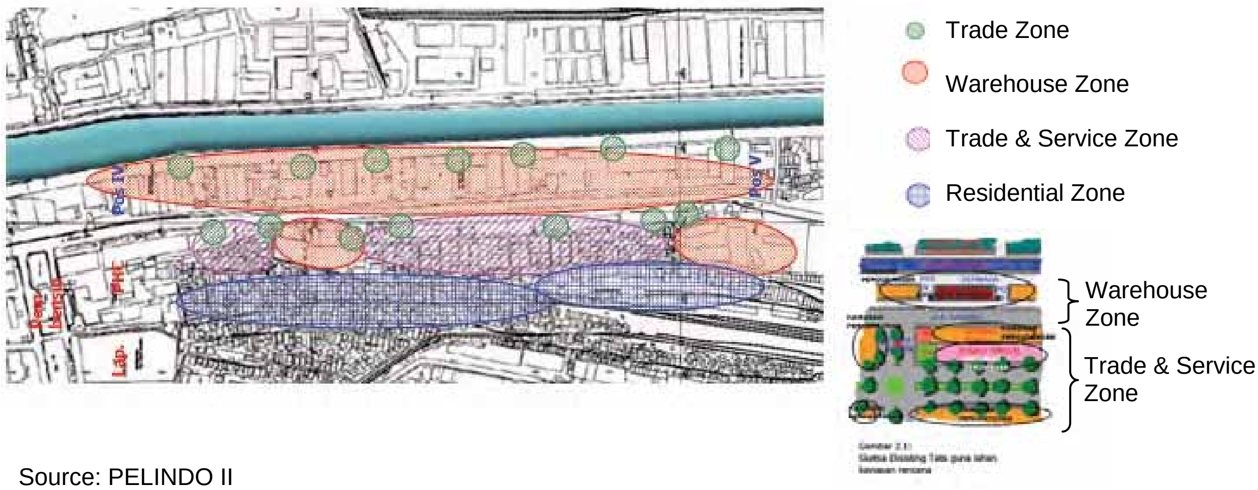
Source: PELINDO III

b. Rehabilitation Plans at Tg. Perak

Kalimas Terminal: The function as a port for traditional shipping has changed because of many steel vessel with length over 50 meter doing loading and unloading of container in the port. The condition of Kalimas is very poor with shallow and dirty water, and many slum areas on the side of river, especially near the Petekan traditional market.

Pelindo III with the Local Government of Surabaya has planned to revitalize Kalimas Terminal. They have commitment to develop Kalimas and provide service for traditional shipping (pelra). The physical work will take around two months with total budget around Rp. 1 billion and will begin in the mid of August 2007.

Figure 6.3.6 Rehabilitation Plan of Kalimas Terminal



Source: PELINDO II

Nilam Terminal: There are several places in Tg. Perak Port where renewal plans have been discussed to rehabilitate old wharves constructed about a century ago around 1910. One of the plans related to increase in container handling capacity is the Rehabilitation Plan of the East Nilam Wharf, which is under discussion in MOT.

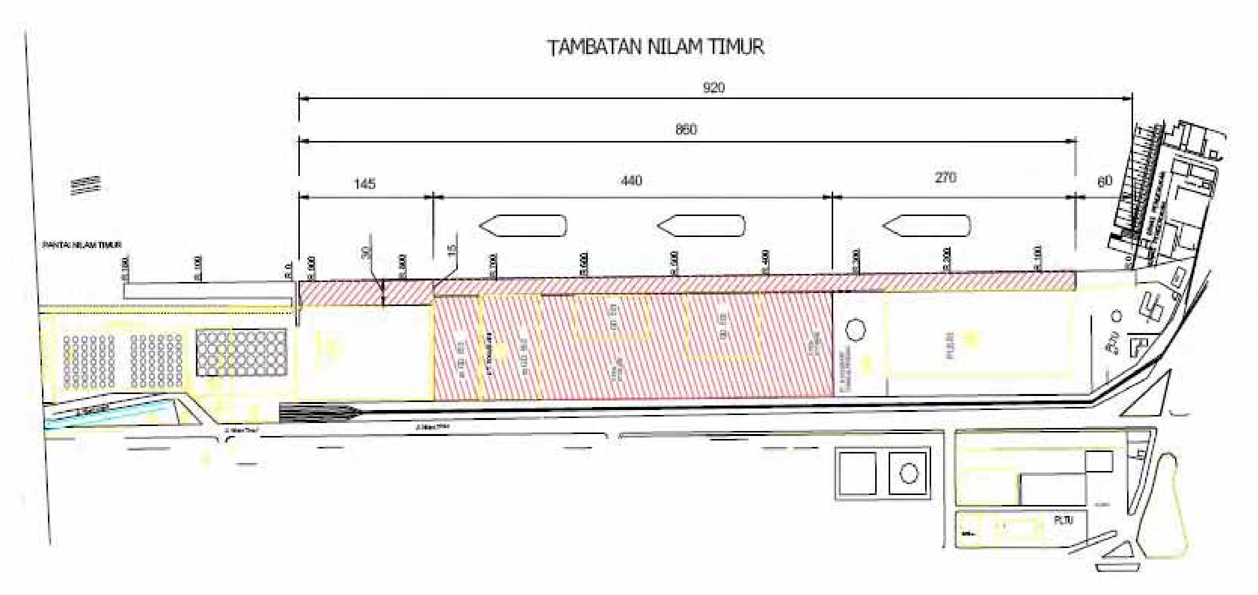
The plan considers rehabilitation of the central portion of the East Nilam Wharf into two multi-purpose berths as shown in Table 6.3.4 and Figure 6.3.7. The total investment cost is estimated to be about US$ 27 million.

Table 6.3.4 Rehabilitation Plan of East Nilam Wharf in Tg. Perak Port

Cargo	Berth size	Equipment	Ground slot	Berth occupancy	Annual Capacity
Container	Length: 440m	3 CC	1,000TEU x 5 tier	70%	250,000 TEU
General Cargo	Area: 3ha	2 HMC	Dwell time: 7days		1,500,000 ton

Source: MOT

Figure 6.3.7 Rehabilitation Plan of Central Part of East Nilam Wharf

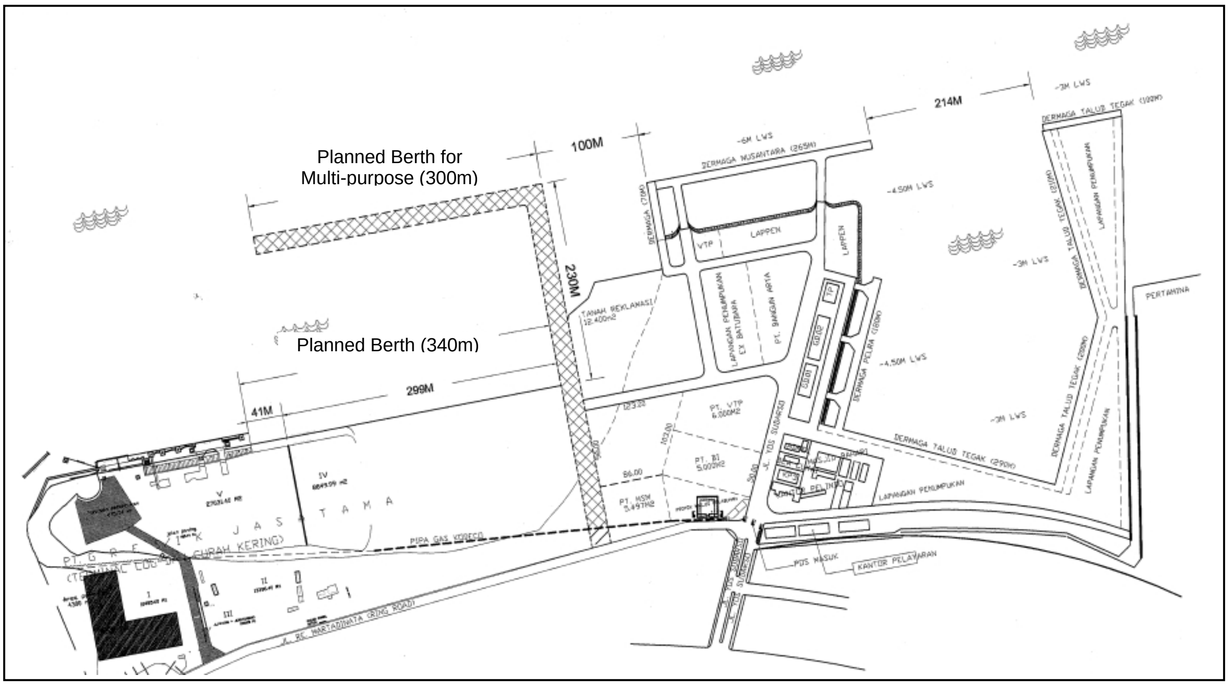


Source: MOT

c. Berth Expansion at Gresik Port

The existing berth occupancy ratio of Gresik port has reached around 70%, so it is necessary the expansion of berth. Thereby, Gresik Port has a plan of the berth expansion for multi purpose as shown the following figure. This plan considers the expansion in the west part of Gresik Port into two berths (300m and 340m).

Figure 6.3.8 Berth Expansion Plan at Gresik Port



Source: PELINDO III Gresik Branch Office

7 TRAFFIC DEMAND FORECAST

7.1 Future Socio-economic Framework

1) Population and Labor Force

In 2005, BAPPENAS forecasted future population of each province up to 2025 based on the census population, using the cohort method. The forecast simply assumed past trend patterns of transmigration among provinces. As for the population of East Java province, this study will use the same forecast.

As the BAPPENAS' projection predicted the birth rate would continue to decline, population growth rate would become lower in most provinces and become negative in DKI Jakarta, 2023 and also in East Java province, 2024 as shown in Table 7.1.1.

The past population trend shows the population share of the Study Area has been increasing from 21% in 1980 to 25.4% in 2005. The trend fits well the following a logistic equation:

$$Y = 100 / (1.0 + \mathrm{Exp}(-9.065 \times 10\text{-}3t + 19.2776)), \quad (R^2 = 0.989)$$

Where, Y: Population Share of Study Area in East Java Province (%)

t : year

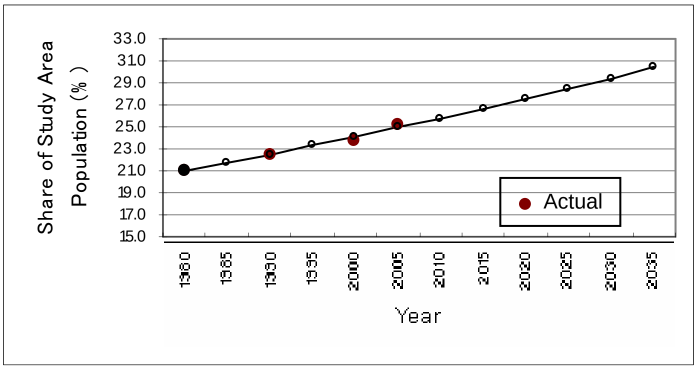
According to the equation, the share of the Study Area will become nearly 30% in the year 2030 (Figure 7.1.1).

Table 7.1.1 Population Forecast by Province

Year	Population (1000)			Annual Growth Rate (%)		
	Indonesia	DKI Jakarta	East Java	Indonesia	DKI Jakarta	East Java
2000	205,132	8,361	34,766	-	-	-
2001	207,927	8,429	34,926	1.363	0.813	0.460
2002	210,736	8,497	35,084	1.351	0.807	0.452
2003	213,550	8,566	35,240	1.335	0.812	0.445
2004	216,381	8,636	35,396	1.326	0.817	0.443
2005	219,204	8,699	35,550	1.305	0.730	0.435
2006	222,051	8,757	35,695	1.299	0.667	0.408
2007	224,904	8,814	35,843	1.285	0.651	0.415
2008	227,779	8,872	35,989	1.278	0.658	0.407
2009	230,632	8,929	36,128	1.253	0.642	0.386
2010	233,477	8,981	36,269	1.234	0.582	0.390
2011	236,331	9,022	36,387	1.222	0.457	0.325
2012	239,174	9,063	36,510	1.203	0.454	0.338
2013	242,013	9,101	36,628	1.187	0.419	0.323
2014	244,814	9,136	36,734	1.157	0.385	0.289
2015	247,572	9,168	36,840	1.127	0.350	0.289
2016	250,342	9,193	36,932	1.119	0.273	0.250
2017	253,089	9,216	37,015	1.097	0.250	0.225
2018	255,792	9,236	37,087	1.068	0.217	0.195
2019	258,437	9,252	37,144	1.034	0.173	0.154
2020	261,005	9,262	37,183	0.994	0.108	0.105
2021	263,585	9,269	37,216	0.988	0.076	0.089
2022	266,102	9,273	37,237	0.955	0.043	0.056
2023	268,564	9,272	37,242	0.925	-0.011	0.013
2024	270,917	9,268	37,227	0.876	-0.043	-0.040
2025	273,219	9,259	37,194	0.850	-0.097	-0.089

Source: Indonesia population projection 2000-2025, BAPPENAS, 2005

Figure 7.1.1 Population Share of Study Area



Population of cities and districts in the Study area was extrapolated up to 2030 by past trend and adjusted so to make the total meet the control total of the said share of the provincial population.

Future population of the Study Area is summarized in Table 7.1.2, which shows a moderate increase of 1.2 times by 2030. Two Districts of Gresik and Sidoarjo which experienced remarkable industrialization in 1990s will have a big increase in population, followed by Surabaya City. In other City and Districts, population will increase at a rate lower than the Study Area average.

Table 7.1.2 Future Population in Study Area

(1000 person)

Population (1000)	2005	2010	2015	2020	2025	2030
Kab. Sidoarjo	1,788	1,985	2,215	2,452	2,684	2,920
Kab. Mojokerto	1,009	1,056	1,110	1,158	1,195	1,224
Kab. Lamongan	1,262	1,256	1,257	1,247	1,224	1,194
Kab. Gresik	1,164	1,242	1,332	1,417	1,491	1,558
Kab. Bangkalan	927	958	994	1,024	1,043	1,056
Kod. Mojokerto	116	117	119	120	120	119
Kod. Surabaya	2,699	2,740	2,797	2,831	2,834	2,819
Study Area Total	8,965	9,354	9,824	10,248	10,591	10,890

Source: JICA Study Team

Employment was forecast based on the assumptions shown in Table 4.2.3, based on the following assumptions.

- The productive age population rate will slightly rise due to a change in the cohort pattern from a pyramid to a bell.
- The labor force rate will become higher mainly due to more active participation of women to the labor market.
- A rise in school attendance rate will decelerate the increase of the labor force rate.
- The reduction of unemployment rate by half of the present in 2030 which is not a forecast but a policy target.

By these assumptions, The number of employment will increase from 4.2 million at present to 5.9 million in 2030, or 1.4 times while population increases 1.2 times in the same period.

Table 7.1.3 Labor Force and Employment of Study Area

(Percent)

Area	Indicator	1997	2003	2005	2010	2015	2020	2025	2030
East Java	Productive Age Population Ratio	83.8	86.0	86.1	86.5	86.9	87.2	87.6	88.0
	Labor Force Ratio	60.2	63.0	63.5	64.8	66.1	67.4	68.7	70.0
	Unemployment Ratio	4.7	4.7	4.5	4.1	3.6	3.2	2.7	2.3
Study Area	Productive Age Population Ratio	84.3	82.4	82.6	83.1	83.6	84.0	84.5	85.0
	Labor Force Ratio	57.3	61.4	61.7	62.6	63.4	64.3	65.1	66.0
	Unemployment Ratio	6.0	6.0	5.8	5.2	4.7	4.1	3.6	3.0

Source: JICA Study Team

In the Study Area, employment in the primary sector has been decreasing along with the progress of urbanization and will therefore continue to decrease. On the other hand, the shares of the secondary and tertiary sector are difficult to foresee because they depend mainly on magnitude and distribution of future investment.

If the trend of investment and change in industrial structure occurred in the past decade continue in the same pattern, employment distribution by sector and by city and district will be as shown in Table 7.1.4. The share of industrial sector (primary: secondary: tertiary)of the entire Study Area will change from 29: 26: 45 in 2010 to 23: 31: 47.

Table 7.1.4 Employment by City and District based on Trend

Year	Province/Area	Composition (%)				Number of Employment (1000 Persons)			
		Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary	Total
2010	East Java	50	16	34	100.0	9,752.2	3,120.7	6,631.5	19,504.5
	Study Area	29	26	45	100.0	1,328.6	1,218.6	2,064.5	4,611.7
	Kab. Sidarjo	14	44	42	100.0	137.0	430.6	411.0	978.7
	Kab. Mojokerto	37	29	34	100.0	192.6	150.9	176.9	520.4
	Kab. amongan	66	9	25	100.0	408.7	55.7	154.8	619.3
	Kab. Gresik	39	28	33	100.0	238.8	171.4	202.1	612.3
	Kab. angkalan	68	6	26	100.0	321.0	28.3	122.8	472.1
	Kod. Mojokerto	6	29	65	100.0	3.5	16.8	37.6	57.9
	Kod. Surabaya	2	27	71	100.0	27.0	364.8	959.2	1,351.0
2020	East Java	46	18	37	100.0	9,738.5	3,704.9	7,727.3	21,170.7
	Study Area	26	28	46	100.0	1,375.9	1,508.1	2,427.0	5,310.9
	Kab. Sidarjo	11	46	43	100.0	139.8	584.5	546.3	1,270.5
	Kab. Mojokerto	33	32	36	100.0	195.0	189.0	216.0	600.0
	Kab. amongan	63	11	26	100.0	407.1	71.1	168.0	646.2
	Kab. Gresik	35	31	35	100.0	256.9	223.9	253.3	734.1
	Kab. angkalan	65	8	28	100.0	345.0	39.8	145.9	530.7
	Kod. Mojokerto	5	30	66	100.0	2.8	18.4	41.2	62.4
	Kod. Surabaya	2	26	72	100.0	29.3	381.4	1,056.2	1,467.0
2030	East Java	42	19	39	100.0	9,359.9	4,234.2	8,691.3	22,285.5
	Study Area	23	31	47	101.0	1,355.0	1,808.0	2,762.8	5,925.8
	Kab. Sidarjo	8	48	44	100.0	127.1	762.6	699.0	1,588.7
	Kab. Mojokerto	28	34	38	100.0	186.5	226.5	253.2	666.2
	Kab. amongan	60	13	27	100.0	389.7	84.4	175.4	649.5
	Kab. Gresik	31	33	36	100.0	262.8	279.8	305.2	847.8
	Kab. angkalan	62	9	29	100.0	356.2	51.7	166.6	574.6
	Kod. Mojokerto	3	30	67	100.0	1.9	19.4	43.4	64.8
	Kod. Surabaya	2	25	73	100.0	30.7	383.5	1,119.9	1,534.2

Source: JICA Study Team

2) GRDP and Investment

The Study Area has attained a fairly high economic growth at an average of 5.7% per annum during 2000 – 2005. In terms of growth rate, the tertiary sector has been leading the growth. Geographically, two cities show the highest growth, followed by three districts adjacent to

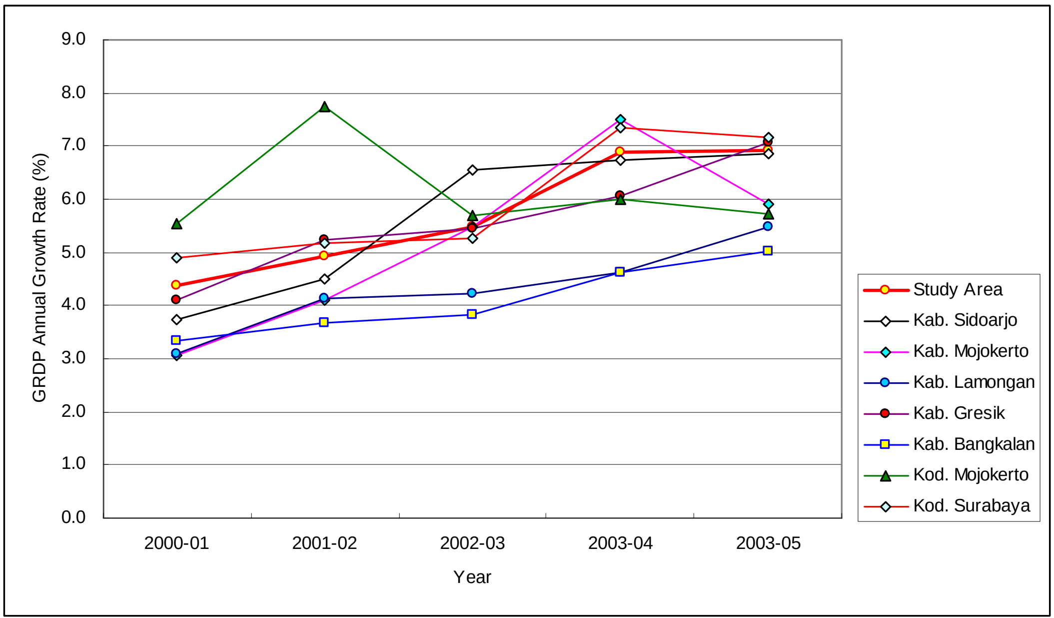
Surabaya, while the growth rates of District Lamongan and Bangkalan are comparatively low (Table 7.1.5 and Figure 7.1.2).

Table 7.1.5 Annual Economic Growth Rate by Industrial Sector (% p.a.)

Industrial Sector	Study Area	Kab. Sidoarjo	Kab. Mojokerto	Kab. Lamongan	Kab. Gresik	Kab. Bangkalan	Kod. Mojokerto	Kod. Surabaya
Primary	1.6	-1.2	3.8	1.6	2.5	1.2	0.0	4.0
Secondary	3.7	3.7	5.3	3.6	5.1	7.0	4.6	3.2
Tertiary	8.2	10.6	6.1	7.3	7.9	5.9	6.7	8.0
All Sector	5.7	5.7	5.2	4.3	5.6	4.1	6.1	6.0

Source: Elaborated from Statistical Yearbook, BPS

Figure 7.1.2 Annual Economic Growth by City and District



Source: Elaborated from Statistical Yearbook, BPS

Table 7.1.6 shows the contribution of each industrial sector to the economic growth, using a rate of GRDP increment of a sector to the total GRDP increment. Urban-type industries of trade, restaurant and hotel showed the greatest contribution of 49% followed by manufacturing (23%) and transportation and communication (11%). In the regencies of Sidoarjo, Gresik and Mojokerto, contribution of manufacturing was remarkable.

Table 7.1.6 Contribution of Industrial Sector to Economic Growth, 2000-2005

(percent,%)

	Industrial Sector	Study Area	Kab. Sidoarjo	Kab. Mojokerto	Kab. Lamongan	Kab. Gresik	Kab. Bangkalan	Kod. Mojokerto	Kod. Surabaya
1	Agriculture	1.9	0.4	15.0	16.8	4.8	7.1	0.0	0.1
2	Mining & Quarrying	0.0	-1.9	3.0	0.6	1.5	4.3	0.0	0.0
3	Manufacturing	23.1	36.6	37.3	4.4	40.3	5.8	8.9	16.0
4	Public Utilities	4.4	2.7	1.8	1.0	9.0	2.1	3.9	4.6
5	Construction	1.7	-0.2	1.1	2.5	2.1	7.4	5.8	2.0
6	Trade, Hotel, Restaurant	49.4	40.4	32.8	58.7	36.1	41.1	48.6	55.8
7	Transportation & Communication	11.2	18.8	2.1	1.2	2.1	8.5	15.9	11.3
8	Financing, ownership & Business Service	4.4	0.7	3.0	5.7	2.6	7.4	8.2	5.9
9	Services	4.1	2.5	3.9	9.2	1.6	16.4	8.7	4.3
	Total GRDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Elaborated from Statistical Yearbook, BPS

In Chapter 2, a relationship between investment and created employment was stated. Accordingly, investment amount per employment was estimated at US$ 96,300 at 2005 constant price for foreign investment, US$ 32,000 for domestic investment and US$ 50.400 in average. Labor productivity by industrial sector was also determined. Using those data, future GRDP and investment required to attain the economic growth were estimated as shown in Table 7.1.7, under the condition of employment increase and distribution shown in Table 7.1.4 while assuming no change in labor productivity.

Under the said conditions, expected GRDP growth is lower than 2% and the investment required to create the necessary job opportunities will be 12-17% of GRDP. Therefore, more investment will be needed in order to attain an improvement in labor productivity and higher economic growth.

Table 7.1.7 GRDP and Necessary Investment under 2005 Productivity

(1) Productivity in 2005 and Future GRDP under the Productivity

Sector	Productivity in 2005			GRDP under 2005 productivity		
	GRDP	Employment	Productivity	2010	2020	2030
	(Rp. Billion)	(1000 pax)	(Rp. Mill./person)	(Rp. Billion)	(Rp. Billion)	(Rp. Billion)
Primary Sector	11,130.5	1,234.9	9.0	12,054.1	11,967.1	11,216.1
Secondary Sector	82,597.3	1,069.6	77.2	89,034.1	108,686.2	128,133.2
Tertiary Sector	86,085.5	1,952.2	44.1	93,544.1	113,582.8	133,264.9
All Sectors	179,813.3	4,256.7	-	194,632.3	234,236.0	272,614.2

(2) Annual Average Economic Growth Rate under Constant Productivity as in 2005

Sector	2005-2010	2005-2020	2005-2030	2010-2020	2020-2030
Primary Sector	1.61	0.48	0.03	-0.07	-0.65
Secondary Sector	1.51	1.85	1.77	2.01	1.66
Tertiary Sector	1.68	1.87	1.76	1.96	1.61
All Sectors	1.60	1.78	1.68	1.87	1.53

(3) Investment required for the Economic Growth shown in Table above

Item	Unit	2005-2010	2010-2020	2020-2030
Increased Employment	1000 person	355.0	699.3	614.9
Required Investment	Rp. Billion	161,012	317,184	278,898
% to GRDP	%	17.2	15.3	12.3

After recovering from economic depression caused by the financial crisis in 1997, the Study Area as well as Indonesia has achieved a high economic growth in this century, ranging 4.0 to 6.0% per annum. Based on this fact, economic growth scenarios for coming 25 years were set up as shown in Table 7.1.8, as a quantitative basis of this Study.

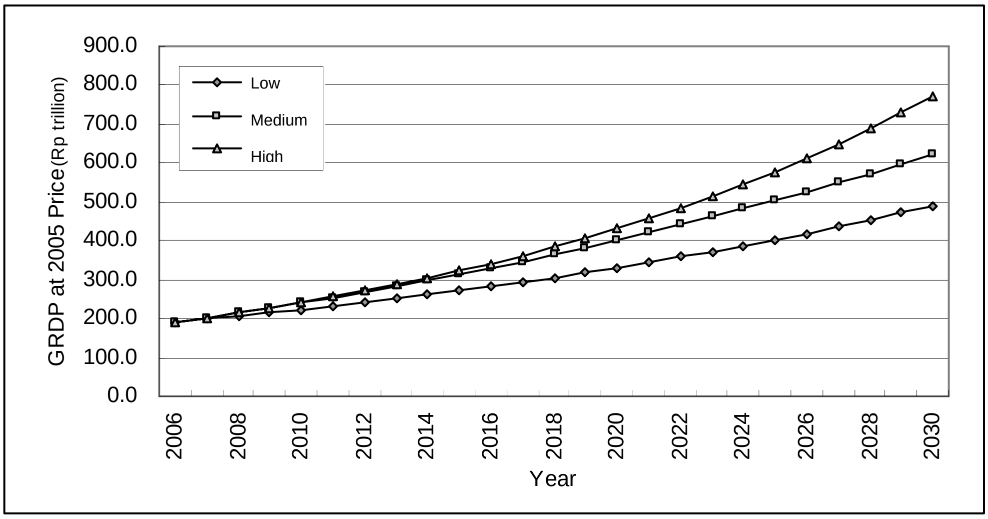
Table 7.1.8 Cases of Future Economic Growth

Case	2006	--------------------------	2030
Case 1: Low Growth	4.0 %	(Constant)	4.0 %
Case 2: Medium Growth	6.0 %	(Lowering linearly)	4.0 %
Case 3: High Growth	6.0 %	(Constant)	6.0 %

Case 3 (high growth case) assumes to continue 6.0% growth for 25 years. Six percent is not necessarily ambitiously too high to accomplish. However, it is very rare to maintain such high growth for 25 years. Case 1 (Low growth case) assumes 4.0% for 25 years, which is more likely as an average growth rate for such a long-term. Case 2 (medium growth case) was set up as an intermediate case between case 1 and 3, where the growth rate will linearly declines from 6.0% toward 4.0% in 2030.

In 25 years, GRDP of the Study Area will grow 2.6 times in Case 1, 3.2 times in Case 2 and 4.0 times in Case 3, respectively (Figure 7.1.3).

Figure 7.1.3 Future Economic Growth in Three Cases



In any case, the growth will never be realized without effort. Capital investment necessary to achieve the economic growth in each case, by a different way using ICOR* (Incremental Capital- Output Ratio) which is defined as a ratio of investment to GDP or GRDP increase.

Using the investment ratios and economic growth rates of the Study Area during 1996 – 2005, ICOR of the Area was estimated at approximately at 1.05 which derived the investment amount necessary for the assumed economic growth as shown in Table 7.1..9. The investment ratio is 13.4% of GRDP in Case 1 and 20.0% in Case 3.

It should be noted that the investment amount was the amount of approved projects proposed by the private sector and not inclusive of public investment. Statistical data shows that 55% of the amount was foreign investment and 45% was domestic investment and more than 90% are in the manufacturing sector.

It is not easy to invite FDI corresponding to 7% to 11% of GDP for a long-term. Only China has been achieving such a high FDI ratio over 10% in the past 10 years. The Study Area will absolutely need to develop such an attractive investment market as well facilitated industrial estates. In this context, the Surabaya new port project will provide a good opportunity to develop an on-shore estate with good access to export/ import gateway.

* Using Y as GRDP, I as investment and Δ as increment, the economic growth = $\Delta Y / Y = (\Delta Y / I) \times (I / Y)$ $= 1.0 / (I / \Delta Y) \times (I / Y) = 1.0 /$ (ICOR) $\times$ (Investment Ratio).
Then, (Investment Ratio) = (Economic Growth Rate) x (ICOR)

Table 7.1.9 Investment Required for Economic Growth Case

Year	GRDP at 2005 price (Rp. Trillion)			Required Investment (Rp. Trillion)		
	Low	Medium	High	Low	Medium	High
2006	191.0	191.0	191.0	8.0	12.0	12.0
2007	198.6	202.4	202.4	8.3	12.6	12.8
2008	206.5	214.4	214.6	8.7	13.1	13.5
2009	214.8	226.9	227.4	9.0	13.7	14.3
2010	223.4	240.0	241.1	9.4	14.3	15.2
2011	232.3	253.5	255.6	9.8	14.9	16.1
2012	241.6	267.7	270.9	10.1	15.5	17.1
2013	251.3	282.4	287.1	10.6	16.1	18.1
2014	261.3	297.7	304.4	11.0	16.7	19.2
2015	271.8	313.6	322.6	11.4	17.3	20.3
2016	282.7	330.1	342.0	11.9	17.9	21.5
2017	294.0	347.1	362.5	12.3	18.5	22.8
2018	305.7	364.8	384.3	12.8	19.2	24.2
2019	318.0	383.0	407.3	13.4	19.8	25.7
2020	330.7	401.8	431.7	13.9	20.4	27.2
2021	343.9	421.3	457.7	14.4	21.0	28.8
2022	357.7	441.3	485.1	15.0	21.6	30.6
2023	372.0	461.9	514.2	15.6	22.2	32.4
2024	386.9	483.0	545.1	16.2	22.8	34.3
2025	402.3	504.8	577.8	16.9	23.4	36.4
2026	418.4	527.1	612.4	17.6	24.0	38.6
2027	435.2	549.9	649.2	18.3	24.5	40.9
2028	452.6	573.3	688.1	19.0	25.1	43.4
2029	470.7	597.2	729.4	19.8	25.6	46.0
2030	489.5	621.5	773.2	20.6	26.1	48.7
Total	7952.8	9497.6	10477.1	334.0	478.2	660.1

Source: JICA Study Team

7.2 Port Demand Forecast

1) Port Freight Traffic

For the convenience of forecasting future demand, cargoes handled in public ports located in and around Surabaya City are classified by cargo type, as follows:

i) container

ii) general cargo

iii) petroleum

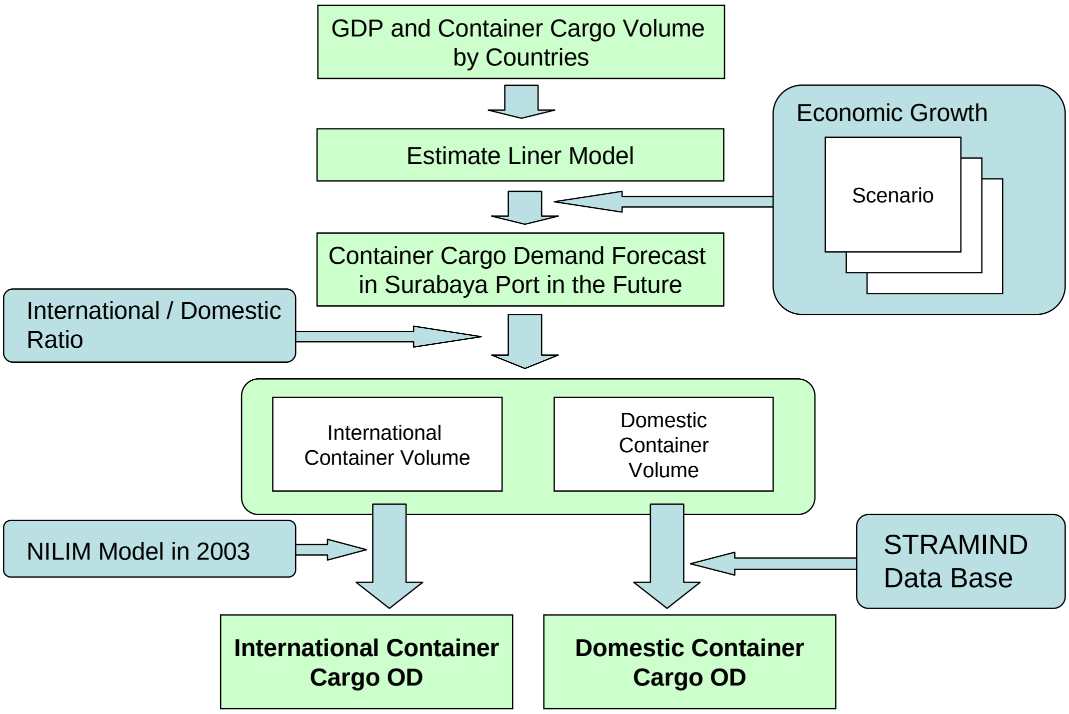
iv) liquid bulk cargo

v) dry-bulk cargo

a. General Cargo and Container

Methodology: Firstly, containers and cargoes are combined together and forecasted as containerizable cargoes and then split into containers and general cargoes, taking future containerization rate into account. Total cargo volume handled in Tj. Perak, TPS, BJTI and Gresik port was estimated and split into international and domestic cargo and then into loaded and unloaded cargo. Finally, they were distributed among origin or destination ports (Figure 7.2.1).

Figure 7.2.1 Forecasting Process of General and Container Cargo



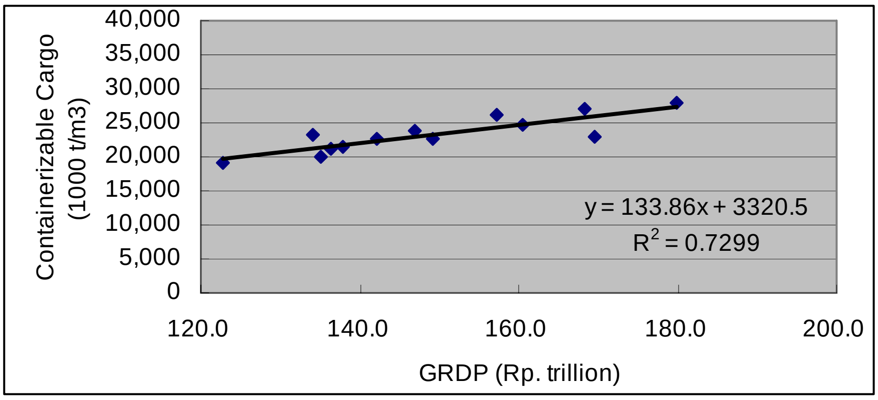
Container and General Cargo Transport Demand: Figure 7.2.2 shows a regression of containerizable cargoes on GRDP which derived the following equation:

$T = 133.86\ Y + 3320.5 \quad (R^2 = 0.7299)$

Where, T: container volume in 1000 TEU

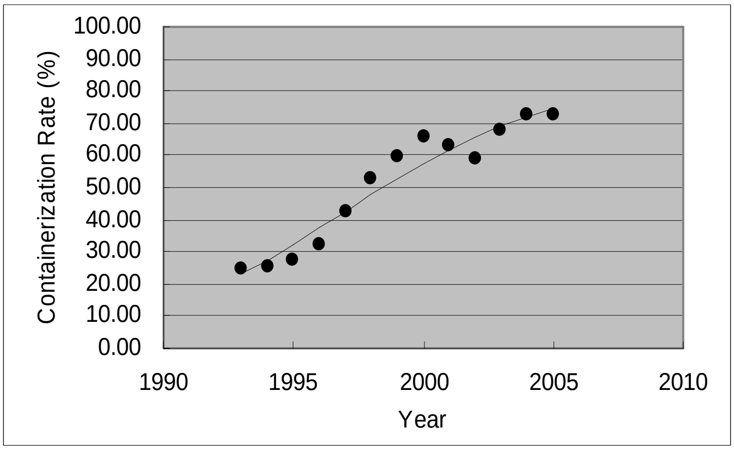
Y: GDP in US$ billion

Figure 7.2.2 Regression of Containerizable Cargo on GRDP in Indonesia



Share of Container Cargo and General Cargo: Containerization rate at Surabaya Port was about 23% in 1993 and currently estimated at 76%, which will continue to rise in the future, presumably to 85% by 2030. A regression equation was obtained as shown in Figure 7.2.3. Using the equation, the containerizable cargoes were split to container and general cargo which was shown in Table 7.2.1.

Figure 7.2.3 Time-series Data of Containerization Rate of Surabaya Port



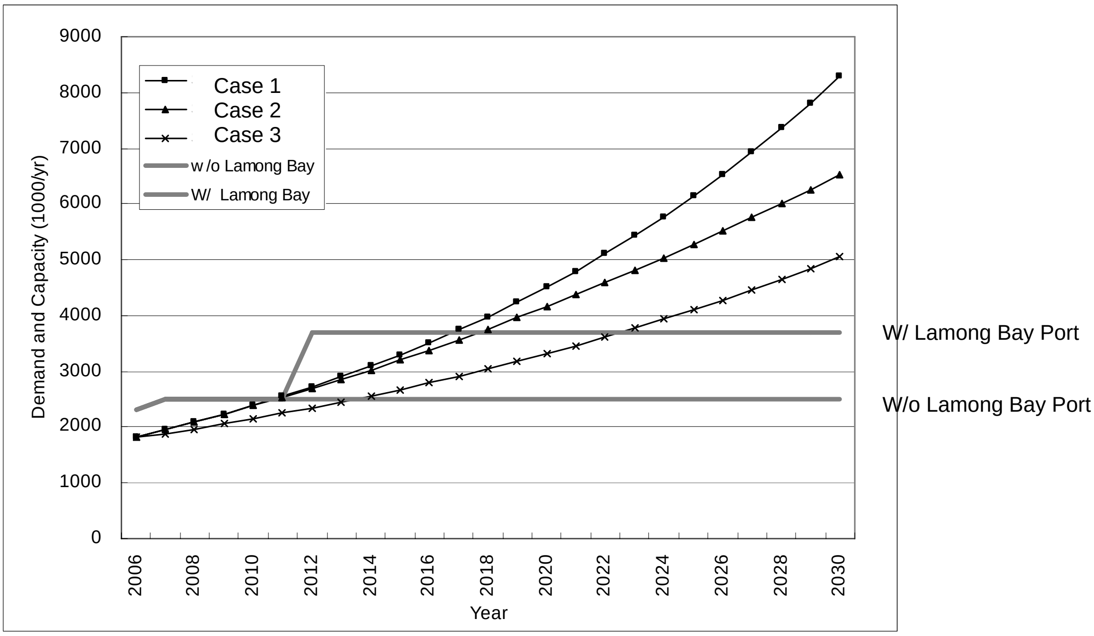
$$Rc = 100 / (1.0 + Exp(-0.24267\, t + 484.605))$$
(R^2 = 0.9281)

Where, *Rc* : Containerization Rate (%)
t: Year

Source: JICA Study Team

Container cargo will increase together with economic growth and even in Case 1 (low growth case) the demand will exceed 5.0 million TEU in 2030 (refer to the following figure). On the other hand, current capacity is estimated to be 2.2 million TEU and by installation of a new gantry crane at TPS wharf, it will become 2.5 million TEU. Under this situation, the demand will reach the expanded capacity at earliest by 2011 and even incase 3 by 2014. By that time, the planned new container port at Lamong Bay has to be developed. The Lamong Bay port will be fully occupied within 6 – 10 years if the economy of the Study Area grows as assumed in Case 1 -3. This is a justification that a new large-scale port should be planned now.

Figure 7.2.4 Demand and Capacity for Container Handling in Surabaya Ports



Source: JICA Study Team

Table 7.2.1 Projection of Container and General Cargo in Surabaya Ports

Year	GRDP (Rp. Trillion)			Containerizable Cargo (1000 ton)			Containerization Rate (%)	Container (1000 TEU)			General Cargo + Bagged Cargo (1000ton)		
	Case 1	Case 2	Case 3	Case 1	Case 2	Case 3		Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
2006	191.0	191.0	191.0	28,883	28,883	28,883	76.4	1,953	1,953	1,953	6,814.5	6,814.5	6,814.5
2007	198.6	202.4	202.4	29,905	30,416	30,416	78.1	2,067	2,102	2,102	6,546.9	6,658.8	6,658.8
2008	206.5	214.4	214.6	30,969	32,014	32,042	79.5	2,179	2,252	2,254	6,349.6	6,563.9	6,569.7
2009	214.8	226.8	227.4	32,075	33,676	33,766	80.6	2,288	2,403	2,409	6,215.6	6,525.9	6,543.3
2010	223.4	239.7	241.1	33,225	35,403	35,592	81.5	2,397	2,554	2,568	6,137.8	6,540.3	6,575.2
2011	232.3	253.1	255.6	34,421	37,197	37,529	82.3	2,505	2,708	2,732	6,109.5	6,602.3	6,661.1
2012	241.6	267.0	270.9	35,665	39,058	39,581	82.8	2,614	2,863	2,901	6,124.4	6,707.2	6,796.9
2013	251.3	281.4	287.1	36,959	40,987	41,757	83.3	2,724	3,021	3,078	6,177.1	6,850.4	6,979.0
2014	261.3	296.3	304.4	38,304	42,985	44,063	83.6	2,836	3,182	3,262	6,262.8	7,028.1	7,204.4
2015	271.8	311.8	322.6	39,704	45,052	46,507	83.9	2,949	3,346	3,455	6,377.6	7,236.6	7,470.4
2016	282.7	327.7	342.0	41,159	47,188	49,099	84.2	3,066	3,515	3,657	6,518.0	7,472.8	7,775.3
2017	294.0	344.2	362.5	42,672	49,395	51,845	84.3	3,185	3,687	3,870	6,681.4	7,734.0	8,117.6
2018	305.7	361.2	384.3	44,246	51,672	54,757	84.5	3,308	3,863	4,094	6,865.5	8,017.8	8,496.4
2019	318.0	378.8	407.3	45,884	54,020	57,843	84.6	3,435	4,044	4,330	7,068.7	8,322.2	8,911.2
2020	330.7	396.8	431.7	47,586	56,439	61,114	84.7	3,566	4,229	4,580	7,289.6	8,645.7	9,361.9
2021	343.9	415.4	457.7	49,357	58,929	64,582	84.7	3,702	4,420	4,844	7,527.0	8,986.8	9,848.9
2022	357.7	434.6	485.1	51,198	61,490	68,258	84.8	3,842	4,615	5,123	7,780.3	9,344.3	10,372.7
2023	372.0	454.2	514.2	53,113	64,123	72,154	84.8	3,988	4,815	5,418	8,048.9	9,717.3	10,934.3
2024	386.9	474.4	545.1	55,105	66,826	76,284	84.9	4,139	5,020	5,730	8,332.4	10,104.8	11,534.9
2025	402.3	495.1	577.8	57,176	69,600	80,662	84.9	4,296	5,230	6,061	8,630.7	10,506.2	12,175.8
2026	418.4	516.4	612.4	59,331	72,445	85,302	84.9	4,459	5,445	6,411	8,943.8	10,920.8	12,858.9
2027	435.2	538.2	649.2	61,571	75,361	90,221	84.9	4,628	5,665	6,782	9,271.6	11,348.2	13,585.9
2028	452.6	560.5	688.1	63,901	78,346	95,435	85.0	4,804	5,890	7,175	9,614.5	11,787.8	14,359.0
2029	470.7	583.3	729.4	66,324	81,400	100,962	85.0	4,987	6,120	7,591	9,972.5	12,239.3	15,180.6
2030	489.5	606.6	773.2	68,844	84,523	106,820	85.0	5,177	6,356	8,032	10,346.1	12,702.3	16,053.2

Source: JICA Study Team

Future total volume was subdivided into International cargo and domestic cargo and further into import/ export or loading/ unloading, based on the present pattern or trend pattern. This process is common to all the cargo type.

This sub-division or classification of container cargo is stated in Section 5). Table 7.2.2 shows the composition of the classified general cargo in the past six years and the average percentage was applied to future demand. Table 7.2.3 shows the result of classification. Break-down into OD ports will be shown in Section 2).

Table 7.2.2 International and Domestic Composition of General and Bagged Cargoes

Port	Cargo Type	Unit	2000	2001	2002	2003	2004	2005	Av. 00-05
Tj. Perak incl. BJTI	Break Bulk Cargo	Ton	2867.1	2455.0	2141.6	1590.7	1372.2	1638.7	2010.9
		M3	2482.7	3566.0	2980.5	3315.0	2560.5	2281.4	2864.3
	Bagged Cargo	Ton	1848.0	1513.6	1526.4	1617.2	1676.1	1655.6	1639.5
		M3	0.0	0.0	0.0	89.8	47.2	5.9	23.8
Gresik	Break Bulk Cargo	Ton	0.0	4543.3	2625.5	1815.1	1830.6	2124.3	2156.5
		M3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total		T/M3	7197.8	12077.9	9273.9	8427.8	7486.6	7705.9	8695.0
International	Import	%	25.5	20.6	22.6	33.8	25.5	21.5	24.9
	Export	%	9.1	4.7	11.9	10.3	9.1	3.1	8.3
Domestic	Unloading	%	38.1	41.9	34.8	35.4	38.1	41.6	38.1
	Loading	%	27.3	32.8	30.7	20.5	27.3	33.8	28.6

Source: JICA Study Team

Table 7.2.3 Classification of Non-Containerized General Cargo

(1000 TEU)

Case	Year	International		Domestic		Total
		Import	Export	Unloading	Loading	
Low	2005	1,700.1	566.6	2,599.1	1,948.8	6,814.5
	2010	1,531.3	510.4	2,341.0	1,755.2	6,137.8
	2015	1,591.1	530.3	2,432.4	1,823.8	6,377.6
	2020	1,818.6	606.1	2,780.2	2,084.6	7,289.6
	2025	2,153.2	717.7	3,291.8	2,468.2	8,630.7
	2030	2,581.1	860.3	3,946.0	2,958.7	10,346.1
Medium	2005	1,700.1	566.6	2,599.1	1,948.8	6,814.5
	2010	1,631.7	543.8	2,494.5	1,870.3	6,540.3
	2015	1,805.4	601.7	2,760.1	2,069.5	7,236.6
	2020	2,156.9	718.9	3,297.5	2,472.4	8,645.7
	2025	2,621.1	873.6	4,007.1	3,004.5	10,506.2
	2030	3,168.9	1,056.2	4,844.7	3,632.5	12,702.3
High	2005	1,700.1	566.6	2,599.1	1,948.8	6,814.5
	2010	1,640.4	546.7	2,507.8	1,880.3	6,575.2
	2015	1,863.7	621.2	2,849.2	2,136.3	7,470.4
	2020	2,335.6	778.5	3,570.6	2,677.2	9,361.9
	2025	3,037.6	1,012.4	4,643.9	3,481.9	12,175.8
	2030	4,004.9	1,334.8	6,122.7	4,590.8	16,053.2

Source: JICA Study Team

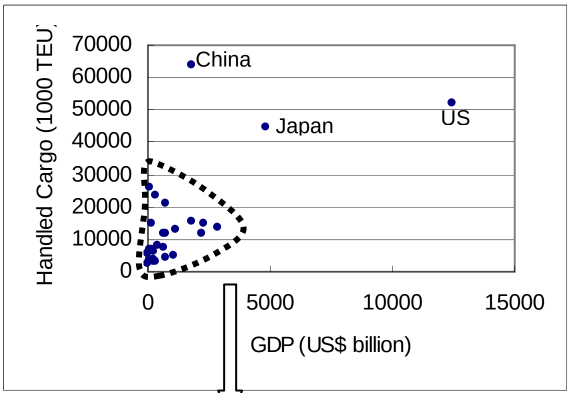
Column 7.1 International Experience between GDP Growth and Container Trade

Funabashi and Takahashi estimated and analyzed international container movement in 2003, using the database in 2002 of Lloyd's Marine Intelligence Unit and Containerization International Year Book. Their paper in a journal issued by the National Institute for Land and Infrastructure Management, Japan presented total TEUs handled in top 30 countries.

The study analyzed those container data with their GDP figures to find meaningful correlation. Three countries of USA, China and Japan were plotted at extreme positions. Countries other than those three countries are scattered in a triangle and seem not to have any correlation at a glance. If excluding some special countries with a hub function, a right-up tendency appears. Although there are no historical data, It implies that a country without a container hub port is likely to increase its international containers in line with economic growth.

Applying the equation to the future GDP assumed in the Study, future container volume of Indonesia ranges from 5.2 million TEU (annual 4% growth) to 7.0 million TEU (annual 6% growth) in 2030. The projection stands for only international containers. It should be noted that fitting of the regression equation shown below is not so good and Indonesia is located about 30% below the regression line.

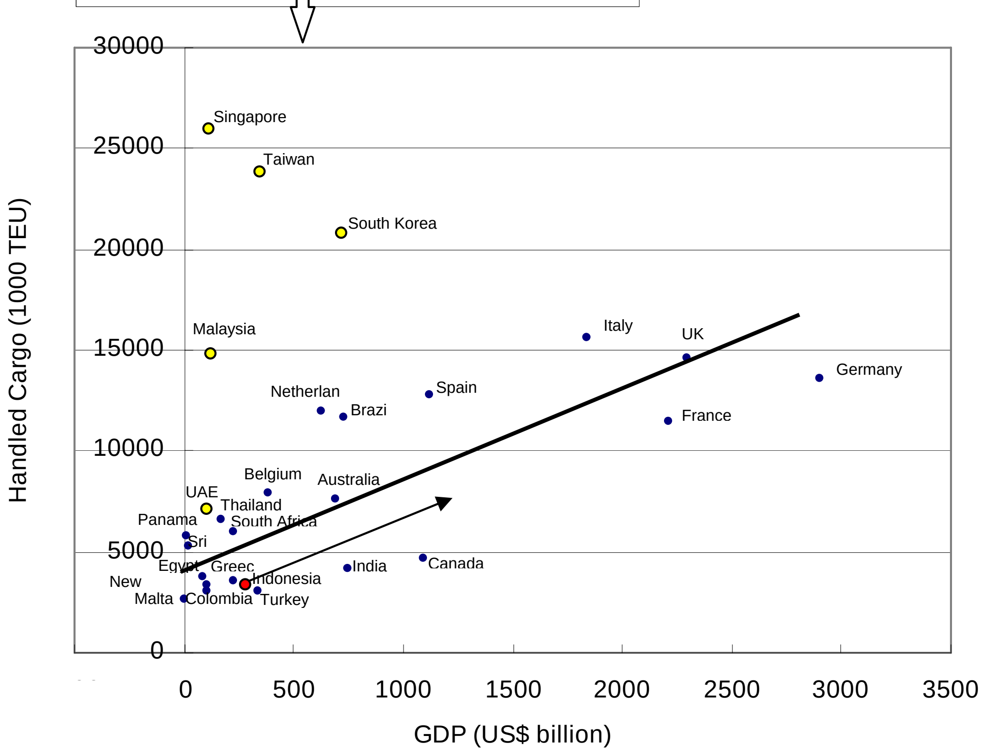
Figure 7C.1 International Comparison of GDP and Container Volume, 2003



$T = 3.962 \times Y + 2180.5$ (R^2 = 0.614)

Where, T: container volume in 1000 TEU

Y: GDP in US$ billion



Source: Analyzed by JICA Study Team based on "Operation analysis of World Containership in 2003", Kaoru Funabashi and Hironao Takahashi,

b. Petroleum

In case of petroleum, past demand fluctuated year by year and then moving average was taken with three years interval for regression. All the petroleum from/ to Surabaya Port was regarded as domestic shipping.

Table 7.2.4 Petroleum Handled at Surabaya Port, 2000 - 2006

Item	Unit	2000	2001	2002	2003	2004	2005	2006
Petroleum	(1000 ton)	5,465.0	6,369.0	5,156.5	6,237.6	6,689.3	5,983.0	8,038.4

Figure 7.2.5 Regression Equation of Petroleum on GRDP

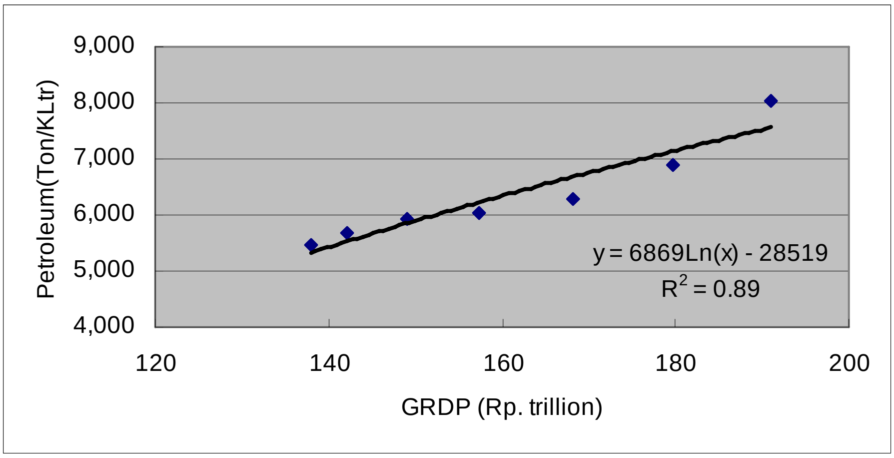
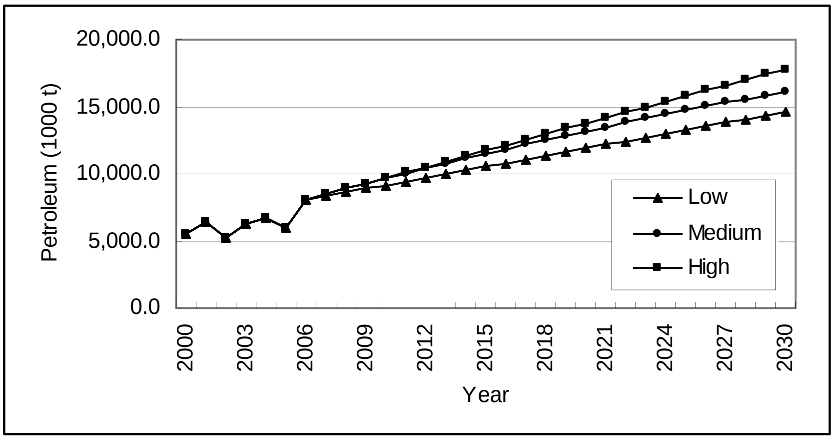


Table 7.2.5 Forecast of Petroleum Handling at Surabaya Port

Year	Petroleum (1000 ton)		
	Case 1Low	Case 2 Medium	Case 3 High
2006	8,038.4	8,038.4	8,038.4
2010	9,176.0	9,666.1	9,707.0
2015	10,542.7	11,498.5	11,737.4
2020	11,909.3	13,179.9	13,767.8
2025	13,276.0	14,722.6	15,798.2
2030	14,642.6	16,137.7	17,828.5

Figure 7.2.6 Projection of Petroleum Handling at Surabaya Port



c. Liquid Bulk Cargo

Liquid bulk cargo other than petroleum will become double in 25 years. Most of the liquid bulk cargo is also for domestic shipping. Out of unloaded cargo, about 70% are loaded again.

Table 7.2.6 Liquid Bulk Cargo Handled at Surabaya Port, 2000 - 2006

Port	Unit	2000	2001	2002	2003	2004	2005
Tj. Perak	(1000 ton)	1341.0	1490.2	1046.4	1241.2	1384.3	1339.4
BJTI	(1000 ton)	-	-	656.4	681.7	581.2	717.7
Total	(1000 ton)	1341.0	1490.2	1702.8	1922.9	1965.5	2057.0

Figure 7.2.7 Regression Equation of Liquid Bulk Cargo on GRDP

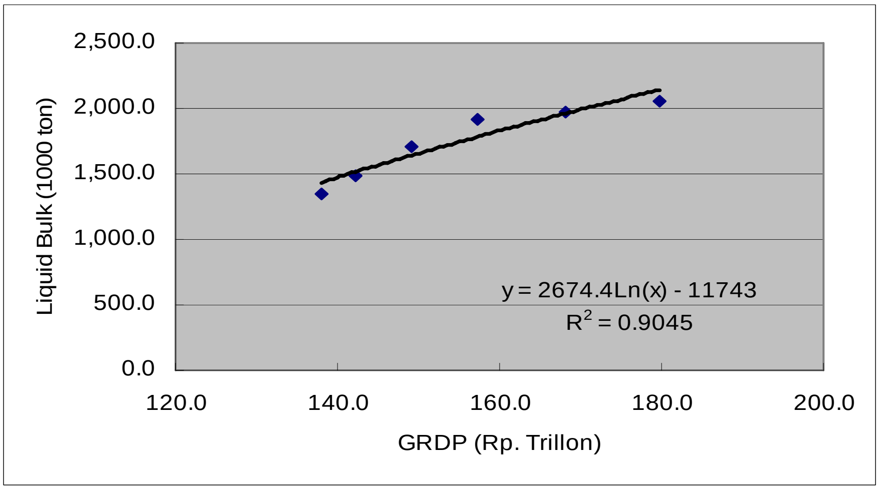


Figure 7.2.8 Projection of Liquid Bulk Cargo at Surabaya Port

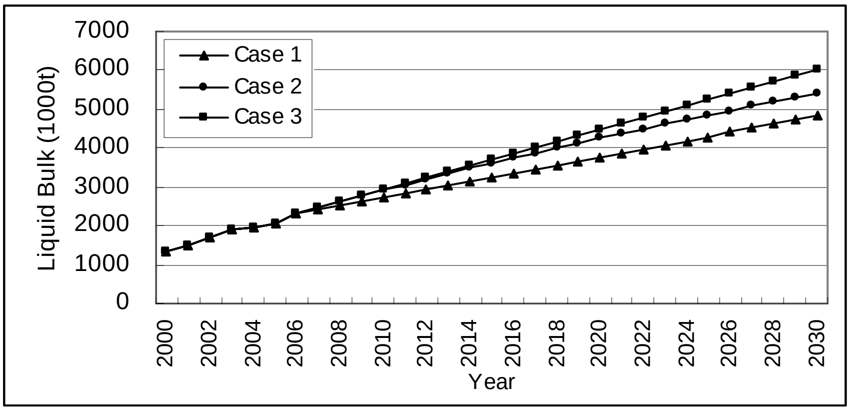


Table 7.2.7 Classification of Liquid Bulk Cargo

Case	Year	International		Domestic		Total
		Import	Export	Unloading	Loading	
Actual Composition (%)	2001	0.5	2.1	56.9	40.5	100.0
	2002	0.6	2.2	55.4	41.8	100.0
	2003	0.4	1.5	56.5	41.7	100.0
	2004	3.0	4.2	57.9	34.9	100.0
	2005	1.0	2.3	56.1	40.6	100.0
	Av. 01-05	1.1	2.4	56.4	40.0	100.0
Low	2005	21.1	46.7	1,154.9	834.3	2,057.0
	2010	31.1	66.2	1,535.8	1,089.6	2,722.7
	2015	37.1	79.0	1,831.6	1,299.5	3,247.2
	2020	43.1	91.8	2,127.4	1,509.4	3,771.6
	2025	49.1	104.5	2,423.2	1,719.3	4,296.1
	2030	55.0	117.3	2,719.1	1,929.2	4,820.6
Medium	2005	21.1	46.7	1,154.9	834.3	2,057.0
	2010	33.2	70.8	1,641.8	1,164.9	2,910.8
	2015	41.3	87.9	2,038.5	1,446.3	3,614.0
	2020	48.6	103.6	2,402.5	1,704.5	4,259.2
	2025	55.4	118.0	2,736.4	1,941.4	4,851.2
	2030	61.6	131.3	3,042.7	2,158.8	5,394.3
High	2005	21.1	46.7	1,154.9	834.3	2,057.0
	2010	33.4	71.2	1,650.7	1,171.2	2,926.5
	2015	42.3	90.2	2,090.2	1,483.0	3,705.7
	2020	51.2	109.1	2,529.7	1,794.8	4,484.8
	2025	60.1	128.1	2,969.2	2,106.6	5,264.0
	2030	69.0	147.0	3,408.7	2,418.4	6,043.2

d. Dry Bulk Cargo

Main dry bulk cargo handled at Surabaya Port is coal and mining products. The volume has been stable since 2000, in the range of 6-7 million ton/ m3. In the meantime coal is recently shifting from Tj. Perak to Gresik Port.

Some manufacturing industries are changing fuel type consumption from petro-products to coal because of its low cost. This change will possibly increase the dry bulk cargoes at Surabaya Port. According to the projection by semi-log linear regression model, dry bulk cargo will be double in 25 years.

Table 7.2.8 Dry Bulk Cargo Handled at Surabaya Port, 2000 – 2006

(ton/m^3)

	2000	2001	2002	2003	2004	2005
Tj. Perak	5,868,660	6,106,267	6,552,609	6,004,292	5,666,104	5,130,638
Gresik	-	316,184	646,793	895,010	1,577,330	2,219,362
Total	5,868,660	6,422,451	7,199,402	6,899,302	7,243,434	7,350,000

Figure 7.2.9 Regression Equation of Dry Bulk Cargo on GRDP

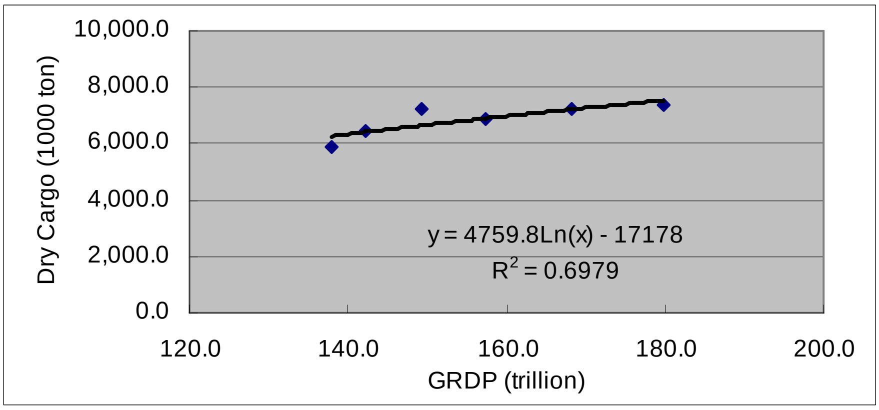


Table 7.2.9 Classification of Dry Bulk Cargo

Case	Year	International		Domestic		Total
		Import	Export	Unloading	Loading	
Actual Composition (%)	2001	60.0	3.1	23.8	13.0	100.0
	2002	51.4	4.1	27.3	17.2	100.0
	2003	45.6	2.5	33.9	18.0	100.0
	2004	42.4	1.5	44.5	11.6	100.0
	2005	50.0	2.3	32.4	15.3	100.0
	Av. 01-05	49.3	2.5	33.3	14.9	100.0
Low	2005	3,674.8	190.0	2,408.9	1,076.3	7,350.0
	2010	4,281.4	221.4	2,806.5	1,253.9	8,563.2
	2015	4,748.0	245.5	3,112.4	1,390.6	9,496.5
	2020	5,214.6	269.7	3,418.2	1,527.3	10,429.8
	2025	5,681.2	293.8	3,724.1	1,663.9	11,363.0
	2030	6,147.8	317.9	4,029.9	1,800.6	12,296.3
Medium	2005	3,674.8	190.0	2,408.9	1,076.3	7,350.0
	2010	4,448.7	230.1	2,916.2	1,303.0	8,897.9
	2015	5,074.3	262.4	3,326.3	1,486.2	10,149.2
	2020	5,648.4	292.1	3,702.6	1,654.3	11,297.4
	2025	6,175.1	319.3	4,047.8	1,808.6	12,350.9
	2030	6,658.3	344.3	4,364.6	1,950.1	13,317.2
High	2005	3,674.8	190.0	2,408.9	1,076.3	7,350.0
	2010	4,462.7	230.8	2,925.3	1,307.0	8,925.8
	2015	5,155.9	266.6	3,379.7	1,510.1	10,312.3
	2020	5,849.1	302.5	3,834.1	1,713.1	11,698.9
	2025	6,542.3	338.3	4,288.6	1,916.1	13,085.4
	2030	7,235.6	374.2	4,743.0	2,119.2	14,471.9

2) Origin/ Destination

a. International Container

To estimate international container cargo distribution, the used “NILIM model in 2003”; which covers, international container distribution to/from Asian countries including Indonesia.

Distribution of Export Container Cargo

The distribution of international container cargo in the future depends on countries future economic growth, and the trend of economic growth will be different by country. Consequently, the economic growth rate is set at 3% in the developed countries and 6% in the developing countries, respectively.

Figure 7.2.10 illustrates the estimated distribution of export container cargo in 2005 and in 2030. The container cargo volume to North America and Europe will continue to increase up to 2030. The biggest growth, however, will happen in Asian countries such as China, Hong Kong and Taiwan. From 2005 to 2030, the export container volume will increase by over three times.

Figure 7.2.10 Estimated Export Container Cargo Distribution in 2005 and in 2030

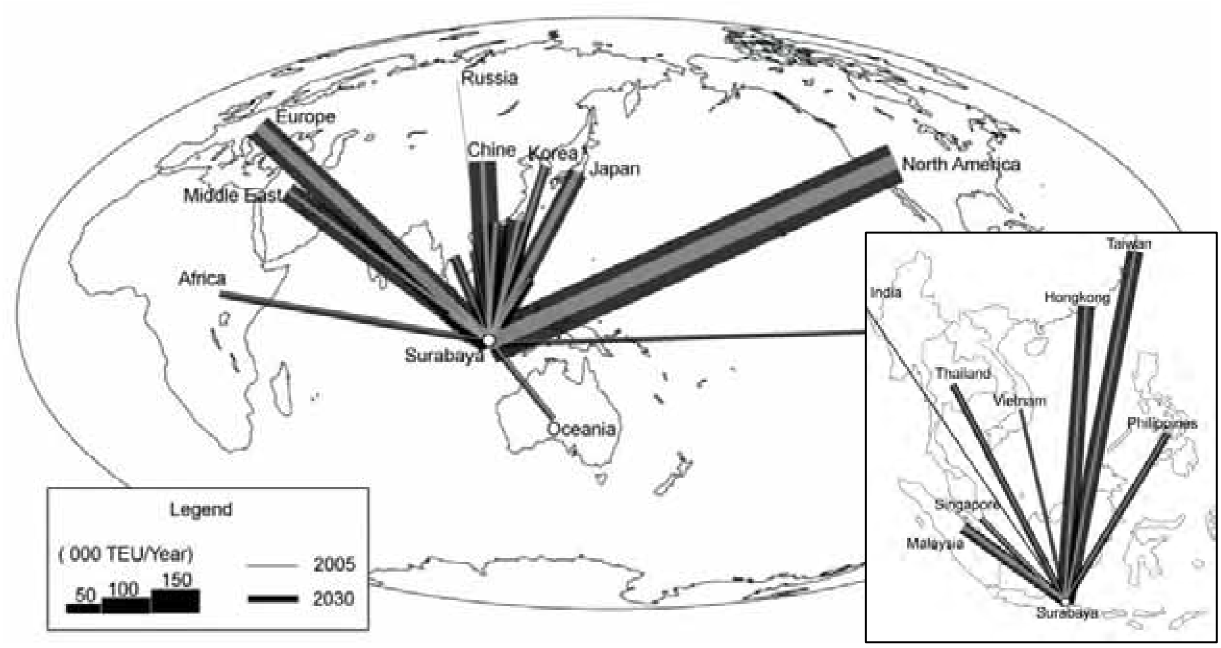
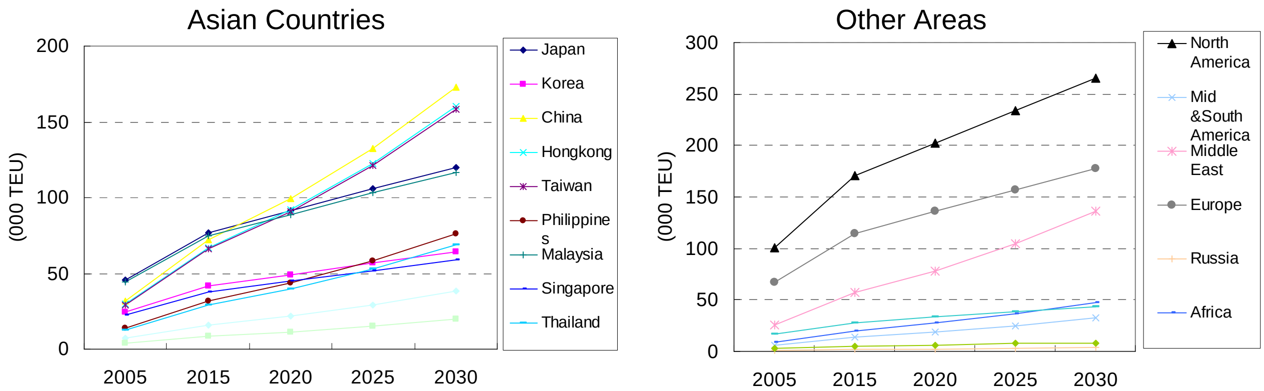


Figure 7.2.11 Estimated Export Container Cargo Distribution



Distribution of Import Container Cargo

The distribution of import container cargo in the future also depends on countries future economic growth. Therefore, the economic growth rate is set similarly as the export container cargo.

Figure 7.2.12 illustrates the estimated distribution of import container cargo in 2005 and in 2030. The highest growth will occur in China where the import container volume from China will sharply increase by over four times. Meanwhile, the container cargo volume to North America and Europe will continue to increase up to 2030. The biggest growth, however, will be in Asian countries such as China, Hong Kong and Taiwan. From 2005 to 2030, the import container volume will increase by over there times.

Figure 7.2.12 Estimated Import Container Cargo Distribution in 2005 and in 2030

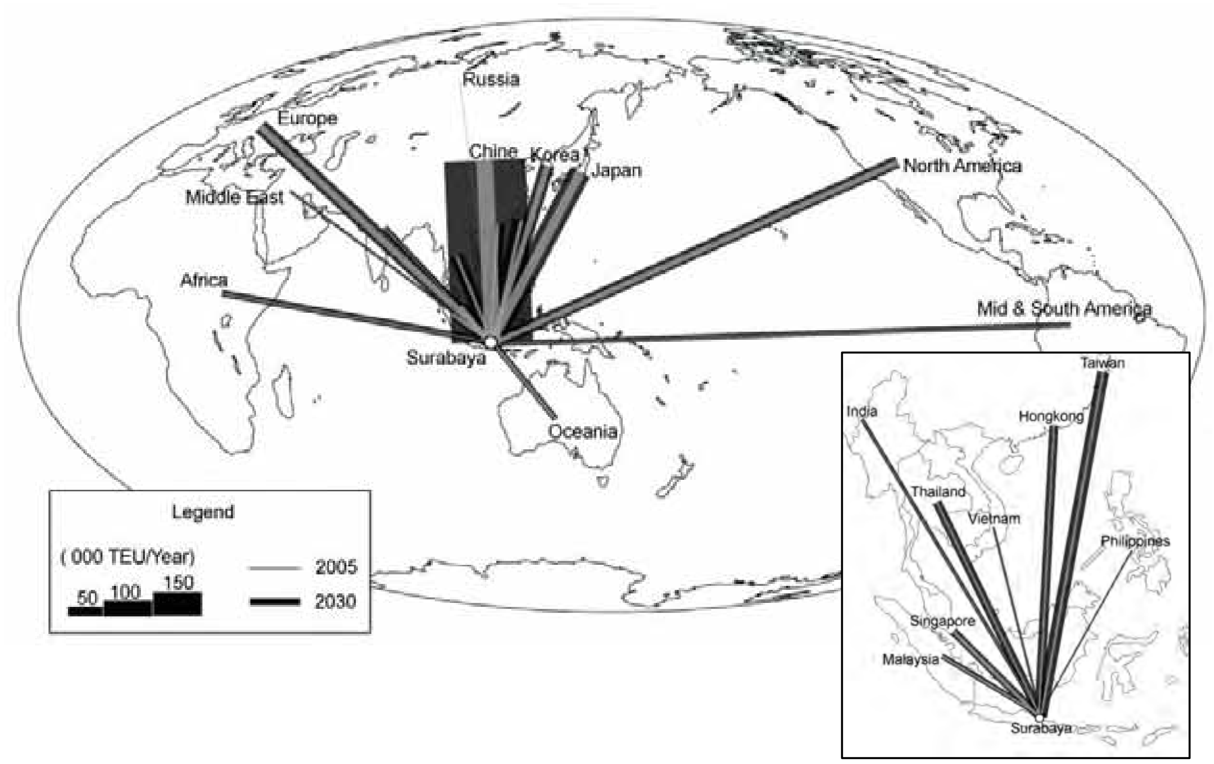
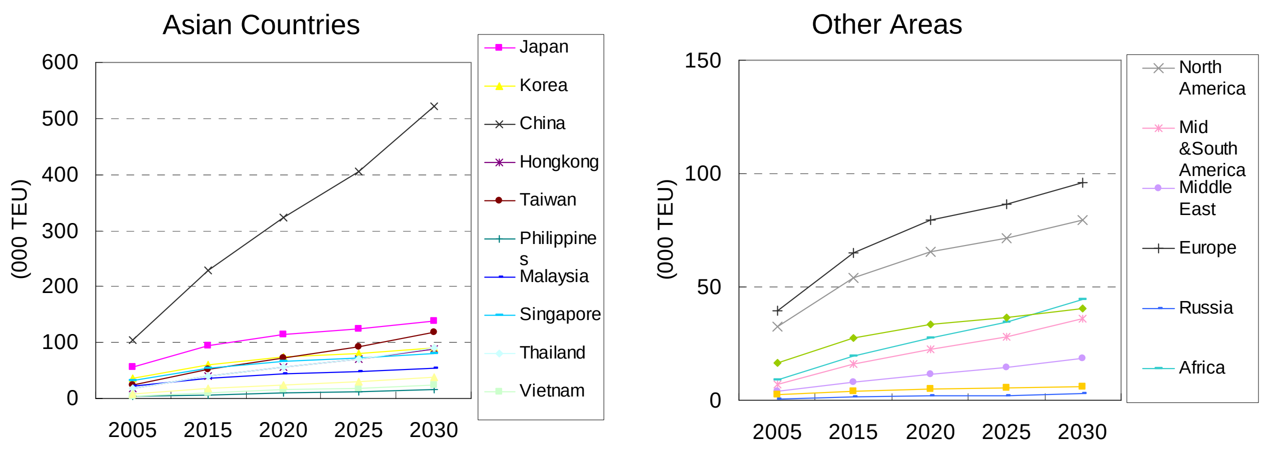


Figure 7.2.13 Estimated Import Container Cargo Distribution



b. Domestic Cargo Distribution

Distribution of Container Cargo

To estimate domestic cargo distribution, the "STRAMINDO Database" was utilized. The following figures show estimated the container cargo distribution (Loading & Unloading) in 2005 and in 2030. Loaded container cargo volume to Kalimantan Island and Sulawesi Island are significantly higher than the other areas. On the other hand, unloaded container cargo volume in Surabaya from South Sulawesi is significantly high.

Figure 7.2.14 Estimated Container Cargo Distribution (Loading) in 2005 and in 2030

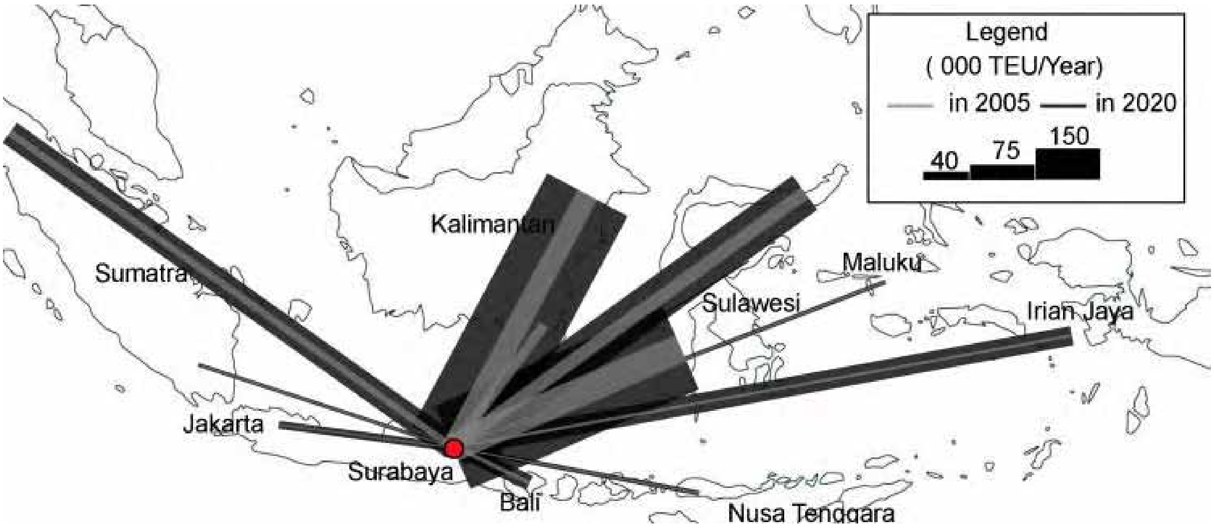
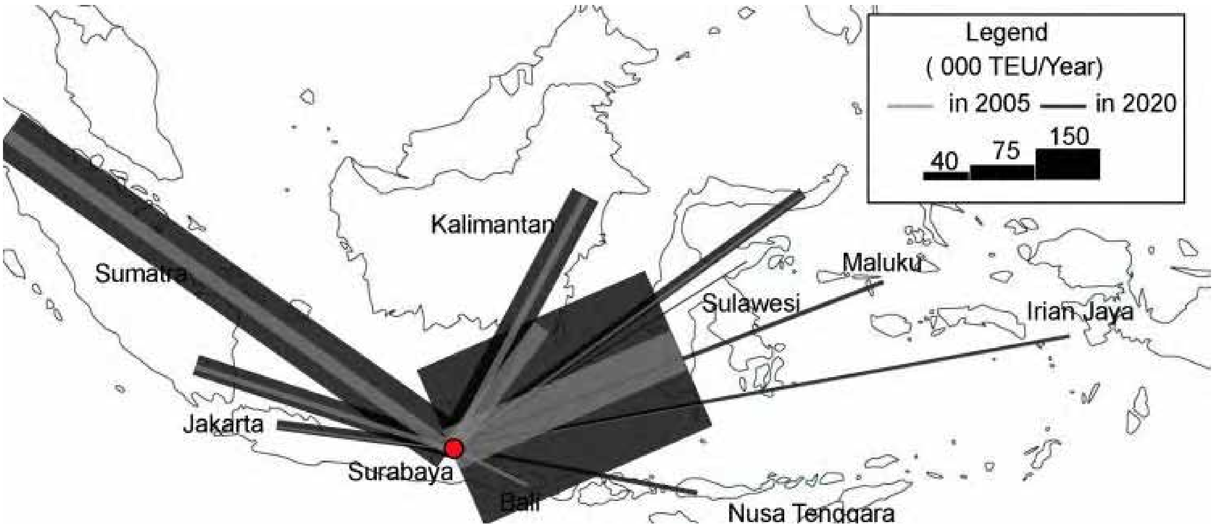


Figure 7.2.15 Estimated Container Cargo Distribution (Unloading) in 2005 and in 2030



Distribution of Non-container Cargo

The following figures depict the estimated non-container cargo distribution (Loading & Unloading) in 2005 and in 2030 to/from Surabaya. The cargo volume to/from Kalimantan Island and Sumatra Island are significantly higher than other areas. It would seem that the non-container cargo such as a petroleum or liquid bulk from Riau in Sumatra Island and East Kalimantan would be remarkably high.

Figure 7.2.16 Estimated Non-container Cargo Distribution (Loading) in 2005 and in 2030

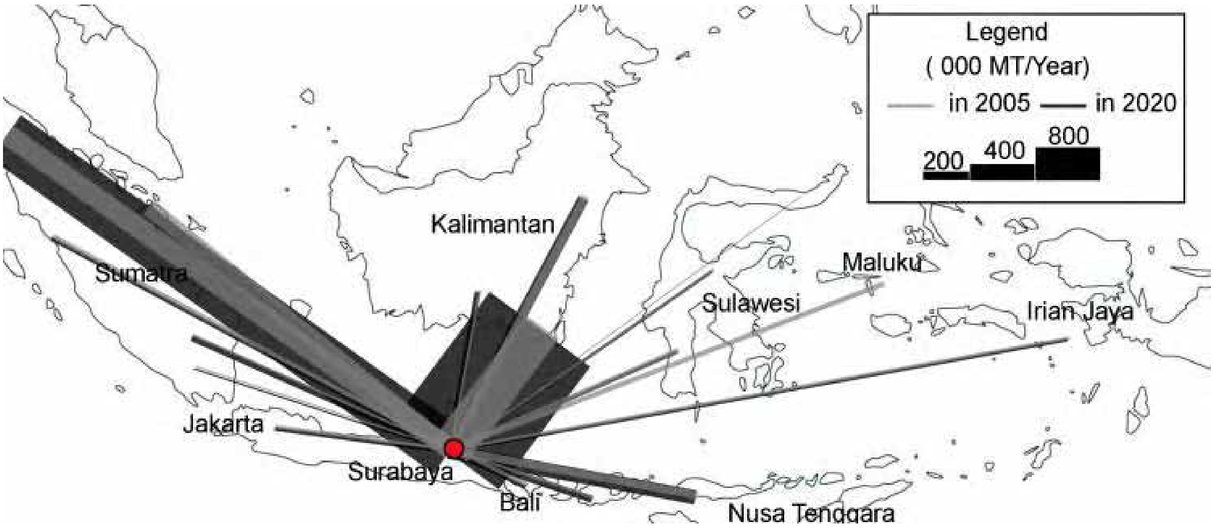


Figure 7.2.17 Estimated Non-container Cargo Distribution (Unloading) in 2005 and in 2030

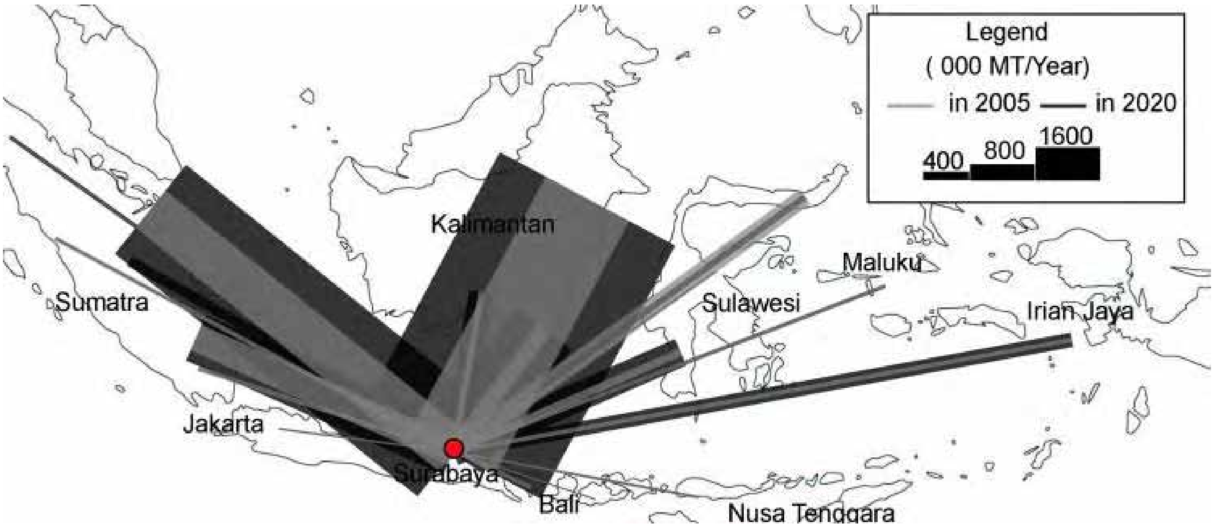


Table 7.2.10 Top 20 Ports of Domestic Shipping from/to Surabaya (Case 2)

(1) Container

Loading

(1000 TEU,%)

	Destination Port	2005	2030		
			Volume	%	Cum.%
89	Ujung Pandang	136	435	30	30
81	Samarinda	58	230	16	45
84	Bitung	65	204	14	59
80	Balikpapan	40	152	10	69
6	Belawan	33	118	8	77
55	Benoa	20	73	5	82
82	Tarakan	7	57	4	86
95	Sorong	7	56	4	90
36	Tanjung Priok	8	39	3	93
96	Jayapura	9	38	3	95
61	Kupang / Tenau	5	23	2	97
92	Ambon	4	21	1	98
34	Panjang	7	19	1	100
87	Pantoloan	1	7	0	100
78	Banjarmasin	51	-	-	100
65	Kalabahi	1	-	-	100
30	Palembang	0	-	-	100
94	Ternate	0	-	-	100
86	Gorontalo	0	-	-	100
63	Ende	0	-	-	100
	Total	452	1,471	100	

Unloading

(1000 TEU,%)

	Origin Port	2005	2030		
			Volume	%	Cum.%
89	Ujung Pandang	207	819	54	54
6	Belawan	64	235	15	69
81	Samarinda	34	136	9	78
34	Panjang	26	101	7	84
44	Banten	17	74	5	89
84	Bitung	12	56	4	93
36	Tanjung Priok	10	50	3	96
61	Kupang / Tenau	4	21	1	98
96	Jayapura	2	15	1	99
55	Benoa	1	7	0	99
80	Balikpapan	2	6	0	100
87	Pantoloan	1	6	0	100
92	Ambon	0	0	0	100
95	Sorong	0	0	0	100
78	Banjarmasin	88	-	-	100
59	Bima	1	-	-	100
Total		470	1,529	100	

(2) Break Bulk

Loading

(1000 MT,%)

Destination Port		2005	2030		
			Volume	%	Cum.%
78	Banjarmasin	253	1053	29	29
50	Probolinggo	333	759	21	50
63	Ende	76	201	6	55
126	Nusa Tenggara Barat	60	149	4	59
76	Kumai	57	122	3	63
36	Tanjung Priok	86	95	3	65
25	Teluk Bayur	107	88	2	68
89	Ujung Pandang	124	85	2	70
81	Samarinda	75	82	2	73
123	Sulawesi Tengah	27	74	2	75
119	Kalimantan Selatan	35	72	2	77
49	Gresik	31	68	2	78
128	Maluku	48	61	2	80
91	Kendari	18	55	2	82
14	Pekanbaru	22	49	1	83
94	Ternate	36	42	1	84
46	Cilacap	15	40	1	85
61	Kupang / Tenau	57	40	1	86
79	Kotabaru	19	38	1	87
62	Waingapu	22	35	1	88
Total		1949	3633		

Unloading

(1000 MT,%)

Origin Port		2005	2030		
			Volume	%	Cum.%
78	Banjarmasin	253	1384	29	29
120	Kalimantan Timur	1284	1144	24	52
89	Ujung Pandang	354	1122	23	75
83	Nunukan	86	285	6	81
76	Kumai	148	128	3	84
121	Sulawesi Utara	19	112	2	86
48	Surabaya	25	78	2	88
14	Pekanbaru	31	73	1	89
34	Panjang	28	50	1	90
70	Sampit	78	48	1	91
81	Samarinda	76	38	1	92
125	Sulawesi Tenggara	10	37	1	93
130	Irian Jaya/Papua	16	36	1	94
119	Kalimantan Selatan	8	32	1	94
82	Tarakan	53	30	1	95
128	Maluku	5	25	1	95
32	Tanjung Pandang	5	23	0	96
26	Kuala Tangkal	8	22	0	96
57	Celukan Bawang	5	21	0	97
126	Nusa Tenggara Barat	5	20	0	97
Total		2599	4845	100	

(3) Liquid Bulk

Loading

(1000 MT,%)

Destination Port		2005	2030		
			Volume	%	Cum.%
78	Banjarmasin	676	1,862	86	86
81	Samarinda	41	147	7	93
44	Banten	89	121	6	99
61	Kupang / Tenau	20	22	1	100
51	Meneg / Tanjung Wangi	2	2	0	100
84	Bitung	2	2	0	100
126	Nusa Tenggara Barat	1	1	0	100
25	Teluk Bayur	1	1	0	100
6	Belawan	1	0	0	100
36	Tanjung Priok	0	0	0	100
28	Muara Sabak	0	0	0	100
12	Dumai	0	0	0	100
20	Tembilahan	0	0	0	100
30	Palembang	0	0	0	100
115	Jawa Timur	0	-	-	100
48	Surabaya	0	-	-	100
Total		834	2,159	100	

Unloading

(1000 MT,%)

Origin Port		2005	2030		
			Volume	%	Cum.%
80	Balikpapan	2,158	4,950	26	26
12	Dumai	1,838	4,348	23	48
120	Kalimantan Timur	816	2,273	12	60
30	Palembang	1,329	2,113	11	71
44	Banten	257	1,559	8	79
20	Tembilahan	349	988	5	85
76	Kumai	57	962	5	90
81	Samarinda	47	813	4	94
27	Talang Dukuh / Jambi	31	442	2	96
84	Bitung	25	219	1	97
6	Belawan	43	91	0	98
36	Tanjung Priok	51	91	0	98
21	Rengat	18	70	0	99
34	Panjang	55	57	0	99
66	Pontianak	5	54	0	99
46	Cilacap	4	31	0	99
89	Ujung Pandang	5	31	0	100
31	Pangkal Balam	3	26	0	100
130	Irian Jaya/Papua	2	24	0	100
51	Meneg / Tanjung Wangi	38	11	0	100
Total		7,138	19,180	100	

(4) Dry Bulk

Loading

(1000 MT,%)

Destination Port		2005	2030		
			Volume	%	Cum.%
6	Belawan	431	1,241	64	64
107	Kepulauan Bangka Belitung	127	326	17	80
12	Dumai	388	184	9	90
30	Palembang	52	133	7	97
14	Pekanbaru	7	57	3	100
26	Kuala Tangkal	2	5	0	100
84	Bitung	0	3	0	100
44	Banten	60	-	-	100
63	Ende	6	-	-	100
81	Samarinda	1	-	-	100
126	Nusa Tenggara Barat	1	-	-	100
80	Balikpapan	1	-	-	100
Total		1,076	1,950	100	

Unloading

(1000 MT,%)

Origin Port		2005	2030		
			Volume	%	Cum.%
119	Kalimantan Selatan	261	1,006	23	23
78	Banjarmasin	224	798	18	41
130	Irian Jaya/Papua	205	652	15	56
32	Tanjung Pandang	155	523	12	68
54	Kalianget	72	373	9	77
30	Palembang	14	314	7	84
89	Ujung Pandang	16	263	6	90
6	Belawan	8	125	3	93
81	Samarinda	35	112	3	95
79	Kotabaru	19	76	2	97
101	Nanggore Aceh Darussalam	9	52	1	98
14	Pekanbaru	8	25	1	99
96	Jayapura	1	20	0	99
12	Dumai	2	18	0	100
31	Pangkal Balam	2	10	0	100
80	Balikpapan	0	0	0	100
121	Sulawesi Utara	831	-	-	100
128	Maluku	184	-	-	100
34	Panjang	144	-	-	100
126	Nusa Tenggara Barat	115	-	-	100
Total		2,409	4,365	100	

3) Port Passenger Traffic

a. Passenger Ship

Maritime transport passengers had been steadily increasing in Indonesia until the end of 1990s. However, as the result of severe competition with air transport service, maritime transport started to lose its patronage.

Although Surabaya has been recording the largest number of passengers in Indonesia, its demand has also dropped sharply after the peak of 1.8 million passengers in 2000, down to less than the half of the peak demand in 2006 (exclusive of Ferry passengers between Tg. Perak and Madra.

To estimate a floor level of the demand, a logistic curve was applied to the reducing trend of passengers of Surabaya port. According to the model, the demand will stabilize at a bottom level of 685,000 passengers per annum.

$$Y = K\left(\frac{1}{1+Exp(at-b)}+1\right) \qquad (R^2=0.94)$$

where : Y : Annual passengers to/from Surabaya port

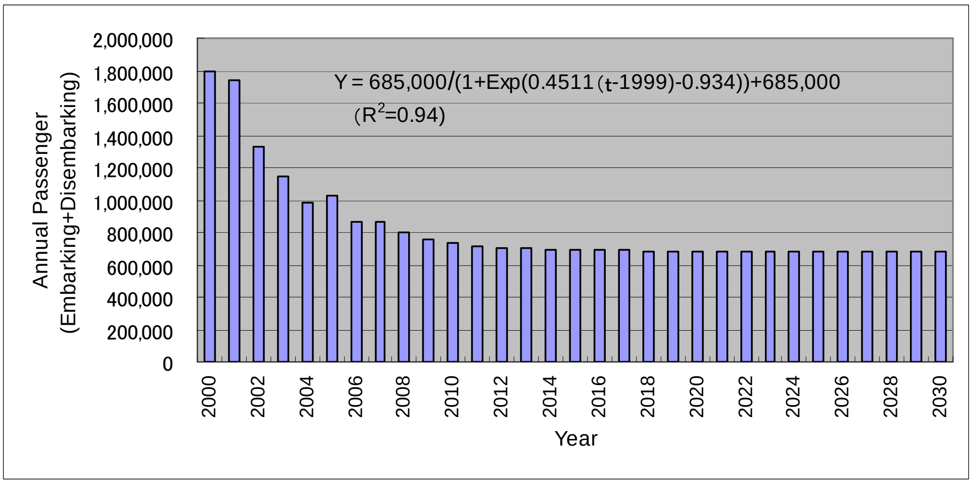
t : year (2000=1)

a : constant (=0.4511)

b : constant (=-0.934)

K : constant (=68500)

Figure 7.2.18 Future Trend of Passengers of Surabaya Port



This projection is only an extrapolation of the trend in the last six years, while future values would depend on the situation of regional economy as well as fare policy of air and maritime transportation if the demand will level off at the said level or not.

b. International Cruise Ship

Since 1990s, the world cruise population has been increasing at a high pace over 10% per annum, now reaching 16 million (forecast in 2002), of which more than 70% are North Americans. Most popular areas of regional cruise are the Caribbean, Mediterranean and Alaska followed by the Singapore-based cruise. Comparatively, South/Southeast Asian regions have been less developed in the cruise business. Indonesia is abundant in tourism resources but they located sporadically in wide area and somewhat inconvenient to compose a circular line visiting several countries.

Some long distance cruise lines are passing through the Java Sea, calling at Bali and Semarang (Tg. Emas Port). Cruise ships call at these ports 5 - 10 times a year. Long distance lines like cruise around the world or crossing the Pacific Ocean is still marginal.

Locating midst of the two ports of Bali and Semarang, Surabaya is forced to compete with them for cruise calls. Unfortunately, within one-day tour sphere from Tg. Perak Port, there seems to be no such attractive sightseeing spot as worldwide well-known like a world heritage. Surabaya city has a long history but rather poor in historic sites. Karapan Sapi is designated as Asia/Pacific Intangible Cultural Assets by ACCU. However, these events are not held all the year round and have not an attractive impact per se, enough to call cruising ships. Mt. Bromo is too far from the port to enjoy tourism activities over there.

Recently, cruise business has been expanding the target market from the rich and old to the young and middle income class. Family cruise also becomes popular gradually. Accordingly, economic and local cruise has been increasing in number. In this trend, Surabaya has a chance to receive cruise ships. If any, however, there may be at most 2-3 calls annually (4000 – 6000 passengers) in coming 5 years.

c. RoRo Ship

Trend of RoRo Ship in Indonesia: Based on the interview with the RoRo shipping company, the number of passengers and vehicles that are using RoRo service have been decreasing recently, as result of competition from cheap air services..

In the case of freight vehicles which use RoRo service such as a pickup and trucks, the transportation cost in using the RoRo service is high compared with other ships type. Consequently, RoRo cargo vehicles have been decreasing recently as well.

The following table shows the future fleet estimation by the STRAMINDO Study. Although the units of fleet in 2014 represent an increase from 2002, in the long-term further increase will be slight or negligible.

Based On the above, it seems that the user of RoRo service will slightly increase or remain stable in the future.

Table 7.2.11 RoRo Ship Fleet Estimation in the STRAMINDO Study

RoRo	2002		2014		2024	
	DWT	Units	DWT	Units	DWT	Units
0 – 4,000 GT	15,000	5,000	21,000	7,000	21,000	7,000
4,000 – 6,000 GT	29,000	6,000	48,000	10,000	48,000	10,000
Over 6,000 GT	8,000	1,000	-	-	-	-
Total	42,000	12,000	69,000	17,000	69,000	17,000

Source: STRAMINDO in 2004

Trend of RoRo Ship in Surabaya Port: In the past 10 years, although the ship calls of RoRo vessels to/from Tg. Perak have increased, the number of vehicle and passengers have slightly decreased. For details refer to Chapter 3 "Existing Ports and Shipping Services" , Section3.2 "Tg. Perak".

The average GT by ship and the number of ships to/from Tg. Perak are shown in the following Table. In Table 7.2.11, the mostly RoRo ships size will be 4,000 – 6,000 GT in the future. Although the average GT to/from Tg. Perak is decreasing in the past 3 years, it seems that the RoRo ship size will be maintained in the future.

Table 7.2.12 RoRo Ship to/from Tg. Perak

Year	Number of Ships	Average GT by ship
2004	651	5,790
2005	818	5,700
2006	884	5,389

Source: PELINDO III

Estimation of RoRo Shipcall: The RoRo ship call to/from Tg.Perak in the future was estimated based on the past trend of one of major RoRo ship company. Table 7.2.13 shows the estimation result of RoRo ship service to/from Tg.Perak. The increase of RoRo ship call in this period is not similar with other ship types. It is therefore projected that the number of RoRo ship calls will increase by 1.5 times until 2030.

Figure 7.2.19 Regression Equation of RoRo Ship

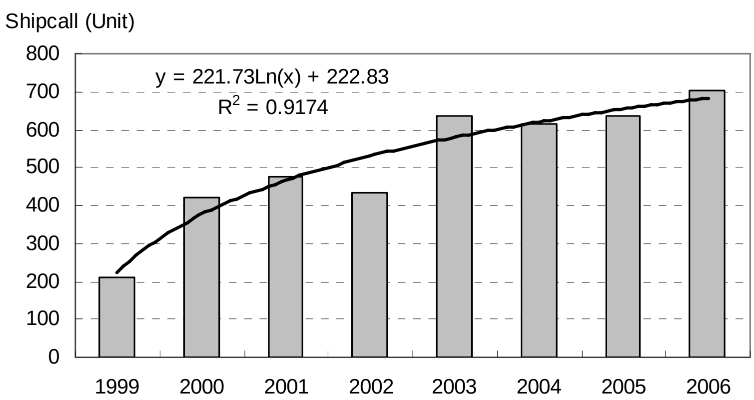


Table 7.2.13 Estimation of RoRo Ship to/from Tg. Perak

(Unit/Year)	2006	2015	2020	2025	2030
Shipcall	884	1,100	1,170	1,230	1,280

7.3 Future Shipping Needs

1) Future Container Shipping

a. Overseas Container Shipping

Trend in container traffic: During the last decades, international container trade continued to increase at a rate far exceeding that of maritime trade as a whole. During the 1980s, a large proportion of growth, which recorded as annual average rate of 7.8%, could be attributed to an increase in container rate. During the 1990s and in early 2000s, the growth of world container trade was accelerated to an average growth rate of 9.1% per year. This can be due to mainly three (3) reasons: (i) liberalization of international trade and facilitation of regional free trade initiatives such as AFTA in the case of Indonesia, (ii) further containerization with developments in information, food and other technologies such as cold chain haulage for perishable goods, and (iii) the emerging China market as a new large container market.

Indonesian ports show a rapid growth rate of international container shipping from 0.92 million TEU in 1990 to 4.56 million TEU in 2003. During the 1990s and early 2000s, the country recorded at an annual international container growth rate of 11.1 %. However during the period 2000 and 2003, growth became moderate, i.e., 6.3 %. Although the figure exceeds the country's GDP growth, this slowdown trend may imply the following peculiar situations in Indonesia to respond to the above three (3) container growth factors, viz:

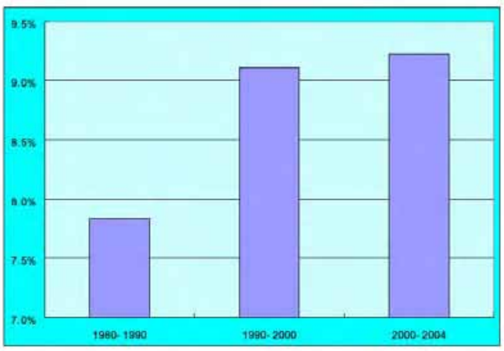
(i) Trade liberalization: Many Indonesian shippers and consignees must benefit from liberalized trade regimes since tariff rates have been considerably reduced within the ASEAN region;

(ii) Further containerization: The three-fourth of Indonesian containerizeable cargo has already been containerized. The country is not far from being at a full fledged level of containerization.

(iii) Emerging China has not stimulated the Indonesian economy in a dynamic manner. Instead, many Chinese products compete with Indonesian products at the developed countries' markets.

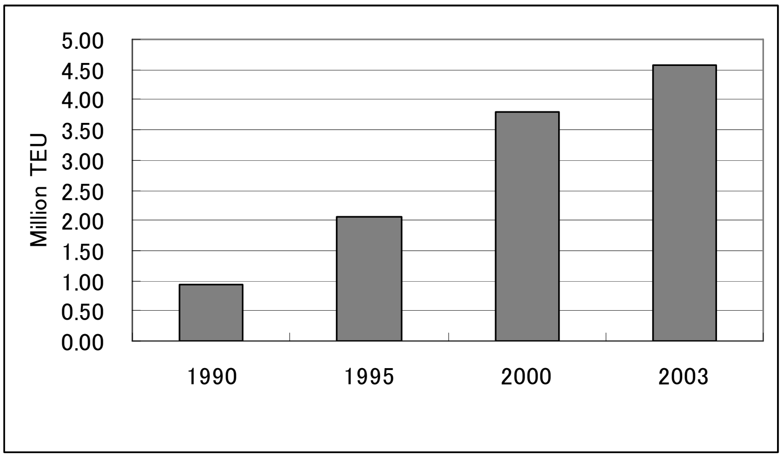
The Study's projection on container port traffic in the previous section considers trade facilitation under the liberalized trade regime, and probably faster than GDP growth, and progression of further containerization. From an international container shipping viewpoint, the projection is highly plausible.

Figure 7.3.1 World Container Trade Growth (1980-2004)



Source: UN ESCAP 2005

Figure 7.3.2 International Container Throughput in Indonesian Ports



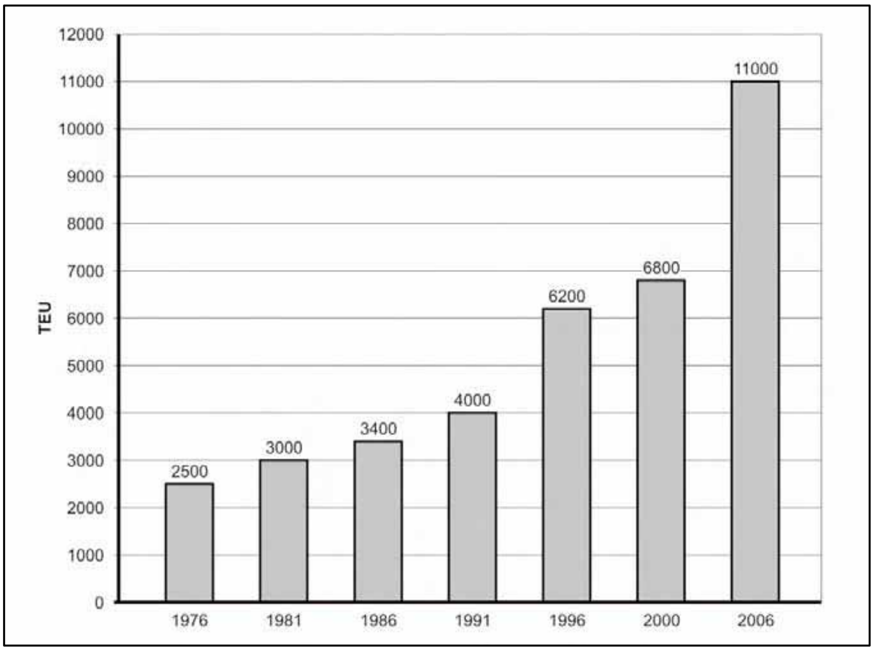
Source: Containerisation International Yearbook

Assignment of container ships: Growing container shipping can be characterized by not only container traffic but also container fleet, particularly ship size. Surabaya has inherent water depth limitation up to more or less 10 meters below sea level. In fact, most of the ships entering into TPS and BJIT range from 500 TEU to 1,000 TEU while the largest ship size was 2,002 TEU in 2005 according to the DGST voyage records. In the case of Tanjung Priok, many ships between 2,000 TEU and 3,000 TEU called the port in 2005 and it is partly explained by better water conditions of the port with depths of (-) 12 meters.

In order to enjoy the scale of economy in shipping business in line with increasing container traffic, the history of containerization has witnessed a progressive increase in maximum vessel size. By the mid-1970s, the 1,000 and 1,500 TEU ships of the first and second generation were being replaced by ships of 2,000+ TEU. The 4,000+ TEU ships appeared at the fleets of most major lines in the early 1990s. The post-Panamax concept became popular at the mid-1990s and thereafter vessels of around and over 6,000 TEU has become dominant in inter-continental shipping services. However, ship size enlargement has not stopped as the largest container vessel in 2006 is MV Emma Maersk with a cellular capacity of 11,000 TEU. BRS-Alphaliner reported that, as of 2005, the world container fleet included 49 units of more than 7,500 TEU and there were 165 more of these very large ships on order.

Those ships are designed to have a wide hull in order to enter into existing international hub ports where most of them offer – 16 meters' berths at best. For instance, the ever large container ship of MV Emma Maersk has a ship draft of 15.5 meters and thus it can call at existing hub ports between Asia and Europe such as Yokohama, Ningbo, Xiamen, Hongkong, Tanjung Pelepas, Rotterdam, Gothenburg, etc. It gives an important indication to port planning. After a long race between larger container ship and deeper container port since 1980s, the shipbuilding side now compromises on the port side with adopting wider breadth and no more deeper draft in ship design.

Figure 7.3.3 Growth in Largest Container Ship Size



Source: Compiled by various sources by JICA Study Team

Photo MV Emma Maersk

Capacity: 11,000 TEU
LOA: 397 m
Breadth: 56 m
Draft: 15.5 m
DWT: 156,907
Speed: Over 25.5 knots
Crew: 13 at normal time

Container shipping network: Over Panamax ships are mostly assigned on inter-continental routes while smaller ships usually serve intra-region routes. In Asia, there are many container shipping routes which are divided into 10 routes as listed in Table 4.4.1. As of 2004, the largest capacity was assigned between East Asia and North East Asia (741,879 TEUs), followed by the Far East and Middle East route. The latter is part of the main East-West trunk route and thus registered very high average ship sizes, e.g., 3,399 TEUs on the average.

Tanjung Perak receives direct ship calls from most of East and ASEAN countries, India and UAE. Although the port enables accommodation of ships of 2,000 TEUs at maximum, most of intra-Asian routes nowadays assign container ships of over 2,000 TEUs on the average. It presents a serious obstacle for the Surabaya economy.

In near future, the port situation of Surabaya will become worse. It is reported that all major Asian container shipping companies are going to assign bigger ships to meet increasing demand. Even Asian feeder operators such as PIL and Wan Hai are going to newly assign vessels over 2,000 TEUs on the average. Provided that the same access channel depth, more or less 10 meters below sea level, would continue, Surabaya would be left behind from any

Asian container shipping networks except short-distance feeder routes such as Singapore and Tanjung Pelepas. (Refer to 7.3.2)

Table 7.3.1 Container Ship Fleet Deployment on Intra-Asian Routes, 2004

Route	Ships Deployed	TEUs Deployed	Average Ship Size
East Asia – Northeast Asia	374	741,879	1,984
Far East – Mid East	186	632,201	3,399
Far East – Indian Subcontinent	233	631,196	2,709
East Asian Coastal	274	622,246	2,271
East Asia – Southeast Asia	305	616,414	2,021
Indian Subcontinent – Southeast Asia	145	320,148	2,208
Indian Subcontinent – Mid East	125	291,363	2,331
Northeast Asia – Southeast Asia	177	283,543	1,602
Far East – Red Sea	71	244,854	3,449
Southeast Asian Coastal	192	236,349	1,231

Source: UNCTAD, 2005

Table 7.3.2 Asian Liner Shipping Companies, 2004

Company	Country / Territory	Existing Ships	Existing Ave. Size (TEUs)	Ships on Order	Ave. Order Size (TEUs)
Evergreen	Taiwan	158	2,880	22	6,909
APL	Singapore	87	3,299	6	4,833
Hanjin	South Korea	78	3,679	10	7,200
NYK	Japan	95	2,737	10	8,200
COSCO	China	107	2,168	20	6,550
China Shipping	China	102	2,137	38	6,289
OOCL	Hong Kong	56	3,643	11	7,182
K-Line	Japan	66	3,000	19	5,632
ZIM	Israel	85	2,200	6	4,667
MOL	Japan	58	3,121	12	6,917
Yang Ming	Taiwan	58	2,759	18	3,556
Hyundai	South Korea	37	3,811	5	6,800
PIL	Singapore	91	1,286	12	2,167
Wan Hai	Taiwan	67	1,448	18	2,889

Source: UNCTAD, 2005

Possibility of direct linkage with trading countries: Owing to a well developed hub-and-spoke container network, many container ships call at Tanjung Perak Port from regional hubs, e.g., Singapore, Tanjung Pelepas, Port Kelang and Hong Kong. Nevertheless, some direct shipping services are available with trading countries, e.g., Japan, China, Taiwan, Philippines, Thailand, India and Oceania countries. .

Theoretically, if traffic demand grows on a route and improved infrastructure accommodates larger vessels than before, the GKS region can expect more direct ship calls from trading countries. This is one of significant port infrastructure development benefits resulting from reduced shipping costs by means of both larger ship assignment and direct or shorter shipping route.

The Study estimates the existing container demand in terms of two kinds of O-D pairs, i.e., trading pairs and port-to-port relations, and the Study projects future container demand in terms of trading pairs (refer to Table 7.3.3).

In the case of the trading pair between Japan and the GKS region, there were 102 thousand TEUs in trading volume in 2005. In fact, direct shipping service carried only 13 thousand TEUs or 13% of the demand while the rest was via any of regional hub ports. Therefore it can be considered that the rest is potential for shipping companies to assign more ships to ply directly between Japanese port(s) and the GKS gateway port. The Study projects the demand of this trading pair from 102 thousand TEUs in 2005 to 170 thousand TEUs in 2015 and 258 thousand TEUs in 2030.

Table 7.3.3 Container Traffic by Trading Country

Import

('000 TEU)

Country Name		2005		2015	2030
		From Origin	Port to Port	From Origin	From Origin
1	Japan	57	2	93	138
2	Korea	37	0	61	90
3	China	105	56	229	521
4	Hongkong	18	69	39	89
5	Taiwan	24	8	52	118
6	Philippines	3	30	7	16
7	Malaysia	22	49	37	54
8	Singapore	33	164	54	80
9	Thailand	18	10	40	91
10	Vietnam	5	0	11	24
11	India	8	3	17	39
12	North America	33	0	54	80
13	Mid &South America	7	0	16	36
14	Middle East	4	0	8	19
15	Europe	40	0	65	96
16	Russia	1	0	1	3
17	Africa	9	0	20	45
18	Oceania	17	33	27	40
19	Others	2	18	4	6
Total		441	441	835	1,585

Export

('000 TEU)

Country Name		2005		2015	2030
		To Destination	Port to Port	To Destination	To Destination
1	Japan	45	11	77	120
2	Korea	24	8	42	65
3	China	32	31	72	173
4	Hongkong	30	52	67	160
5	Taiwan	29	14	66	158
6	Philippines	14	34	32	76
7	Malaysia	44	70	75	117
8	Singapore	22	205	38	59
9	Thailand	13	19	29	69
10	Vietnam	7	0	16	38
11	India	4	4	8	20
12	North America	100	0	170	265
13	Mid &South America	6	0	14	33
14	Middle East	25	0	57	137
15	Europe	67	0	114	178
16	Russia	1	0	2	4
17	Africa	9	0	20	47
18	Oceania	17	26	28	44
19	Others	3	18	5	8
Total		441	493	932	1,770

Source: JICA Study Team

A deep seaport could provide an opportunity to attract larger vessels to directly connect with worldwide ports beyond the regional hub ports provided that there would be enough shipping demand. Ship assignment is a purely business decision. Although it is difficult to predict all business decisions which eventually form a market, in principle, shipping lines intend to assign competitive vessels. For instance, they may assign large vessels on long-distance inter-continental routes to offer reasonable tariff setting while small vessels on short-distance feeder routes to offer frequent and convenient service. Taking the shipping business environments into account, the Study sets average container ship size by route and in the projection years of 2015 and 2030 as shown in Table 7.3.4.

Table 7.3.4 Average Container Ship Size by Route Type

(TEU)

Route	Existing	2015	2030
Southeast Asia Coastal Route	1,200	2,000	2,000
East Asia – Southeast Asia Trunk Route	2,000	3,000	4,000
South Asia, Middle East – Southeast Asia	2,500	3,500	5,000
North America – Southeast Asia	4,000	6,000	8,000
Europe – Southeast Asia	4,000	6,000	8,000

Source: JICA Study Team

At present, container operators provide regular shipping services according to a weekly schedule. Their foremost concern on GSK is its weekly container volume. Table 7.3.5 indicates the comparison between the SFEA's weekly container traffic and the required traffic volume to attract trunk/direct ships regularly by each trading group. In this exercise, the required traffic volume is calculated as follows:

i) Future direct ship sizes by trading group between 2,000TEU and 8,000 TEU,

ii) Required container carrying volume per ship capacity (20% excluding transshipment and empty containers),

iii) Competitive shipping environment where four (4) shipping lines make weekly ship calls and

iv) Shipping line's market share by direct service (80%)

They are all adequately set based on the assumption of future shipping business environments.

The exercise has obtained the following indications:

i) Under the year 2005 situations, there is no trading route which has sufficient demand to allow container ships of over 2,000 TEU. In reality, it is true. Tanjung Perak Port receives ships as large as around 2,000 TEU but they are not weekly.

ii) China is the largest trading partner in import. By 2015, the trading demand with China shows enough volume to allow 3,000 TEU ship to weekly call at GSK gateway port while 4,000TEU ship is possible by 2030.

iii) Japan is the second largest trading partner in both import and export. However, future traffic is not sufficient to assign over 3,000 TEU ship weekly. If containers are consolidated between Japan and Korea, it will become possible to assign a 4,000 TEU ship on the route in 2030.

iv) Traffic demand will substantially increase on the India – Middle East route from 820 TEU weekly in 2005 to 4,300 TEU weekly in 2030 or by 5.2 times. However, future demand is not sufficient to assign the assumed ship size. At best, a ship of 2,000 TEU will be possible in direct operation. However it is questionable that such a ship assignment program will be competitive with the conventional shipping arrangement via a regional hub port such as Singapore.

v) North America, mostly USA, is the largest export market for the GKS economy at present and in future. However container flow is quite directional due to too moderate import. Since this trans-Pacific route requires large ship arrangement like over Panamax ships in the future, the demand is not sufficient to meet it. Similarly, the Europe route is not sufficient in demand for a shipping line to maintain direct shipping service.

As results, the GSK gateway port is expected to receive numerous container ships below 4,000 TEU during the planning period particularly between 2015 and 2030.

This exercise also shows some possibility to receive over Panamax ships under different conditions. For example, only one mega carrier would decide to drop by GSK as one of ports of call at the Asian side by a ship of 6,000 TEU for trans- Pacific route or Europe route. In such a case, a mega carrier may want to unload and load more than 2,400 TEU weekly to meet its ship's 20% hull space. It is possible to occur in 2015 although one mage carrier's base is far from a status of being regional hub port. Therefore, a combination of ship call number with ship size largely depends on shipping lines' decision and port marketing in order to meet port demand.

Table 7.3.5 Shipping Market Analysis to Connect GKS Gateway Port by Direct Ship

(Unit: TEU))

GKS's Trade Groups	Year 2005			Year 2015			Year 2030		
	GKS Weekly Traffic	Assigned Ship Size (Ave.)	Required Traffic to Assign Ship1/	GKS Weekly Traffic	Assigned Ship Size (Ave.)	Required Traffic to Assign Ship1/	GKS Weekly Traffic	Assigned Ship Size (Ave.)	Required Traffic to Assign Ship1/
China	2,740	2,000	4,000	6,020	3,000	6,000	13,880	4,000	8,000
Japan – Korea	3,260	2,000	4,000	5,460	3,000	6,000	8,260	4,000	8,000
India – Middle East	820	2,500	5,000	1,800	3,500	7,000	4,300	5,000	10,000
North America	2,660	4,000	8,000	4,300	6,000	12,000	6,900	8,000	16,000
Europe	2,140	4,000	8,000	3,580	6,000	12,000	5,480	8,000	16,000

Note1: 1/ = (average trunk/direct ship size: 2,000-8,000) x (required loading & unloading containers per ship capacity: 0.2) x (disembarkation and embarkation: 2) x (weekly ship calls: 4) x (line haul operators' share on route: 0.8)

Note2: Excluding transshipment and empty containers

b. Domestic Container Shipping

Domestic container shipping also enables to increase profit by means of larger container ships. But its scope is limited due to their inherent operational characteristics within limited domestic waters. More specifically, they are long port staying time and short navigation time. With a large container ship, a shipping company can enjoy operation cost reduction per TEU in navigation but it has to bear more ship depreciation cost in ports.

Tanjung Perak Port is the largest domestic container shipping port with many port-to-port links. Among them, the thickest links lie on with Sulawesi and Kalimantan. The previous JICA study on domestic shipping and maritime industry (JICA STRAMINDO 2004) analyzed the opportunity of assigning larger ships than the present ones, i.e., 10,000 dwt at maximum. The results indicate that the most economically selected ship size is 15,000 – 20,000 dwt for the Makassar route (Sulawesi) and 15,000 dwt for the Balikpapan route (Kalimantan). (Refer to Table 7.3.6 and Figure 7.3.4)

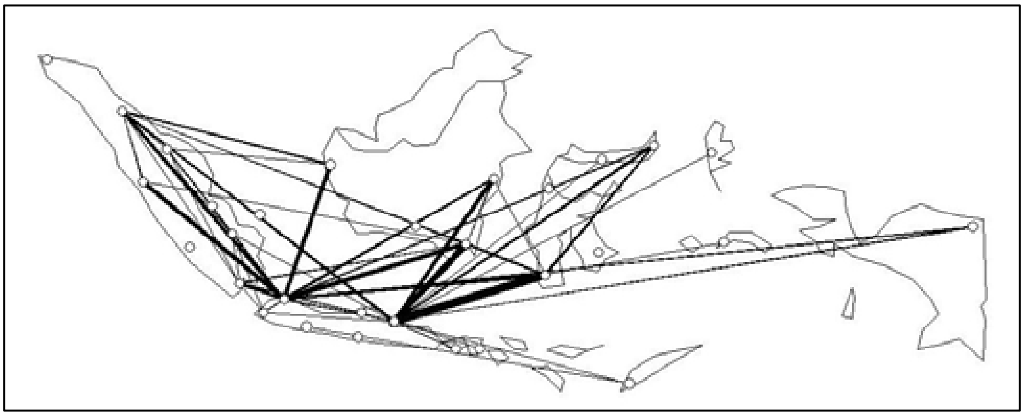
It is considered a useful input to the Study's port planning. The maximum size of future domestic container shipping is 20,000 dwt and thus the existing port infrastructure, a critical depth of 10.5 meters, can likely accommodate all the domestic container fleets during the planning period.

Table 7.3.6 Suitable Ship Size for Domestic Container Shipping

Primary Route		Demand (1,000)		Cost Indicator (15,000 DWT = 1.000)			
		MT	TEU	10,000 DWT	15,000 DWT	20,000 DWT	30,000 DWT
Based on Year 2014 Demand							
Tg Perak	Makassar	4,186	299	1.082	**1.000**	**1.000**	1.048
Tg Perak	Balikpapan	669	47	1.083	**1.000**	1.117	1.407
Based on Year 2024 Demand							
Tg Perak	Makassar	6,833	488	1.082	**1.000**	**1.000**	1.048
Tg Perak	Balikpapan	1,179	84	1.083	**1.000**	1.001	1.072

Source: JICA STRAMINDO (2004)

Figure 7.3.4 OD Structure of Containerized Sea Traffic



Source: JICA STRAMINDO (2004)

2) Estimated Container Shipcalls

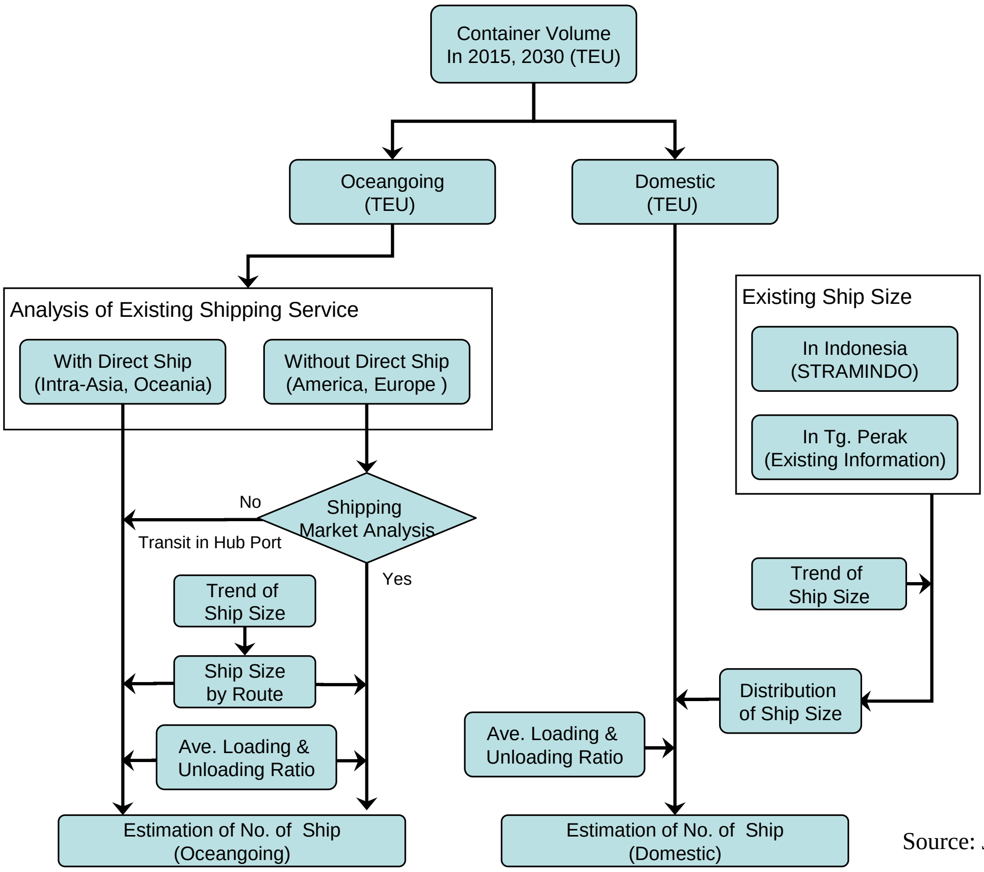
a. Methodology

Figure 7.3.5 illustrates the calculating process of container fleet. Taking the situations in container shipping into account, it seems that the characteristics of future demand and shipping service of it are different between the oceangoing and the domestic. Thereby, we estimate the container fleets, separately.

Oceangoing: Firstly, we analyze the existing shipping service by with/without direct ships. After that, the shipping market to/from America and Europe is analyzed. Furthermore, the container fleet is estimated by the container volume (TEU), distribution of ship size and the loading (unloading) ratio.

Domestic: We also analyze characteristics of domestic container ship size using STRAMINDO Data and the existing information of Tg.Perak. After that, the container fleet is estimated by the container volume, ship size and the loading (unloading) ratio.

Figure 7.3.5 Analyzing Process for Estimation of Container Ship Fleet



Source: JICA Study Team

b. Characteristics of Oceangoing Container Ship

Trend in Ship Size: To analyze shipping market in the future, the study examined the existing situation of container ship by major routes, such as from Asia to North America or Europe. In addition, the study reviewed container vessel technology trend.

The following table shows the existing container shipping fleet and ship size of big operators/alliances on major routes. Overall, the average ship size of North America and Europe route are significantly higher than that of Intra-Asia. Especially, the average of ship size of 5 Mega Carries on Europe route is over 5,000 TEU.

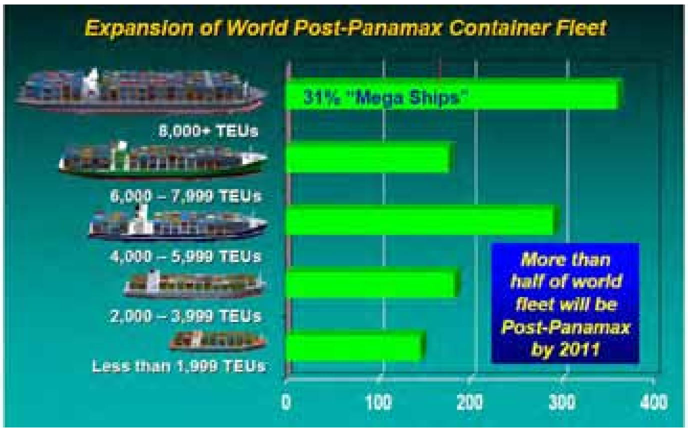
Table 7.3.7 Existing Situation of Container Ship by Major Route

Operator / Alliance	North America Route (West Side)		North America Route (East Side)		Europe Route		Intra-Asia
	No. of Ship	Ave. Ship Size (TEU)	No. of Ship	Ave. Ship Size(TEU)	No. of Ship	Ave. Ship Size(TEU)	Ave. Ship Size(TEU)
Maersk Sealand	16	4,286	25	4,097	25	7,170	-
Evergreen	23	4,061	18	3,870	25	4,518	-
The Grand Alliance/ Americana	34	4,611	27	3,950	44	5,432	-
The New World Alliance	37	4,648	9	4,122	24	5,589	-
CKYH	55	3,987	24	3,860	63	4,641	-
5 Mega Carries Sub Total	165	4,303	103	3,966	181	5,291	-
Others	50	2,509	28	3,897	76	4,391	-
Total	215	3,886	131	3,951	257	5,025	1,800

Source: TAKAHASHI Hironao, Container Transport and Container Port, 2004

The following figure shows the new build orders of container ships. 31% of built container ship in 2006 is more than 8,000 TEU class, and more than half of world fleet will be Post-Panamax class (4,000-5,999 TEU). In addition, there are plans to invest in 18,000 TEU container ship (Malacca max) on Asia-Europe route in 2010 by this report. This type of ships can reduce cost by 30% compared with 4,800 TEU Vessel (Panamax), primarily due to economies of scale". Therefore, the expansion of container ship size will continue in the future.

Figure 7.3.6 New Build Orders of Container Ships in 2006



Source: Maritime Vessel Technology Trends, American Association of Port Authorities

Distribution of Oceangoing Container Ship Size: The existing and future distribution of ship size to/from America/Europe and other countries is shown in the following table. There was a significant increase in ship size between 1998 and 2003. Based on the prevailing trend primary ship size will be more than 4,000 TEU for long distance routes in the future. The distribution of ship size in 2015 is forecasted based on the container vessel technology trend by 2011. In the long term, i.e. 2030, it is difficult to forecast the distribution of ship size, due to many uncertain factors.

Table 7.3.8 Distribution of Ship Size in America / Europe & Others

	TEU	Ave.TEU	1998*	2003*	2015**	2030**
1	-499	250	0.9%	0.4%	0.5%	-
2	500-999	750	0.9%	0.4%	0.5%	-
3	1,000-2,499	1750	16.3%	7.9%	11.0%	-
4	2,500-3,999	3,750	43.9%	20.7%	16.0%	-
5	4,000-5,999	5,000	33.5%	56.2%	25.0%	-
6	6,000-7,999	7,000	5.4%	14.8%	16.0%	-
7	Over 8,000	9,000			31.0%	-
Ave. TEU		-	4,000	4,800	6,000	8,000

Source *: Report of National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport, Japan
**: Estimated by the Study Team.

The existing and future distribution of ship size for intra-Asia routes is shown in the following Table, indicating an increase in the recent years. In particular, as compared with in 1998 and in 2003, the share of the large ship size (No.3 & No.4) increased during the period. On the other hand, the share of small ship size (No.1 & No.2) decreased. The ship size for Intra-Asia routes is 30-40% lower than that of America / Europe & Others at 1998 and 2003. In this study, the ship size and future distributions are assumed based on the existing situation.

Line Haul Operator's Share on Route: In this study, a line haul operator's share is assumed based on the existing major routes in the world, say, 0.9.

Table 7.3.9 Distribution of Ship Size in Intra-Asia

	TEU	Ave.TEU	1998*	2003*	2015**	2030**
1	-499	250	17.9%	6.9%	2.0%	-
2	500-999	750	29.6%	16.6%	5.5%	-
3	1,000-2,499	1750	52.5%	62.0%	55.0%	-
4	2,500-3,999	3,750	0.0%	14.5%	30.0%	-
5	4,000-5,999	5,000	0.0%	0.0%	7.5%	-
6	6,000-7,999	7,000	-	-	-	-
Ave. TEU		-	1,200	1,800	2,500	3,500

Source *: Report of National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport, Japan
**: It is assumed by the Study Team.

c. Estimation of Oceangoing Container Shipcalls

The following table shows the estimated oceangoing ship calls to/from Surabaya port from 2005 to 2030. The actual ship calls to/from TPS in 2005 was 1,493, whereas, the estimated container ship calls is1,440, showing validity of the estimation model.

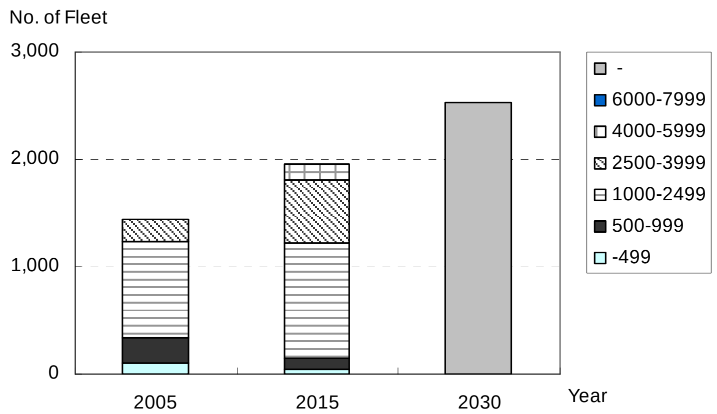
The numbers of ship calls will increase substantially throughout the period, and at the same time, the distribution of ship size will significantly change between 2005 and 2015. It is therefore necessary to construct a new and deeper sea port to meet future requirements.

Table 7.3.10 Estimated Oceangoing Container Ship Calls by Ship Size in the Future

No.	Ship Size	Intra-Asia & Oceania		America & Europe & Others		Total			Reference	
		2015	2030	2015	2030	2005	2015	2030	DWT	Berth Depth (Full Loaded)
1	-499	39	-	0	-	99	39	-	-9,000	Max -8m
2	500-999	108	-	0	-	239	108	-	-16,000	-9m to -10m
3	1000-2499	1,080	-	0	-	893	1,080	-	-40,000	-11m to -12m
4	2500-3999	589	-	0	-	209	589	-	-55,000	-13m
5	4000-5999	147	-	0	-	0	147	-	-75,000	-14m
6	6000-7999	0	-	0	-	0	0	-	-95,000	-15m
7	Over 8000	0	-	0	-	0	0	-		
Total		1,963	2,425	0	104	1,440	1,963	2,529		

Source: JICA Study Team

Figure 7.3.7 Distribution of Oceangoing Container Fleet



d. Characteristics of Domestic Container Ships

Container Volume in the Future: The following table shows the estimated domestic container cargo volume to/from Surabaya port quoted from "7.2 Port Demand Forecast". The growth is as high as 3.6 times during the period 2005 -2030.

Table 7.3.11 Domestic Container Cargo Volume

(000 TEU)	2005	2015	2020	2025	2030
Loading	410	775	1,068	1,211	1,471
Unloading	426	805	1,158	1,258	1,529

Existing Ship Size in Inddonesia: The existing and future distribution of ship size in Indonesia is shown in the following Table, which are the results of analysis done by STRAMINDO in 2002. The average TEU capacity in 2024 is 40% higher than that in 2005. because time horizons for analysis is not exactly the same, the conditions for the years 2015 and 2030 are interpolated or extrapolated.

Table 7.3.12 Distribution of Domestic Container Ship Size

DWT	2002			2014			2024		
	000 DWT	000 Unit	Share	000 DWT	000 Unit	Share	000 DWT	000 Unit	Share
1000-2000	1	1	0.1%	1	1	0.1%	1	1	0.0%
2000-4000	46	15	6.3%	46	15	3.0%	55	18	2.1%
4000-8000	321	53	43.8%	315	53	20.5%	383	64	14.3%
8000-12000	112	11	15.3%	110	11	7.2%	114	11	4.3%
12000-18000	192	14	26.2%	806	58	52.5%	1608	116	60.1%
Over 18000 (18000-24000)	61	3	8.3%	257	12	16.7%	513	26	19.2%
Total	733	97	100.0%	1535	150	100.0%	2674	236	100.0%
Ave. DWT	9,939			13,264			14,205		
Ave. TEU	663*			884*			947*		

Source: STRAMINDO
*: TEU=0.0667 DWT (Report of National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport, Japan)

Existing Ship Size in Tg. Perak (Conventional) : The existing container ship size in Tg.Perak is shown in the following table. It is noted that the average ship size in Tg. Peark is lower than that in STRAMINDO Data.

Table 7.3.13 Container Ship Size to/from Tg.Perak

	Shipcalls	Ave. GT	Ave. DWT	Ave. TEU
2005	4,018	5,735	6,505	434

Source: PELINDO III and BJTI

Line Haul Operator's Share: It is assumed that line haul operator's share is the same as the oceangoing.

Loading (Unloading) Ratio: The loading (unloading) ratio is estimated using the historical data in Tg. Perak. This value is a little bit higher than that of oceangoing routes.

Table 7.3.14 Loading (Unloading) Ratio in Tg.Perak

	Ave. Ship Size	Ave. Loading (Unloading) Volume (TEU)	Line Haul Operator's Share	Loading (Unloading) Ratio
2005	434	88	0.9	0.23

Source: It is estimated using PELINDO III and BJTI data

e. Estimation of Domestic Container Shipcall

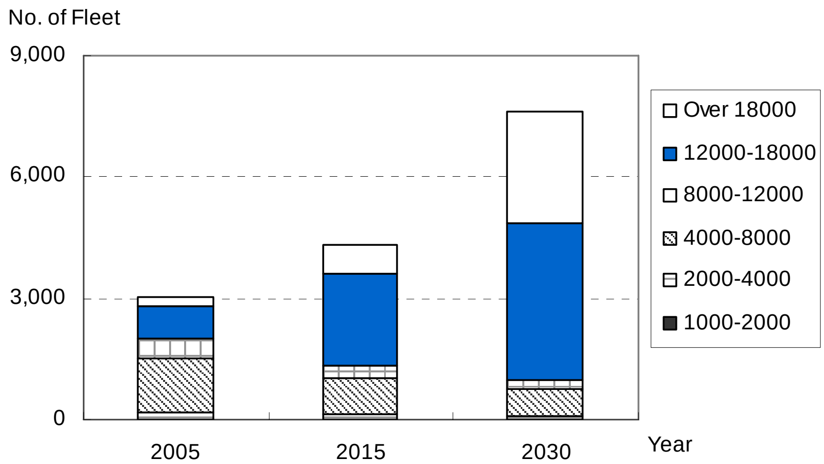
The following table shows the estimated domestic ship calls to/from Surabaya port from 2005 to 2030. The numbers of shipcalls continues to increase throughout the period. The distribution of ship size shows a enlargement during the same period.

Table 7.3.15 Estimated Domestic Container Fleet by Ship Size

Ship Size (DWT)	Ship Size (TEU)	2005	2015	2030	Berth (m)
1000-2000	100	4	3	3	Max -8
2000-4000	200	191	130	76	
4000-8000	400	1,333	890	694	
8000-12000	667	465	311	191	-9
12000-18000	1,000	797	2,277	3,891	
Over 18000 (18000-24000)	1,333	253	726	2,777	-10
Total		3,043	4,336	7,629	

Source: JICA Study Team

Figure 7.3.8 Distribution of Domestic Container Fleet

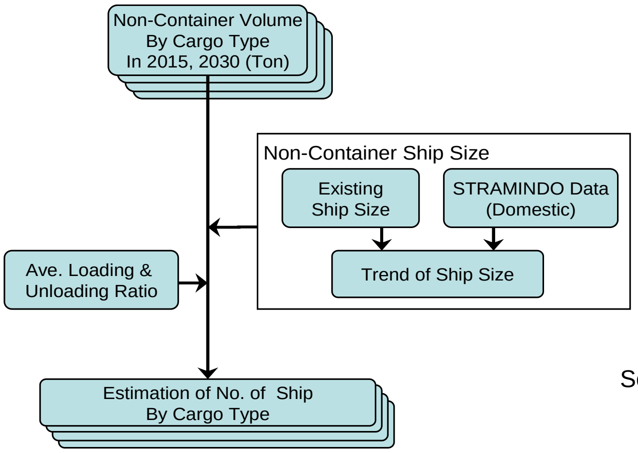


3) Estimated Non-Container Shipcalls

a. Methodology

The following figure illustrates the process of estimating non-container ship calls. Firstly, the study analyzed the trend of ship size based on the existing ship sizes calling at Tg. Perak and STRAMINDO Database. The future ship sizes by cargo type were estimated in STRAMINDO. After that, the non-container fleets are estimated by the non-container volumes, trend of ship size and the loading (unloading) ratio.

Figure 7.3.9 Analysis Process for Estimation of Non-Container Ship Fleet



Source: JICA Study Team

b. Non-Container Volume in the Future

The following table summarizes the estimated non-container volume by cargo type to/from Surabaya port, based on the medium case of economic growth. The total cargo volumes in 2030 are 2.1 times higher than that of 2005.

Table 7.3.16 Estimated Non-Container Volume to/from Surabaya Port

No.	Cargo Type	Cargo Volume (000 ton)		
		2005	2015	2030
1	General Cargo	7,705	7,236	12,702
2	Petroleum	5,980	11,498	16,137
3	Liquid Bulk Cargo	2,057	3,614	5,394
4	Dry Bulk Cargo	7,350	10,149	13,317
Total		23,092	32,497	47,550

Source: JICA Study Team

c. Non-container Ship Size

Existing Ship Size to/from Tg.Perak: The change in ship size to/from Tg.Perak during the past 5 years is shown in the following table. In all, there is no observable trend in ship enlargement . Regarding tankers, the ship calls (unit) was increasing, but the average ship size was decreasing. Therefore, the ship size trend in non-container fleets differs from that of the container ship traffic.

Table 7.3.17 Existing Ship Size to/from Tg. Perak

		2002	2003	2004	2005	2006
Dry Bulk & General Cargo	Unit	6,920	6,970	7,925	6,587	6,657
	GT	17,478,461	19,079,896	19,294,120	17,988,650	16,277,929
	Ave. Ship Size (GT)	2,526	2,737	2,435	2,731	2,445
Tanker	Unit	1,448	1,342	1,609	1,557	1,697
	GT	8,147,530	8,031,573	8,940,963	7,396,154	7,400,399
	Ave. Ship Size (GT)	5,627	5,985	5,557	4,750	4,361
Other (Traditional)	Unit	1,627	1,312	1,405	1,247	1,297
	GT	326,310	281,764	285,727	204,710	231,016
	Ave. Ship Size (GT)	201	215	203	164	178

Source: PELINDO III Branch Office

Trend of Oil Tanker: It was true for oil tanker operators to expand their fleet size to capture high productivity during the last three decades from the 1950s to the 1970s. Today, the largest crude oil tanker has a capacity of 563 thousand DWT while the average size is at 98 thousand DWT.

PERTAMINA tanker fleets calling at Tg. Perak are divided into six (6) ship sizes:

i) 3,500 DWT for black oil (lubricant oil, etc.) or LPG

ii) 5,000 DWT for black oil

iii) 6,500 DWT for LPG

iv) 18,000 DWT for while oil (kerosene, petrol, etc.)

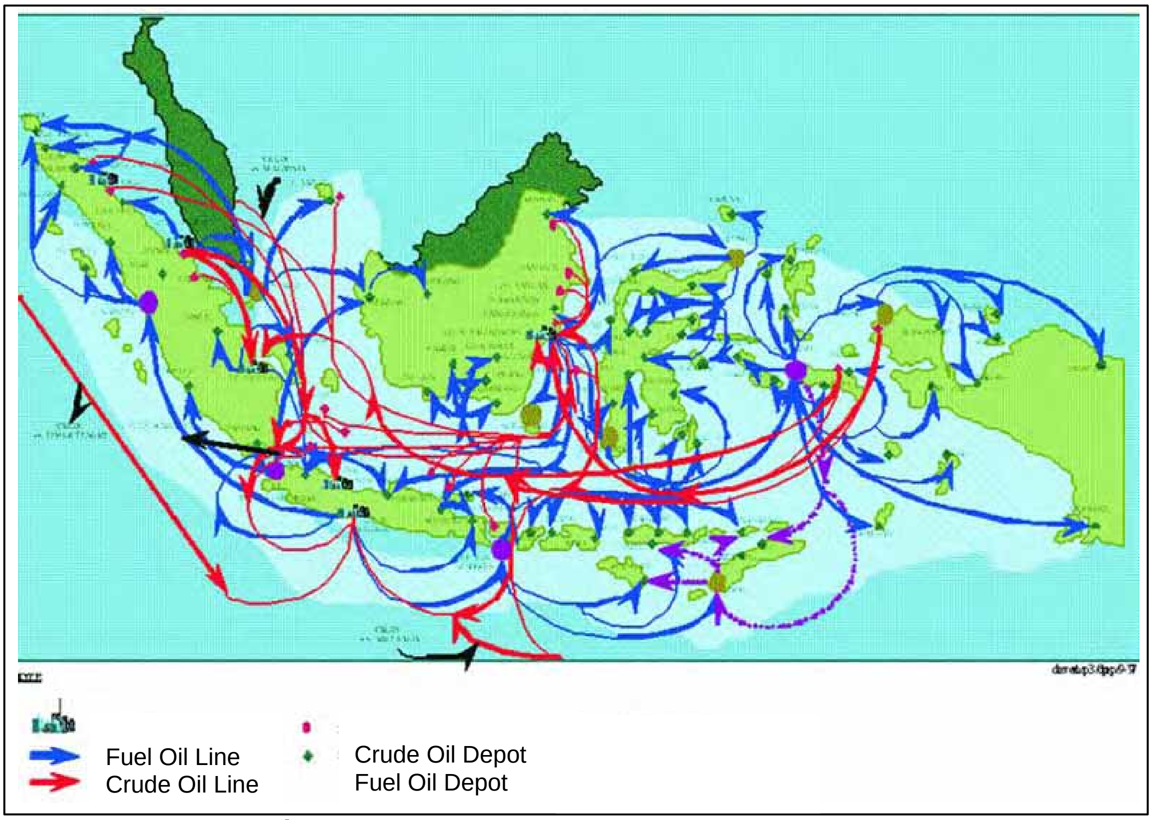
v) 30,000 DWT for while oil, and

vi) 37,000 DWT for white oil

Most of refined oil products come from Balikpapan (East Kalimantan), Cilacap (Yogyakarta) and Dumai (Riau) as shown in Figure 7.3.10. Although Pertamina fleets include tankers of 85,000 DWT, there is no plan for them to call at Tanjung Perak according to Pertamina Shipping.

Other liquid bulkers such as CPO vary from shipping routes and ship sizes. But the largest one is around 50,000 dwt. There seems to be no reason to assign larger tankers in the future.

Figure 7.3.10 Pertamina Shipping Route Plan



Source: PERTAMINA Shipping 2006

Pipeline Development: PERTAMINA plans to develop a pipeline from Tuban to Surabaya. This plan will transport petroleum products by SPM (Single Point Mooring) in the Tuban, and these products will be transported through a 138km long pipeline to the installation depot in Tg.Perak. This plan starts construction work from 2007. Therefore, it seems that the petroleum products excluding LPG will be transported by the pipeline, and the shipcalls of PERTAMINA to/from Tg.Perak will decrease in the future.

The following table shows the cargo volumes of PERTAMINA by product type to/from Tg.Perak. With a new pipeline, the study estimates that most of the white oil carried by domestic shipping would be diverted. The number of ship calls for such diversion is equal to 10% of all tanker ship calls at Tg. Perak.

Table 7.3.18 Cargo Volumes of PERTAMINA by Product Type

No.			2002	2003	2004	2005	2006
1	Oil and Petroleum	Shipcalls	278	305	297	209	142
		Ave. DWT	14,124	14,570	16,008	18,322	19,217
		000 Ton	1,686	1,913	2,127	1,708	1,317
2	LPG	Shipcalls	54	55	75	65	77
		Ave. DWT	3,560	3,567	3,596	3,649	3,504
		000 Ton	86	87	122	106	122
Total		Shipcalls	332	360	372	274	219

Source: PELINDO III Branch Office

Dry Bulk Carrier: Regarding bulk carriers, the largest calling vessel was 365 thousand DWT and the average size is 49 thousand DWT. Further enlargement is technically possible but it may reduce cost-productivity due to limited opportunities and insufficient port infrastructure.

Dry bulk carriers are grouped into four (4) in terms of ship size. They are (i) handy-size (20,000 – 35,000 dwt), (ii) Handymax (35,000 – 50,000 dwt), (iii) Panamax (50,000 – 80,000 dwt) and (iv) Cape-size (over 80,000 dwt).

At Tanjung Perak, two Cape-size bulkers called in 2006. Their sizes were recoded at around 87,000 dwt. It is considered that the largest size for dry bulk haulage in the ASEAN region and the port is likely to accommodate such Cape-size vessels in the future.

Trend of Ship Size: The following table shows the estimated distribution of domestic non-container ship size by STRAMINDO in 2002. The average DWT of bulkera will increase up to 2014, after which time it will decrease. The average DWT of conventional ships will slightly decrease and that of the tanker will be remain steady. Therefore, the trend of non-container ship size will be not the same as the container ship size trend, and it seems that the non-container ship size profile will remain the same in the future.

Table 7.3.19 Distribution of Domestic Non-Container Ship Size

Type	DWT	2002		2014		2024	
		000 DWT	Unit	000 DWT	Unit	000 DWT	Unit
Conventional	0 – 1,000	318	637	517	1,034	812	1,625
	1,000 - 2,000	297	198	481	321	756	504
	2,000 – 4,000	472	157	1,300	433	2,539	846
	4,000 – 8,000	810	162	897	179	967	193
	Over 8,000	543	54	602	60	649	65
	Total	2,440	1,208	3,797	2,028	5,724	3,233
	Ave. DWT	2,020		1,870		1,770	
Bulker	1,000 – 4,000	13	5	9	4	11	4
	4,000 – 8,000	74	12	53	9	64	11
	8,000 – 15,000	101	9	133	12	213	19
	Over 15,000	399	13	695	23	822	27
	Total	587	40	890	48	1,111	62
	Ave. DWT	14,680		18,540		17,920	
Tanker	0 – 1,000	51	101	67	135	71	142
	1,000 – 4,000	532	213	707	283	746	298
	4,000 – 8,000	371	62	494	82	521	87
	8,000 – 15,000	248	23	329	30	347	32
	15,000 – 25,000	360	18	479	24	505	25
	25,000 – 35,000	405	14	539	18	568	19
	Over 35,000	180	5	239	6	252	6
	Total	2,146	434	2,855	578	3,010	609
	Ave. DWT	4,940		4,940		4,940	

Source: STRAMINDO

d. Estimation of Shipcalls

The study estimated non-container shipcalls on the assumption that ship size and loading (unloading) ration are the same as that of existing situation. According to the future ship calls for petroleum, it is estimated considering the pipeline development by PERTAMINA from Tuban to Surabaya.

The estimated ship calls of non-container are shown in the following table. The total number of ship calls will increase by 23% between 2005 and 2015 and further by .49% between 2015 and 2030.

Table 7.3.20 Estimated Non-Container Shipcalls

Cargo Type	Cargo Volume (000 ton)			Shipcalls		
	2005	2015	2030	2005*	2015	2030
Petroleum	5,980	9,774	13,717	1,158	1,900	2,700
Liquid Bulk Cargo	2,057	3,614	5,394	399	700	1,000
Dry Bulk Cargo	7,350	10,149	13,317	4,726	6,500	8,600
General Cargo	7,706	7,237	12,702	4,955	4,700	8,200
Total	23,093	30,774	45,131	11,238	13,800	20,500

Source: * Tg.Perak & Gresik Port, the shipcalls are including traditional ships

8 COMPARISON OF PORT CANDIDATE SITES

8.1 Comparison Methods and Port Candidate Sites

1) Comparison Method

This chapter aims at comparing several candidates for port development in order to meet the following two tasks:

i) To assign a suitable role to each port site in an integrated long-term metropolitan ports plan.

ii) To select two candidate sites for a deep water container port for further detailed analysis in the latter phase of the Study.

The second task is a transitional task in the Study. A deep water container port project is capital intensive and it will work as a gateway port in the GKS region. Therefore the project will be forged out after scrutinizing various interactive factors in the next phase.

To meet the above tasks, the Study comparatively analyzes the candidate sites based on the following criteria:

i) Conformity with the long-term regional development scenario, wherein likely development impact on the regional economy and regional structure are analyzed;

ii) Inherent natural conditions and man-made obstacles which affect port development such as soil, tide, frontage water, submarine cable, pipeline, sunken vessels, etc.

iii) Possible port development area and size in terms of berth length and depth, port land area and anchorage area to meet a certain suitable segment of the GKS port demand. Construction methods such as reclamation, trestle, etc. are preliminarily examined. Although this work items (possible area and size) must be treated as indicative, they contribute to comparative analysis;

iv) Initial infrastructure construction and necessity of non-revenue generating infrastructure. A possible port layout with necessary supporting facility such as breakwater is discussed at a conceptual level. Although quantitative construction cost is not estimated at this stage, a conceptual plan consisting of basic layout, suitable construction method and the necessity of initial dredging and supporting facility would give important implications to construction difficulty.

v) Periodical maintenance dredging at port water, anchorage area and access channel. Although quantitative periodical dredging volume is not estimated at this stage, its necessity is discussed from past dredging records and relevant studies which are unfortunately limited and insufficient for the Study.

vi) Port development entity and financing method. Existing land ownership largely affects the establishment of an implementation body with a financing plan. Since the government is keen on introducing a PPP approach in port development and management, such possibility is examined.

vii) Addressing regional shipping needs which public ports should meet and where public ports, including existing and planned; are designed to work as an integrated system. A deep water container port deserves the highest priority in the system since it becomes the connection node with overseas markets as well as a conduit for investment in the GKS region;

viii) Development of access roads and other port supporting utilities and facilities. Sufficient land connectivity must be provided. If not at present, necessary development items are identified;

ix) Land availability in direct hinterland. When developing a new regional gateway port, integrated logistics and industrial development at adjoining lands is very much desirable. Such possibility of port-cum-hinterland development is examined; and

x) Due considerations of natural and social environments. Anticipated adverse impact on natural environment and social acceptance are preliminarily assessed. If any problems are anticipated in port construction and operation, necessary mitigation measures are also considered.

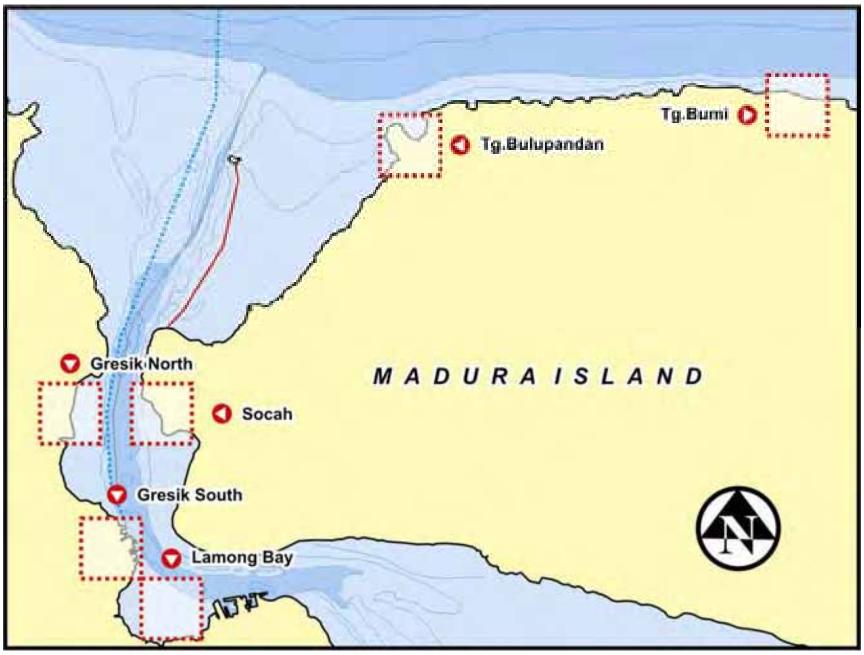
2) Port Site Candidates

At the inception meeting of the Study in November 2006, six (6) port candidates were identified. They are (i) Lamong Bay in Surabaya City, (ii) Gresik South and (iii) Gresik North in Gresik Regency and (iv) Socah, (v) Tanjung Bulupandan and (vi) Tanjung Bumi in Bangkalan Regency.

To undertake comparative analysis in an effective manner, the port candidates are divided into three (3) groups in relation with the West Surabaya Access Channel, i.e., : (i) inner access channel sites including Lamong Bay and Gresik South, (ii) middle-distance access channel sites including Gresik North and Socah, (iii) access channel free sites including Tanjung Bulupandan and Tanjung Bumi. (Refer to Figure 8.1.1)

The three (3) groups share similar conditions of access channel and direct hinterland within a group but quite different from other groups.

Figure 8.1.1 Location of 6 Port Site Candidates



8.2 Inner Access Channel Sites

1) Location and Land Development Situation

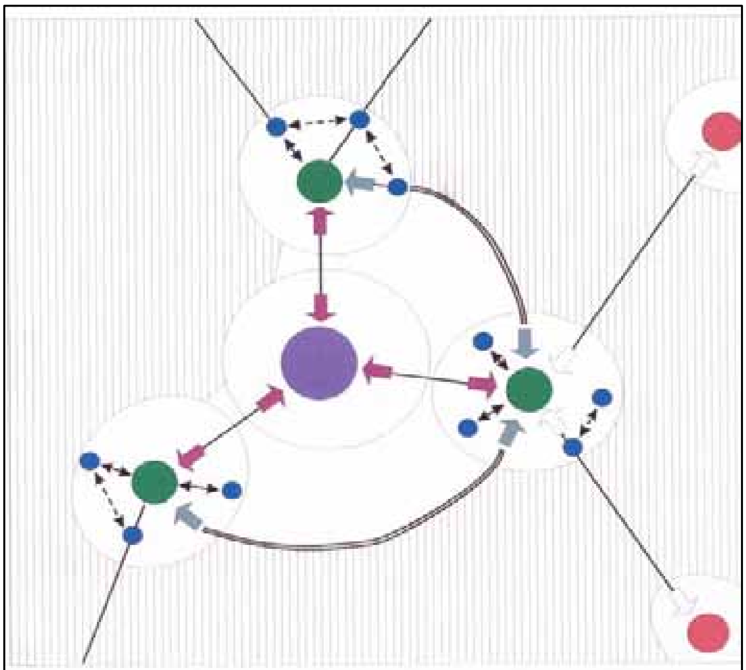
a. Location Assessment from Regional Development Viewpoint

The two port candidate sites of Lamong Bay and Gresik South are lined along the coastline between Tanjung Perak Port and Gresik Port. Because of their location, if they were fully developed as public ports, the structure of GKS would become further monocentric.

Urbanization and industrialization in a monocentric pattern is somewhat natural and very common in many urban economies; however the monocentric structure do have disadvantages such as only sprawl development without spatial arrangement plan. Individual investments in development may prefer a monocentric structure since investors as sprawling development entities can access easily to existing accumulated infrastructure and economy. However individual sprawling activities as a whole may gradually generate economic losses externally and internally and thus degrade the entire socio-economic system by way of traffic congestion, environment degradation, too much speculation, and commodity/service price escalation. In a transition from city economy to metropolitan economy, therefore urban structure transformation must be undertaken from a monocentric pattern to a multi-nucleus structure.

The inner access channel sites would bring about such peculiar monocentric pattern related spatial management issues and thus careful coordination is needed between economy and environment, between industrial development and community development and between freight movement and people movement in order to minimize undesirable economic losses. Even if this case is employed, the GKS region must pursue a multi-nucleus structure without a gateway port project in order to create a new growth pole in the region.

Figure 8.2.1 Concept of Multi-nucleus Regional Structure



Sumber : Gerd Henningings, Bernd Jenssen and Klaus R. Kunzmann "The Promotion of Relief Poles a Strategy for The Deconcentration of Metropolitan Region Dev't in Developing Countries".

b. Port Development Opportunities

The development of Lamong Bay Port has already been authorized by the government with the reclamation of the container yards up to 50 ha. It has a capacity of about 1.0 to 1.2 million TEUs p.a.

The plan has deep sea container berths with a length of 1,280m, three trestles with a length of 260m each, and container yards of 50 ha. There are several technical subjects to be overcome. Taking international hub port construction and its effect on regional development, they have to be dealt with under the clear initiative by the Government of Indonesia, inter alia:

- Confirmation of project viability in terms of port development and its access channel improvement;
- Selection of economic structures and construction method taking due consideration of environmental impact; and
- Introduction of efficient port management and operation methods through a PPP approach.

The Project has been promoted by the government by means of PPP on the occasions of the 2nd Infrastructure Conference (November 2006) and others, and the government considered that the project could have a high possibility that it would be implemented soon. Thus, in this JICA Study, the Project has been treated as a precondition.

In case of South Gresik, the candidate area is the former plywood factory of PT. Nusantara Plywood. The available land area is limited to about 68 ha, including an area of 11 ha owned by PELINDO III. The area is not large enough for a container port, if future demands at 2025 and 2030 are considered. It has another disadvantage in accessibility through the existing two-lane road which runs through the already congested downtown Gresik. In addition, there is an expansion plan of the existing neighboring jetty owned by PT. Sumber Mas Indah Plywood, which was approved by the authorities. Therefore, it is considered that the location of South Gresik has less priority than that of the other candidate sites for the new container port.

c. Land Access Condition

Both sites are accessible to the Surabaya – Gresik toll road and only a port access road is necessary. Since Lamong Bay is close to Tanjung Perak Port, cargo transfer in between does not need to use the toll road, instead it could pass through an ordinary road (Jl. Greges – Jl. Tambaklangon).

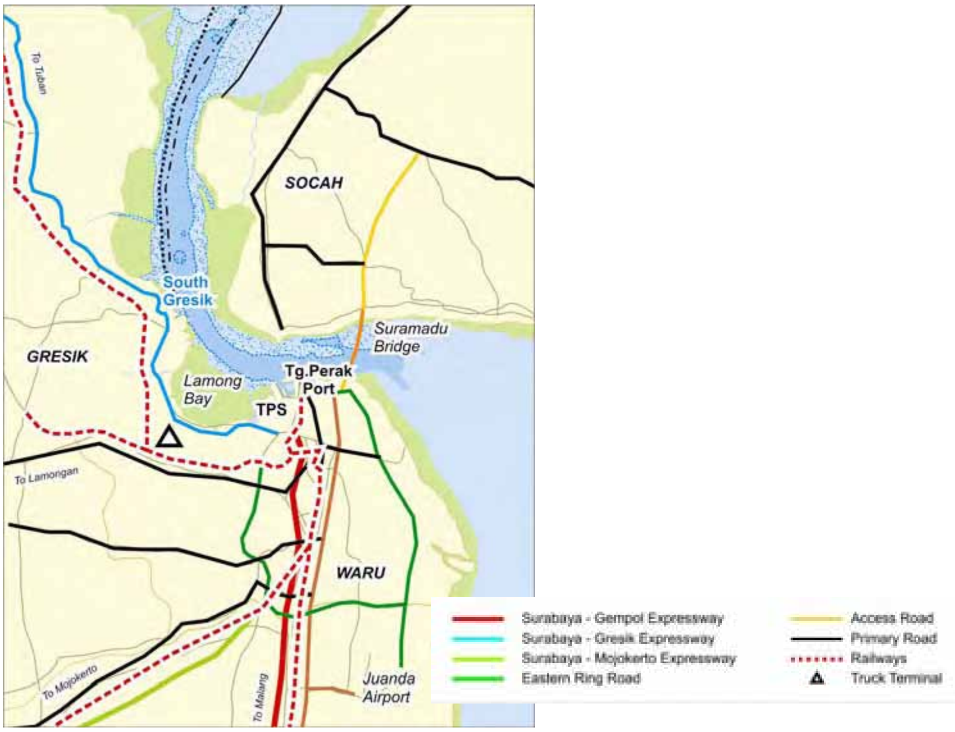
To the Lamong Bay site, land acquisition (5.5 ha or 1.1 km) for the access road has already been acquired by PELINDO III. However, additional land acquisition is necessary to extend the access road to connect with the toll road. This land acquisition will be carried out by Surabaya City.

To the Gresik South site, there is an existing road. But it is too narrow to ensure smooth truck and trailer flow. Although road widening would be necessary to access a public port, unfortunately most of the road side is urbanized and no diversion route is available.

Table 8.2.1 Land Access to Site Candidates in Lamong Bay and Gresik South

Candidate Site	Total Dis.	Tg. Perak - Candidate Site	Connection with Existing / Planned Major Trunk Road and Remarks
Lamong Bay	12km	Tg.Perak – Tambaklangon: 11km	✓ Primary road named Jl. Greges Katianak
		Tambaklangon – Candidate Site : 1 km	✓ New development is needed.
Gresik South	19km	Tg.Perak –Tol Dupak: 6km	
		Tol Dupak –Tol Gresik : 9 km	✓ Surabaya – Gresik Toll Road (4 lanes/2 ways)
		Tol Gresik – Indor : 4 km	✓ Load bearing capacity of access road is quite low.

Figure 8.2.2 Location and Access Condition to the Inner Access Channel Sites



d. Hinterland Development in Lamong Bay

Four kecamatan areas face the bay. In terms of population density, Krembangan is already urbanized while the rest areas have relatively low density profiles. Near the bay, Tandes Industrial Estate (partly operational) and Surabaya Industrial Estate Benowo (planned) are located. Those estate areas will be able to absorb some new industrial investment together with port development.

Because of the proximity to Tanjung Perak, the site can work as an integral part of a port and logistics center. In this sense, the site is convenient for the existing logistics service providers located at the PELINDO III Perak port area.

Table 8.2.2 Population at Lamong Bay's Direct Hinterland

City/Regency	District/sub-district	Area (ha)	Population	Density (per ha)
Surabaya	Krembangan	834	114,506	137.3
	Asemrowo	1,544	36,937	23.9
	Benowo	4,579	67,074	14.6
Gresik	Kebomas	3,006	84,968	28.2

Source: Surabaya/ Gresik in figure 2005/2006

e. Hinterland Development in Gresik South

The site is located in the midst of Kecamatan Gresik which is mostly urbanized. Gresik Regency designates an industrial area of 1,541 ha within Kecamatan Gresik. Since the lands are considerably developed, there is limited capacity to absorb new investment together with new public port development.

Since the land is bankrupted factory land, no land acquisition and land development is required in port development.

Table 8.2.3 Population at Gresik South's Direct Hinterland

Regency	Sub-district	Area (km^2)	Population	Density per ha
Gresik	Gresik	554	87,126	157.3

Source: Gresik in Figure 2005/2006

2) Physical Site Conditions

a. Physical Conditions

The sites of Lamong Bay Port and South Gresik Port are located in the central and northern sides of Lamong Bay, respectively, or the right and the left coasts of the Lamong River. The port facilities at Lamong Bay Port occupies the central portion of the bay, and South Gresik Port occupies the triangular-shaped northern coast. They have the following similar physical conditions:

i) The two sites are located on a muddy swamp outside of the mouth of the Lamong River. The foundation consists of clayey silt, i.e. very soft clayey silt on the surface and hard clayey silt at about 50m deep. Construction of port facilities such as container yards should be done by paying attention to settlement of soft foundation layer and introduction of an appropriate foundation improvement method such as a vertical drain method.

ii) The water depth in the central stream in front of the bay exceeds 20m, providing a sufficient water depth for berthing/unberthing, turning, and navigating. A jetty can be extended into the deep water with a depth of, for instance, 17m.

iii) The current speed exceeds 2 knots during spring tides, which sometimes results in drifting of .anchored ships and maritime accidents.

iv) If the construction of the port affects “the hydraulic cross section” then countermeasures shall be taken into consideration such as introduction of permeable structures.

b. Access Channel Condition

In the both sites of Lamong and South Gresik Ports, determination of the berth depth should be accompanied by a prudent consideration on the possibility and cost of access channel maintenance. Without proper assessment of optimum channel depth and maintenance plan, the port plan itself cannot be justified.

In case that the depth of the quay is, for example, 14m as per Lamong Port plans, the channel depth should be planned to be the same 14m, or at shallower depth by 1.0m to 1.5m in consideration of tidal window (waiting for high tide). In any case, the cost for initial dredging and maintenance dredging against siltation shall be quantitatively evaluated from technical, financial and other aspects.

In the introduction of large container vessels at the Surabaya Channel, one more important issue for the both sites is the hindrance to safe navigation at shallow shoals, which exist in front of the PT. Smelting Jetty. There are three levels of countermeasures as follows:

i) Installation of marker buoys at the shoals by the District of Navigation,

ii) Removal of the shoals by dredging by DGST or PELINDO III, and

iii) Introduction of Vessel Traffic Management System (VTS) by ADPEL.

3) Environmental Considerations

a. Lamong Bay

EIA (ANDAL): The ANDAL study titled “Environmental Impact Analysis for the Development of Tanjung Perak Port in the Direction of Lamong River and Lamong Bay” was prepared and approved on 4 May 2001. The plan included land reclamation of 40ha for a container terminal and 8.6ha for a passenger terminal in the initial development phase until 2005. The Environmental Management /Monitoring Plan (RKL/RPL) was approved on 4 May 2001. However, due to change in scope for the current project development plan, i.e., land reclamation (50 ha) at 1.2km off the coastline, a re-study of the ANDAL report is under preparation. With regards to it contents, the baseline for the following issues were collected and the anticipated impacts were examined;

i) Natural Environment: climate, air quality and noise, geology, topography, soil, hydrology, water quality, biodiversity (benthos, plankton, mangrove, seabirds, corals), land use, etc.

ii) Social Environment: demography, occupation, road and traffic, etc.

Among the above-mentioned data, some are presented below together with some updated baseline data.

Physical Environment: The bay consists of wetland (muddy river delta) and some mangrove sites. The hinterland of the bay is occupied by industrial estates and human settlements. The seawater quality of the Lamong bay is relatively good (surveyed in Nov, 2006). Tidal current is not strong (<2knots), and wave is always calm. The seabed is mainly composed of silt clay and deep soft mud. Sediment content is mainly silt. Other related data include data on hydrology, air quality, noise, seabed material conditions are also presented in the ANDAL Study (2001).

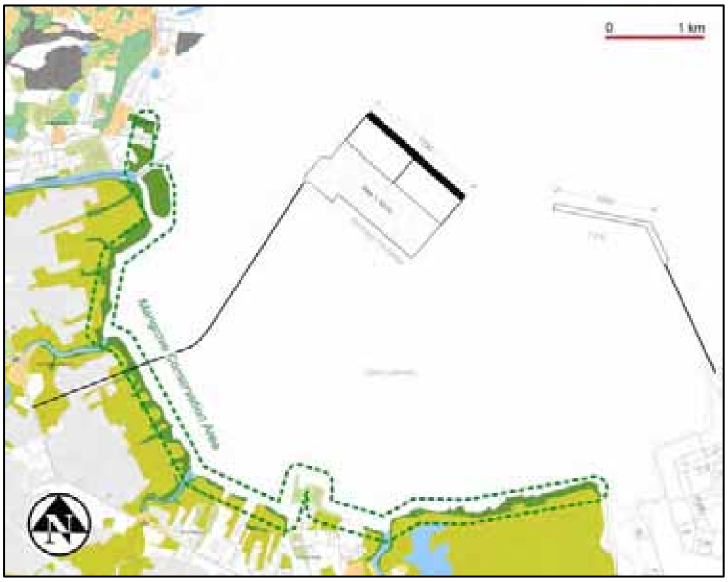
Ecological Resources: Major assessment points are laid on mangroves and water birds as below while other types of biota such as types of benthos, phytoplankton, and terrestrial biota were also identified in the ANDAL study (2001).

i) Mangroves: The bay consists of wetland. Coastline along the Lamong bay and the Galang island (small delta-like island at the mouth of the Lamong river) has been designated as a conservation area by the East Java Province (based on Provincial Master Plan, 2005-2020 (approved under provincial decree No.2)). The province has initiated a mangrove re-greening program with the participation of the local fishermen since 2004. Up until 2006, around 870,000 mangrove trees have been planted along the bay and in Galang Island. Program will further be implemented in year 2007.

ii) Water birds: Mangrove and associated water provide habitat for many inhabitants including water birds. According to the ANDAL study in 2001, in the mouth of Kali Lamong and Kali Sememi, 8 families and 18 species of water birds were identified, of which 9 species are to be protected.

Anticipated Environmental and Social Impacts: Reclamation will be carried out 1.2km off the coastline. Existing waterways are able to flow into the bay, therefore, no large-scale alternation of topographic features are expected to take place in the project. The vegetation including protected mangrove areas along the coastline will be preserved. The fishermen are also able to fish around the bay and be able to make their way through the bay. However some adverse impacts on natural /social environment may occur if not managed properly. Further studies on the environmental and social impact assessment including the natural/social environment through the ANDAL study, as well as RKL/RPL are required under the responsibility of the government to minimize the anticipated adverse impacts.

Figure 8.2.3 Mangrove Conservation Areas (Lamong Bay)



Source: JICA Study Team

b. Gresik South

EIA (ANDAL): The ANDAL study on Gresik commercial port project was prepared and approved on 31 July, 2006. The project consists of two phases, i.e., phase I for development of coal terminal (2.4ha) and phase II for development of bulk goods, log and multipurpose terminal. The environmental management/monitoring plan (RKL/RPL) was prepared along with the ANDAL study and approved together. Although the ANDAL study focuses on the existing public port, it is an environmental report near the site, precisely only 2 km north from the candidate site, and some descriptions and data are worth quoting for the environmental assessment around the site candidate in Gresik South.

Physical and Natural Environment: The area is located at the south of Gresik port, within the industrial estate zones. Several new industrial estates (e.g.. flour, noodle, crude oil etc.) are to be established in the close by area. Tidal current is not strong (<2knots), thus wave is always calm and seabed is mainly composed of silt clay and the land foundation, of deep soft mud. Sediment content is mainly silt.

Water Quality: Seawater quality (surveyed in Feb 2006) at Gresik area (Sukomulyo) does not meet the standard for DO, turbidity, Fenol, Hg, Cd, Cu etc. Other related data such as air quality, noise, seabed material conditions are contained in the ANDAL study.

Ecological Resources: Types of benthos, phytoplankton, zooplankton were identified in the ANDAL study. However no protected or endangered species are to be found in the area.

Other Environmentally Sensitive Issues: Submarine pipelines have been installed offshore between the south of Gresik port and the offshore of west Madura (in operation under KODECO). There is also a power cable line on the upstream. There is a risk that the existing pipeline/cable lines would affect construction /operation of the navigation channel.

Anticipated Environmental and Social Impacts: Since the site candidate is located near from Lamong Bay, 1.5 km from Kali Lamong, large capital investment in port development such as reclamation may bring about a similar apprehensions as in the Lamong Bay project case. From a social impact viewpoint, port development may not cause resettlement within the site since it is an abandoned factory. However, the access road is too narrow to serve for a public port. Taking already densely urbanized surrounding areas into account, i.e., 157 inhabitants per ha, the port would become a nuisance facility during its operation phase. In addition, the land acquisition for access road widening would raise a resettlement issue in the district.

4) Overall Assessment in the Group

The Governor of Java East recommended that Tanjung Perak Port be expanded to Lamong Bay by 50 ha only on 11 October 2005.The Lamong Bay Port Project is treated as a given condition in the JICA Study from its scope of work agreement. According to the schedule, the BOT concessionaire will be determined with a concession agreement in 2007. The port construction will be done during the period 2008 and 2011. Thereafter, the new container port will become operational.

The new site is designed to be constructed with a berth of 1,280 meters long and 14 meters depth. However there is no plan to improve the Surabaya West Access Channel to support the new project.

In regard to the latter, according to the Study’s demand forecast, the expanded Tanjung Perak Port including TPS and Lamong Bay will be able to meet container traffic demand until 2017. Before a new deep seaport commence its operation somewhere else, at least the Lamong Bay port will have to play as a gateway port in the GKS region.

The Study suggests PELINDO III to build or more precisely resume bulk port operation in Gresik South. It seems difficult to use the area of 68 ha as a public container as already stated.

In the metropolitan ports system, the Gresik coastal area between Surabaya City boundary and Maspion Industrial Estate is suggested to become a bulk cargo center with 10 private jetties and publicly-operated port(s) focusing on dry bulk cargoes such as coal.

8.3 Middle-distance Access Channel Sites

1) Location and Land Development Situations

a. Location Assessment from Regional Development Viewpoint

Two candidate sites, Gresik North and Socah are dangled at the middle of the West Surabaya Access Channel and facing each other. Both candidate sites share some similarities in port development such as use of the same access channel, underdeveloped but abundant direct hinterland and poor land transport infrastructure since the northern areas such as north Java coastal (PANTURA) and Madura Island from Surabaya suffers from weak transport infrastructure compared with the areas southwards.

However, port development impact on regional development varies from one to another. If Gresik North were developed, it might promote the northern coastal development in Java from Gresik, Lamongan, Tuban and Bojonegoro. On the other hand, if Socah were developed, it might accelerate Madura Island development which the SURAMADU bridge project is going to promote. Although the two sites do not fall on the designated gateway port site in the provincial spatial plan, i.e., the northern coast of Madura Island, they are expected to generate considerable regional development impact but towards different directions.

Both the sites would require considerable infrastructure development besides the port itself. The most critical infrastructure needed is the access channel. If one of them were developed, many large container ships would pass through the access channel every day, requiring deeper and wider channel space constantly. In the case of Gresik North, the existing toll road should be extended from Manyar to a nearby new junction, and preferably further extending to the northern coastal area in East Java. In the case of Socah, one access road would be branched from the currently under construction access road to Burneh and is required for a shortcut to SURAMADU Bridge. At the Madura side, public utilities such as electricity, piped water, telecommunications are also necessary to prepare the area of gateway port.

b. Port Development Opportunities

The North Gresik and Socah sites have the following similar conditions from the view point of port development:

i) The both sites are located next to the No Anchor Area.

ii) The sites are located at the place where the hydraulic cross section records faster currents due to the narrow width at the Tg. Sawo - Ug. Slempit Line. In order to maintain the present cross section and water depth, the structure of the berthing facility at midstream locations shall be permeable such as pile-type platform.

The site of North Grasik has the following features as a port development site:

i) A gas pipeline is laid in front of the site. The berthing facility shall be located beyond the gas pipeline in the channel. Then, the distance from land is about 3km. Long access trestles or causeways will become necessary. Operation efficiency would be decreased due to long access distance.

ii) The distance from the pipeline to the present channel centerline is about 500m, if the face line of the berthing facility has a bend as shown in Figure 8.3.2. If the face line is a straight-line for a 3,000m long pier, the distance becomes as short as 200m. This short clearance between the berthing ship and passing ship is not manageable for safe ship navigation and berthing/unberthing operations.

iii) There are other types of port facility alignment than (1) the Pile Pier and Trestle-type such as (2) Reclamation plus Trestle-type and (3) Reclamation plus Basin Excavation-type. They are technically unfavorable in consideration of construction cost.

The site of Socah has the following characteristics:

i) The water area of Tg. Bulu and its down stream is relatively wide in the West Channel and hence it is designated as the anchorage for large vessels. The distance from the centerline of the channel to the shore is about 1.5 km at Tg. Bulu. Therefore, there is enough space for berthing/unberthing facilities and operations.

ii) There can be three alternatives to develop the Tg. Bulu area as shown in Figure 8.3.3, i.e. (1) Pier plus Trestle-type, (2) Pier plus Reclamation-type, and (3) Excavation-type. They have advantages and disadvantages. The impact on hydraulic cross section must be duly considered for the case of type (2) and (3).

iii) The technical advantages and disadvantages of the above alternative plans cannot be evaluated at this stage. Further information is needed such as subsoil strength and consolidation characters which can be measured and examined based on soil investigations.

iv) Coastal land area can be used as the port area including container yard, administration and access roads.

c. Land Access

The total road distances from Tanjung Perak to Socah as well as to Gresik South are almost the same, 31-32 km. Gresik North needs the toll extension and an access road of 7-12 km depending on port design. Using the toll road network, those sites are accessible from Tanjung Perak within 30 minutes and thus the inter-port connection does not seem critical between regional gateway ports.

Gresik North needs a toll road extension by 6 km while Socah requires a branch road from the bridge access road, i.e., 13 km in order to avoid traffic congestion on the existing national road.

Figure 8.3.1 Land Access to Site Candidates in Gresik North and Socah

Candidate Site	Total Dis.	Tg. Perak - Candidate Site	Connection with Existing / Planned Major Trunk Road and Remarks
Gresik North	32km	Tg.Perak –Tol Dupak: 6km	
		Tol Dupak – Manyar : 20 km	✓ Surabaya – Gresik Toll Road (4 lanes/2 ways)
		Manyar – Candidate Site : 6 km	✓ New development is needed.
Socah	31km	Tg.Perak – Tambakwedi: 5 km	✓ Planned Eastern Ring Road
		Tambakwedi – Kesek: 10 km	✓ Suramadu Bridge (Under construction)
		Kesek - Labang: 3 km	✓ ROW established and preliminary works has been completed (4 lanes/2 ways).
		Labang – Socah: 10 km	✓ Alignment of road has not been planned and no land acquisition going on (4 lanes/2 ways).
		Socah – Candidate Site: 3 km	✓ New development is needed.

d. Hinterland Development in Gresik North

Manyar's population density is as low as 9.7 persons per hectare. Gresik Regency designates one third of Manyar area, i.e., 3,456 ha, for industrial purpose although most of the existing lands are fishponds and mangroves. In particular the coastal area of 2,000 ha is designated as international seaport-cum-industry development area. Although the lands are all wet lands, possible development area together with port is huge enough.

Table 8.3.2 Population at Gresik North's Direct Hinterland

Regency	Sub-district	Area (km^2)	Population	Density per ha
Gresik	Manyar	9,542	92,352	9.7

Source: Gresik in Figure 2005/2006

e. Hinterland Development in Socah

Socah is sparsely inhabited. The Bangkalan Spatial Plan designates the lands for rural residential, agricultural and fishponds. But, according to Bangkalan Regency, the land can be used for port development and its associated logistics and industrial development in a scale of some thousand hectares.

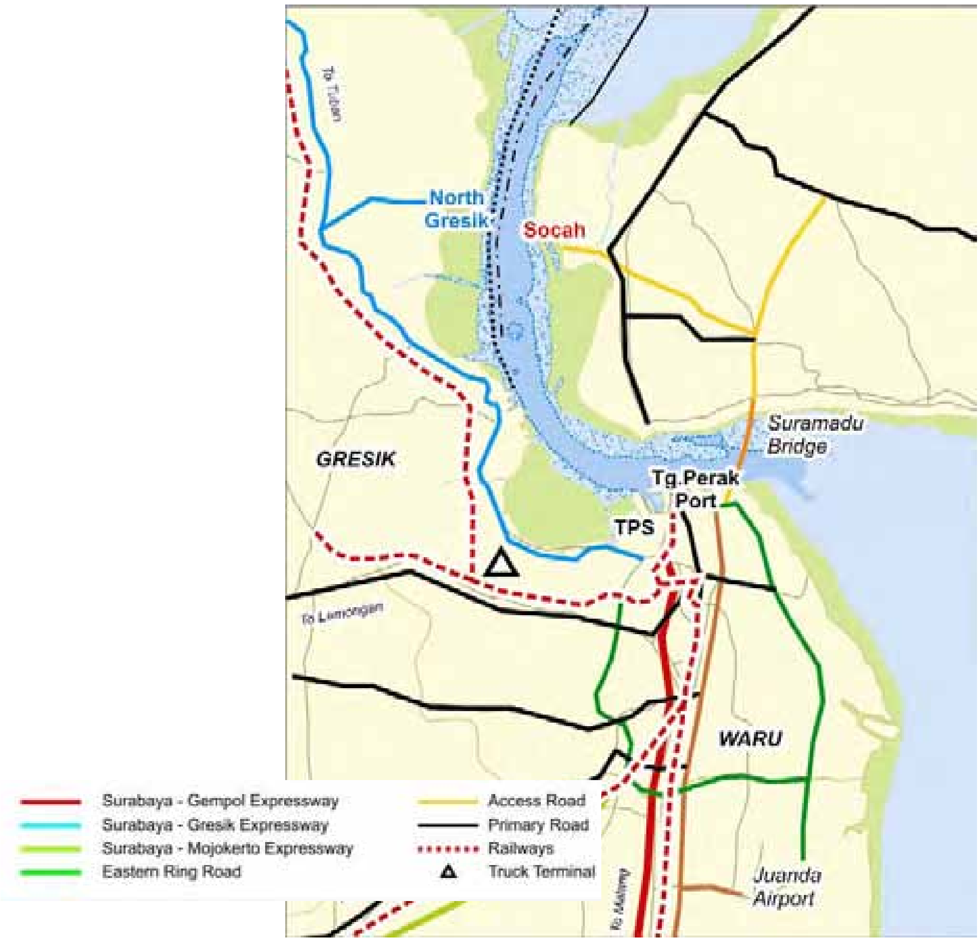
At Tanjung Piring, next to Socah District, one shipyard started its operation since 1994 (PT. Adiluhing Sarana Segara). Since Tanjung Perak is small for shipyards, one manager from PT. Dumas Tanjung Perak Shipyard established the shipyard at Tanjung Piring. Since business is going well, the location shows potential to attract maritime industries such as shipbuilding and repairing. The location provides two advantages such as front waters and the proximity to Tanjung Perak.

Table 8.3.3 Population at Socah's Direct Hinterland

	Area (km2)	Population	No. household	Density per ha
Socah sub-distrcit	53.8	55,493	12,196	10.3
Da'iring village	3.3	2,168	406	6.5
Junganyan village	0.86	2,830	592	33
Pernajuh	5.9	903	184	1.5

Source: Bangkalan in figure (2005/2006), BAPEDA/Bangkalan

Figure 8.3.1 Location and Access Condition to the Middle-distance Access Channel Sites



2) Physical Site Conditions

a. Physical Conditions

The sites of North Gresik and Socah are located on the opposite side of the Access Channel facing each other, and have the following similar physical conditions:

i) The both sites are located near the narrow passage at the Tg. Sawo - Ug. Slempit Line, where current speed is relatively high in the Surabaya Channel.

ii) North Gresik has a vast swampy mud area of about 740ha. The Socah site has narrower shallow mud area. The distance from the existing land to the water depth of 14m is about 2,500m at North Gresik, and 550m to 1,900m at Socah.

iii) The subsoil condition is that, according to Pelindo III's soil investigation, North Gresik site has unfavorably very deep soft clayey silt layer (deeper than 50m). There is no soil boring data at Socah site. Basing from the boring data near the site, there is a possibility for the Socah site to have rather thin very soft surface clayey silt layer and, underneath it, deep medium-hard mud layer. For both sites, settlement of foundation is expected to occur when a surcharge is laid on the soft layer such as reclamation.

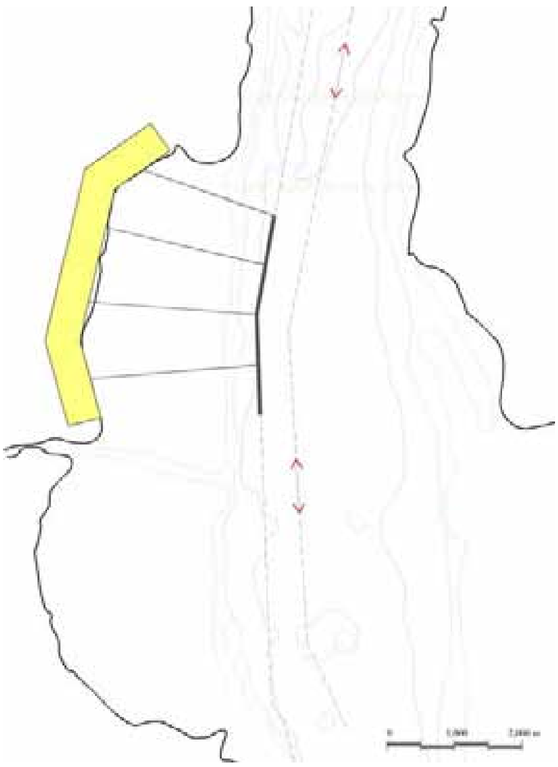
b. Access Channel Condition

In both sites of North Gresik and Socah, improvement and maintenance of the West Access Channel is an indispensable condition for large design vessel. It might be necessary to consider Tidal Window (usage of high tide) in addition to the planned channel depth.

In addition, in the case of Socah (3)-type development, maintenance dredging of the artificially excavated basins will become necessary. Careful discussions and planning shall be made on the effect of increasing the hydraulic cross section due to excavation of the basins.

It can be judged at this stage of the Study that the site of North Gresik is not preferable in consideration of gas pipeline and geological/geographical conditions. The site of Socah can be evaluated after the soil conditions, maintenance possibility of the West Access Channel, effects of increase in the hydraulic cross section, and other issues will be cleared.

Figure 8.3.2 Conceptual Development Plan of North Gresik Site



Source: JICA Study Team

Figure 8.3.3 Conceptual Development Plans of Socah Site

(1) Pier plus Trestle-type (2) Pier plus Reclamation-type (3) Excavation-type

Source: JICA Study Team

3) Environmental Considerations

a. Gresik North

Past Environment Study as Reference: PELINDO III contracted ITS with the Technical and Environmental Study on Channel, Sedimentation and Reclamation along the Madura Strait in 2000 to make a preliminary technical and environmental assessment. Since the study report includes South Mireng (1,100ha) and North Mireng (500ha) as part of the study area, it is considered worth reviewing in this section.

Physical Conditions: Sharing border with the Kali Mireng, the southern part of the river is occupied by several private ports where Maspion port is located at the north end. At the north side, it encompasses a vast wetland along the coastline of Manyar (113 km^2) that continues until the north end of Ujun Pangkah. Most of the wetland is used for fishpond aquaculture, which occupies 42% of the total area of Gresik Regency.

Natural Environment: Tidal current is not strong (<2 knots), thus wave is always calm and seabed is mainly composed of silt clay and the land foundation, of deep soft mud. Sediment content is mainly silt. Sea water quality in the area does not meet standard for DO, turbidity, Fenol, Hg, Cd, Cu etc (similar to that of Gresik South). In the reference report, other related data such as air quality, noise, seabed material conditions are also contained.

Ecological Resources: The north area of Kali Mireng is occupied with wetland and mangrove forests with high density along the coastline. From Manyarejo (north end of the Manyar sub-district) up to Ujung Pangkah has been designated as conservation area by the regency in accordance with the Gresik Spatial plan approved in 2004 which states:

i) Mangroves: 12 families and 24 species of mangroves were found in the area.

ii) Water Birds: 6 families and 12 species of water birds were identified around the mouth of the Kali Mileng.

Social Environment: Fishermen represent the largest population in the area. Manyar has been traditionally famous for brackish water pond culture[1]. Recently technology for the intensification of brackish water pond aquaculture has been adopted in the area. Manyar now accounts for 20% of the brackish water pond production in Gresik Regency. It was reported that in Gresik, the number of fishermen has increased by 3 times in the last 5 years through introduction of these new technologies (by BAPEDAL/GRESIK).

Table 8.3.4 Type of Fishing and Its Production (Manyar and Gresik Regency)

(tons/year)

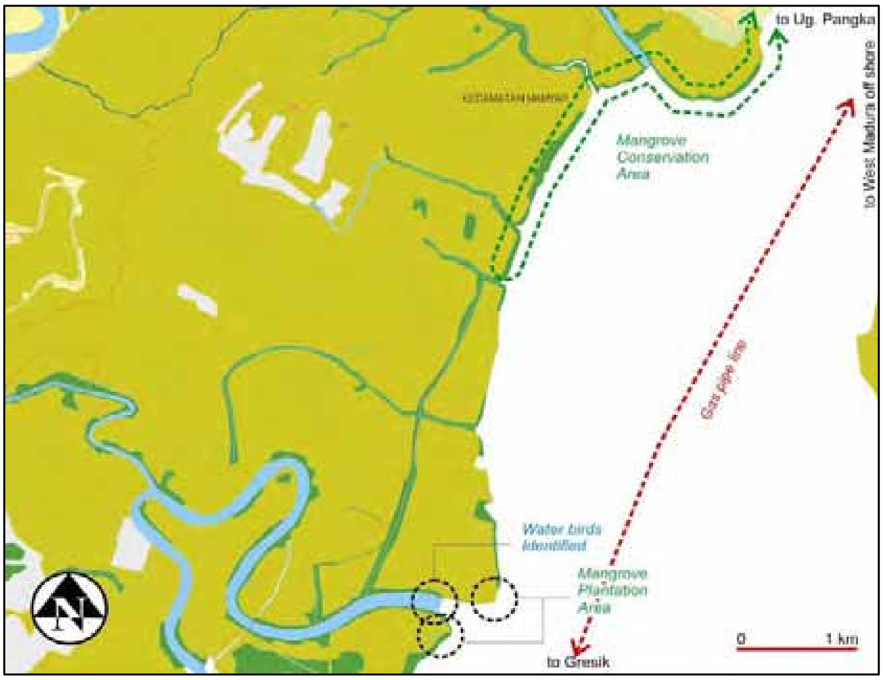
	Sea fishing	Tambak (Sea-water)	Tambak (Freshwater)	Others	Total
Manyar	199	4,510	3,102	42	7,853
Gresik Regency	23,134	22,043	14,079	481	59,738

Source: Gresik in figure (2005/2006)

Other Environmentally Sensitive Issues: Submarine gas pipelines have been installed between the Gresik and the offshore of west Madura (operated by Kodeco). There may be at risk that the construction/operation of the port would be affected by the existing pipeline.

Anticipated Environmental and Social Impacts: The site candidate is mainly occupied by wetland (mainly used for fishpond) and mangroves. The land is located next to the ecologically sensitive area, which has been designated as a conservation area. The impact to these terrestrial and marine ecologies must be taking into account. The most affected people are the fishermen engaged in tambak aquaculture, who could be either positively or negatively affected by the development. Installed pipelines along the coast may be a risk in dredging the navigation channel.

Figure 8.3.4 Ecological Resources and Land and Marine Uses (Gresik North)



Source: JICA Study Team

[1] Brackish water *(tambak)* pond culture can be categorized in two types: sea-water dam (payau dam) and fresh water dam.

b. Socah

Baseline Data Collection: Since there is no concrete port development plan prepared, only the Technical and Environmental Study on Channel, Sedimentation and Reclamation along the Madura Strait in 2000 by PELINDO III with ITS is an available reference report for environmental considerations. The study report includes Ujung Piring/ Sembilangan (500ha), Junganyar Cape (500ha) in Bangkalan Regency. However, few baseline data on those areas were provided for our review. In order to reinforce limited secondary data, a preliminary socio-environmental survey (in form of public consultation) was carried out at Da'iring village with an attendance of the village head and local villagers (including fishermen).

Physical and Natural Environments: The district of Socah has a total area of 53.8km^2. Socah comprises 11 villages, of which four are facing the coastal area. Among the four, Da'iring, Junganyar and Pernajuh fall into the study area. The coastline area is composed of low and wet lands with fishpond. Residential area can be found along the south coastal area of Da'iring and also along the west coastline of Junganyar village. Inland fishpond area can be found across the road (that runs parallel to the coastline) and along the Glodakandung River. The rest of the area is mainly covered with farming land. Natural conditions are characterized as follows:

i) Tidal current is not strong (<2 knots), wave is always calm and seabed is mainly composed of silt clay and deep soft mud. Sediment content is mainly silt.

ii) Although, no secondary data on water quality around the area are available at this moment, due to the recent reduced fish catch in around the sea area, it is indicated that the seawater quality may be deteriorating (due to industrial wastes from Gresik industrial estates).

iii) Data on air quality, noise, seabed material conditions are not available.

Ecological Resources: The coastline facing the Madura Strait is used as a capture area for marine products, such as milkfish, king prawns sea bass, mullet, crabs etc. However, as mentioned above, due to seawater quality degradation in their sea fishing area, fish catch has been reduced over the last 10 years. It can be indicated that marine ecological chain may have altered over the time.

Mangroves are either naturally grown or planted on pond dikes and adjacent tidal flats by the local villagers to stabilize dikes for erosion prevention, and to provide nurseries for commercially important fish. Mangrove reforestation has been promoted both by the local government as well as the village initiative to integrate conservation and mangrove forest management. No protected or endangered species are reported in the area, however, some water birds were identified along the mangrove belt and some of them may include species of protected kinds.

Social Environments: Although no labor distribution data is available on a district base, survey at the Da'iring village has revealed that the farmers represent the largest employment (40%), followed by fisheries (30%) in coastal villages although many of them are engaged both in farming and fisheries. The rest (30%) are mainly migrant workers overseas (other Asian countries, the Middle East countries etc.)

In the local agriculture, main crops cultivated are rice, corn and peanuts. The productivity of each crop is similar to that of regency average rate. However, if compared to that of province (rice: 5.4, corn: 3.6, peanuts: 1.2 (tons/ha)), the productivity is relatively low for all crops. In the village, 70% of the main crops are cultivated for daily consumption, while 30 % are for commercial purposes. Harvest is once a year (due to lack of water).

Table 8.3.5 Main Crops and Production in Socah

	Harvest area (ha)	Production (ton)	Productivity (Kw/Ha)
Rice	2,918	12,652	4.3 (4.5)*
Corn	1,630	3,056	1.9 (1.7)*
Peanuts	1,720	2,064	1.2 (1.0)*

Source: Bangkalan in figure (2005/2006)
* Figures in brackets are average figure of the Regency

Fisheries activities comprise of sea fishing and fishpond aquaculture (*tambak*) in the area. Sea fishing is the largest income generating type of fishing in the area. Most of the fishermen go on day fishing (3-4km offshore). Main fish caught are; milkfish, king prawns, crabs etc.

The average income generated from sea fishing is approx. Rp.40, 000 per trip. Aquaculture (*tambak*) is also practiced, mainly dominated by production of milkfish Harvest is every 6 months and the income generated is 6,500Rp/kg (productivity:150kg/ha[2]). Recently, in replacement of a long–practiced traditional *tambak,* an intensification of the brackish water pond culture has been introduced in some parts of the land fishing area. In addition, simple fish meat processing industries have been set up in demand for processed fish meat for export. Some investment has been made in the village (such a storage house, purchase of fish seeds etc.) for the introduction of this new fishing technology[3].

Table 8.3.6 Type of Fishing and Its Production in Socah

(ton)

	Sea fishing	Fishpond	Others	Total
Socah	1,615	445	-	2,060
Bangklanan Regency	23,088	1,520	38	24,646

Source: Bangkalan in figure (2005/2006)

Other social indicators worth considering are as follows:

i) Drinking water is mostly supplied by well. Usually, at least one healthcare centre is located in each village.

ii) There are schools up to junior high school in villages, and students go to nearby urban center for secondary education.

iii) In Da'iring village, around 60 families (15% of the population) could be categorized as "very poor", who are entitled to subsidies from the government. The average daily expenditure is expected to be around Rp30,000 to 40,000 per family.

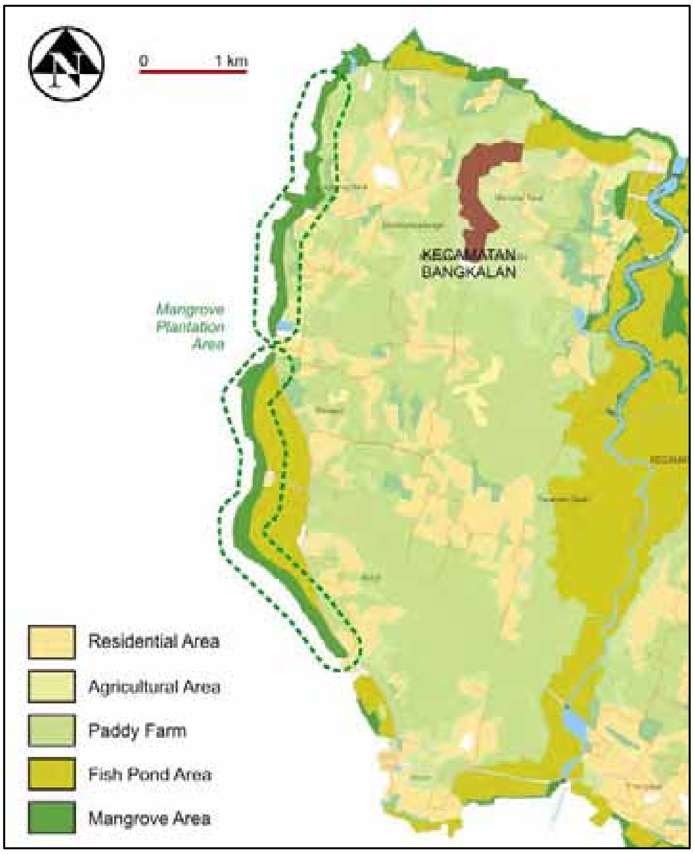
Anticipated Environmental and Social Impacts: There are some residential areas along the coastline (around 300 to 350 households) near the border of Da'iring and Junganyan village. Theses houses will be affected and may require resettlement due to port development. With regards to fisheries activities, sea fishing will be affected because of the disturbance of their fishing grounds during construction period. Some fishponds and mangrove forests along the shoreline will be affected. However, it may also bring an alternative livelihood opportunity for the local villagers who depend on small-scale fisheries.

Perception towards port development was surveyed at the consultation meeting at Da'iring village. In general, the perception towards port development in the area was positive. However, it was also noted that local people's view and opinions should be fully incorporated form the

[2] Average size of fishpond is 2.5ha.
[3] Micro credit institution has been established in the village (fist to be operated in the regency) for industry investment

early stage of project preparation. It was also mentioned that the new job opportunity for the local people should be given as a priority in relation to the project.

Figure 8.3.5 Ecological Resources and Land Use (Socah)



Source: JICA Study Team

4) Overall Assessment in the Group

In conclusion, the Study does not recommend Gresik North to be the site for an international container port. Soft soil conditions and the existing of pipelines are main reasons. From an integrated development purpose, the site must cost investors at additional land reclamation and reinforcement and thus it is not attractive.

Private jetties are acceptable as long as they do not hamper the access channel traffic. In the case of Socah to be an international container port, however, the private jetties from Gresik North would make channel traffic management more difficult. Therefore, the Study does not recommend to access to the West Surabaya Access Channel from both the sides.

Socah has better location conditions. As already noted, the site has several planning issues to be elaborated in the next phase. They are summarized as follows:

i) Port layout and construction method;

ii) Access channel improvement, maintenance dredging and surface traffic management;

iii) Impact of port development on the current tidal flow or selection of less influential construction method;

iv) Soil reinforcement to support heavy infrastructure (if necessary);

v) Social and natural environmental consideration particularly resettlement of the existing fishery communities; and

vi) Land infrastructure development and integrated area development

8.4 Access Channel Free Sites

1) Location Assessment from Regional Development Viewpoint

The two candidate sites, Tanjung Bulupandan and Tanjung Bumi, are located in the northern coast of Madura Island. Only the two of six candidates fulfill the East Java Spatial Plan towards the year 2020. The spatial plan intends to maximize the development impact of SURAMADU Bridge, creating a regional growth pole and reducing economic disparity between Madura and other surrounding areas. The intention to designate the northern coastal area of Bangkalan Regency as a new international port is to make a port touch deep waters directly and not via the West Surabaya Access Channel any more.

Therefore, a new port associated with direct hinterland development at either Tg. Bulupandan or Tg. Bumi can trace the spatial plan exactly. Although an access channel free port is attractive, it does not guarantee economic port development. There is a strong need to select a combination of the most adequate site and the most suitable construction plan and method, and to make integrated efforts in the site and its surroundings to become a regional logistics and industry hub.

In addition, a gateway port development must address overall Madura Island development at least at the western part. The existing road network has been historically developed to meet only marginal rural economy needs. In addition, public utilities such as electricity, piped water, telecommunications are also necessary to prepare the area for gateway port.

The two sites are expected to generate almost the same impact on regional development mentioned above. Tg. Bulupandan is more advantageous due to its proximity to the bridge than Tg. Bumi (by some 20 km).

The offshore gas station of Sepulu closes the opportunity to develop a deep seaport between Tg. Bulupnadan and Tg. Bumi. This is the main reason why the two candidate sites have a considerable distance in between.

a. Port Development Opportunities

The sites of Tg. Bulupandan and Tg. Bumi have the following characteristics with regard to their development opportunities:

i) The most significant advantage of these sites is their locations outside of the Madura Strait, which are free from restrictions related to the Surabaya Access Channel. The most prominent peculiarity of the sites is that they have a potential of developing a deep sea port of around 15m deep.

ii) Possibility of expansion in the future is an important condition for a port. For the two ports, there is a limit of future expansion at the Prohibited Area of the offshore oil field at Sepulu. They have, however, enough space between the site and the borders of the Prohibited Area.

iii) The immediate hinterland shown in the conceptual plans is fish ponds at Tg. Bulpandan and agricultural fields at Bumi. At Tg. Bulupandan, the port area can be secured in the bay and the sea area by reclamation. In the case of Tg. Bumi, the location of the new port shall be outside of the existing town center where houses are densely constructed already. In the both cases, the access road just behind the port area can be secured at the coastal area by reclamation.

iv) Structure and construction works are also similar for both ports. It can be judged, however, that the site of Tg. Bulupandan has a advantage over Tg. Bumi, because the distance from Suramado Bridge is much shorter.

b. Land Access

The on-going SURAMADU Bridge project includes access road up to Burneh with a right-of-way of 40 meters in width. From Burneh, an extension road is necessary to Tanjung Bulupandan. To Tanjung Bumi, there are two choices: using and widening the existing road from Arosbaya or constructing a different alignment road from Burneh.

Table 8.4.1 Land Access to Site Candidates in Tg. Bulupandan and Tg. Bumi

Candidate Site	Total Dis.	Tg. Perak - Candidate Site	Connection with Existing / Planned Major Trunk Road and Remarks
Tg. Bulupandan	39km	Tg.Perak – Tambakwedi: 5 km	✓ Planned Eastern Ring Road
		Tambakwedi – Kesek: 10 km	✓ Suramadu Bridge (Under construction)
		Kesek - Burneh 10 km	✓ ROW established and preliminary works has been completed (4 lanes/2 ways).
		Burneh - Arosbaya: 11 km	✓ Alignment of road has been planned but no land acquisition going on. (4 lanes/2 ways). New development is needed.
		Arosbaya – Candidate Site: 3 km	✓ New development is needed.
Tg. Bumi	63km	Tg.Perak – Tambakwedi: 5 km	✓ Planned Eastern Ring Road
		Tambakwedi – Kesek: 10 km	✓ Suramadu Bridge (Under construction)
		Kesek - Burneh 10 km	✓ ROW established and preliminary works has been completed (4 lanes/2 ways).
		Burneh - Arosbaya: 11 km	✓ Alignment of road has been planned but no land acquisition going on. (4 lanes/2 ways). New development is needed.
		Arosbaya – Tg. Bumi: 27 km	✓ Widening of existing road between Arosbayabarat – Tg. Bumi is needed (4 lanes/2 ways).
		Tg. Bumi – Candidate Site: 1 km	✓ New development is needed.

c. Hinterland Development in Tanjung Bulupandan

The direct hinterland is sparsely inhabited with a population density of less than 10 persons per hectare.

The port development FS report proposes a new town of 1,387 ha with a planned population of 77,000. The new town area is divided into mainly three functions such as logistics area, industry area (heavy and high-tech industries) and residential area. Each function is segregated from others with greenery space.

If this urban development plan is to be realized, around 10,000 local people have to be resettled. The families which request to stay in the same area may be transferred within a new town through land adjustment and re-plotting or other methods. The suitability of this new port town plan should be reviewed from logistics, urban and regional planning and social acceptance viewpoints.

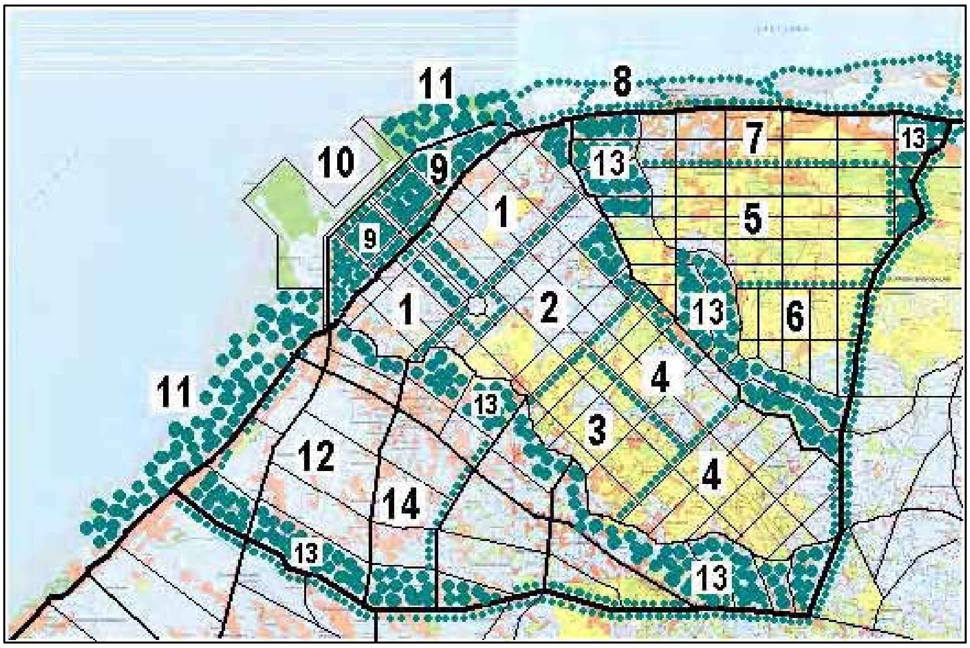
The land is either government or privately owned. Although related cadastral map is not available at present, government land may be used as seed land to coordinate private land owners in an overall direct hinterland development plan. However, part of government lands is managed for national defense purpose and thus land use conversion should be planned under coordination of relevant agencies.

Table 8.4.2 Population and Population Density (Klampis)

	Area (km2)	Population	No. household	Density per ha
Klampis sub-distrcit	67.1	50,416	13,480	7.5
Ko'ol village	1.65	1,877	683	4.1
Tobadung village	1.50	1,367	694	9.1
Mrandung village	2.82	2,010	722	7.1

Source: Bangkalan in figure (2005/2006), BAPPEDA/Bangkalan

Figure 8.4.1 Land Use Plan for New Container Port in Bangkalan and Its Surroundings



Source: FS on New Container Port at Bangkalan Regency (2005, East Java Province - Gadjah Mada University)

d. Hinterland Development in Tanjung Bumi

Compared with Tg. Bulupandan, Tg. Bumi has some accumulated buildings and trading activities particularly along the existing coastal road. Although new port area may not include the road-side settlement, associated hinterland development must affect the area.

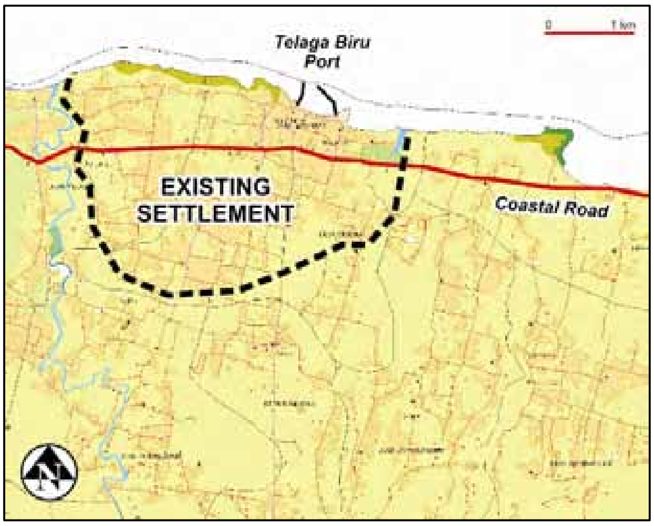
To jointly develop the direct hinterland, all the land right holders should be organized under an area development body where Bangkalan Regency takes an initiative. A bypass road is necessary in parallel with the existing coastal road to diverge through traffic.

Table 8.4.3 Population and Population Density (Tanjung Bumi)

	Area (km2)	Population	No. household	Density per ha
Tanjung Bumi Sub-District	67.49	48,303	11,927	7.1
Telaga Biru village	2.1	4,369	839	20

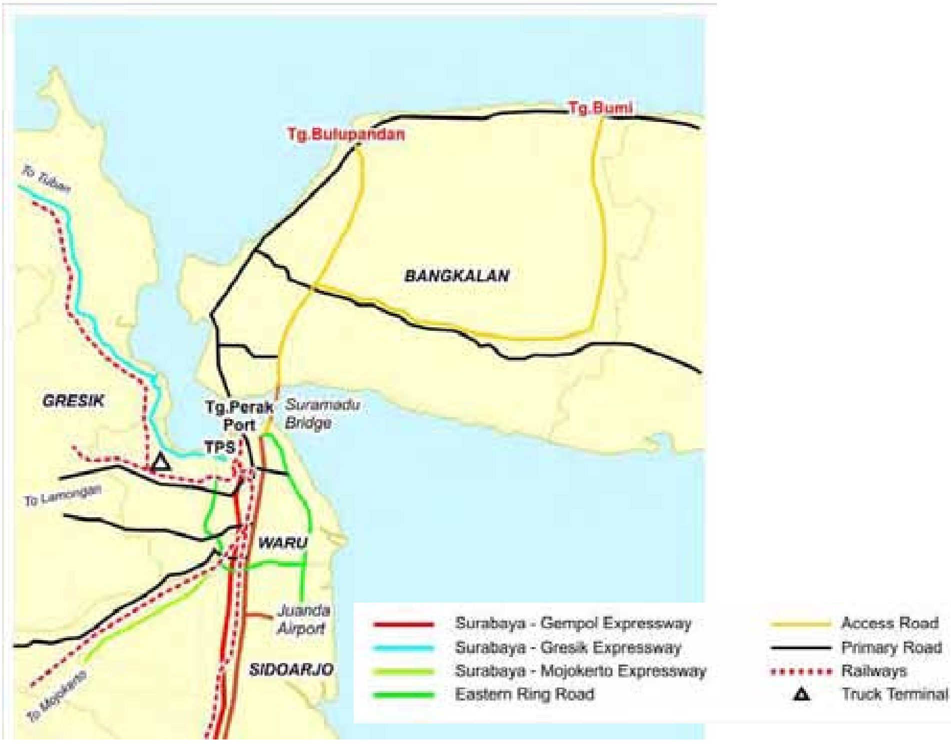
Source: Bangkalan in figure (2005/2006), BAPPEDA/Bangkalan

Figure 8.4.2 Existing Conditions (Tanjung Bumi)



Source: JICA Study Team

Figure 8.4.3 Location and Access Condition to the Access Channel Free Sites



2) Physical Site Conditions

a. Physical Conditions

The sites of Tg. Bulupandan and Tg. Bumi have the following similar physical conditions:

i) The sites are facing the Java Sea, and exposed to severe oceanographic/ coastal conditions, including strong wind and high waves during the west and the east monsoons. Thus, breakwaters are required to shelter the harbor, channel and basins.

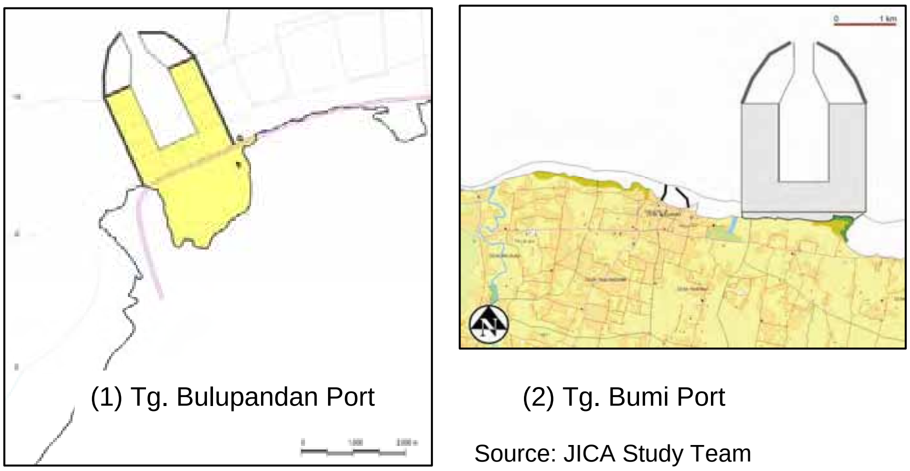
ii) The seabed of the coastline of Madura Island consists originally of coral and hard rock, and, on the surface, sand, silt and coral debris. Littoral drift of the seabed materials causes sedimentation of shallow harbor such as existing Tg. Bumi Port. It is necessary to extend the breakwaters to a deep depth where seabed materials can not move under the action of high waves.

iii) Existence of hard rock layer at a shallow depth imposes a possibility to move the port facilities to offshore-side in order to secure a water depth of, for example, 14m, while avoiding extra expense for dredging of channel and basins.

b. Access Channel Condition

In the both sites of Tg. Bulpandan and Tg. Bumi, a certain degree of sedimentation in the access channel at the mouth of the harbors due to littoral drift is anticipated, and hence, maintenance dredging will be required, although the frequency could be small.

Figure 8.4.4 Conceptual Development Plan of Tg. Bulupandan and Tg. Bumi



(1) Tg. Bulupandan Port

(2) Tg. Bumi Port

Source: JICA Study Team

3) Environmental Considerations

a. Tanjung Bulupandan

Baseline Data Collection methodology: The provincial government contracted the feasibility study on container port development in the northern coast of Bangkalan Regency to Gadjah Mada University in 2005. Although the report is treated at a FA status, no environmental analysis was made except organizing focal group discussions. In addition, the secondary data available on a district basis, in order to obtain further environmental as well as socio-economic condition of the area are limited. Thus, a preliminary socio-environmental survey (in form of public consultation) was carried out at Ko'ol village with an attendance of the village head and local villagers (including fishermen).

Physical Environment: The sub-district of Klampis has a total area of 67.1km^2. Klampis comprises 22 villages, of which 10 are facing the coastal area of the Java sea. Among the ten, Ko'ol, Tobadung and Mrandung fall into the study area. The coastline area is composed of low and wetland with fishpond. Fishponds are also found inland. Farming and residential area occupies rest of the area.

Ecological Resources: Although no detailed information on biodiversity in the area is available at this moment, the Study Team has preliminarily understood the ecological resources from ocular observation and through interviews with the villagers. The coastline facing the Java Sea is a good capture area for marine products, such as milkfish, king prawns sea bass, crabs etc. Mangroves are planted along the fishpond for erosion prevention as well as creating a natural barrier between saline and fresh water environment. They are also used krapu (local fish) to egg in the mud. Although no coral reefs are reported in the site, they were formerly found during the ANDAL study (2001) for Lamong Bay port development at approximately 10km west of Tg. Modung. The Study Team observed some dead corals the field survey along the coast area. Further investigation on inhabitant of coral reefs and other endangered biological species is required to assess the ecological resources.

Social Environments: Although no labor distribution data is available on a district bases, the preliminary survey has revealed that, in Ko'ol village, the farmers represent the largest employment (40%), followed by fisheries (30%) although many of them are engaged both in farming and fisheries. The rest (30%) are migrant workers (of which women accounts for 4%).

Main crops cultivated are rice, corn and peanuts. The productivity of each crop is almost equal to that of average rate of the regency. However, if compared to that of province, e.g., rice: 5.4, corn: 3.6, peanuts:1.2 tons/ha, the productivity is relatively low for all crops. Most of the cultivated crops are for daily consumption. Some commercial crops (such as garlic leaf, tomatoes) are produced yet at small-scale.

Table 8.4.4 Main Crops and Production in Klampis

	Harvest area (ha)	Production (ton)	Productivity (ton/ha)
Rice	1,239	5,551	4.5 (4.5)*
Corn	7,176	12,845	1.8 (1.7)*
Peanuts and long bean	3,153	3,026	1.0 (1.0)*

Source: Bangkalan in figure (2005/2006) * Figures in brackets are average figure of the Regency

Main fisheries activities comprise of sea fishing and fishpond aquaculture (*tambak*) in the area. Although sea fishing is the largest income generating type of fishing in the area, its production is small compared to other study areas (it is 1/4th of that of Socah). Although number of sea fisherman in Klampis is largest in the whole regency, reliance on traditional small-scale fishing is resulting in relatively low productivity. Most of the fishermen go on day fishing (3-4km offshore). As for aquaculture fishing (mostly milkfish, prawns), harvest is every 6month.

Table 8.4.5 Type of Fishing and Its Production (Klampis)

(ton)	Sea fishing	Fishpond	Others	Total
Klampis Sub-District	3,694	141	-	3,841
Bangklanan Regency	23,088	1,520	38	24,646

Source: Bangkalan in figure (2005/2006)

Some other social indicators are as follows:

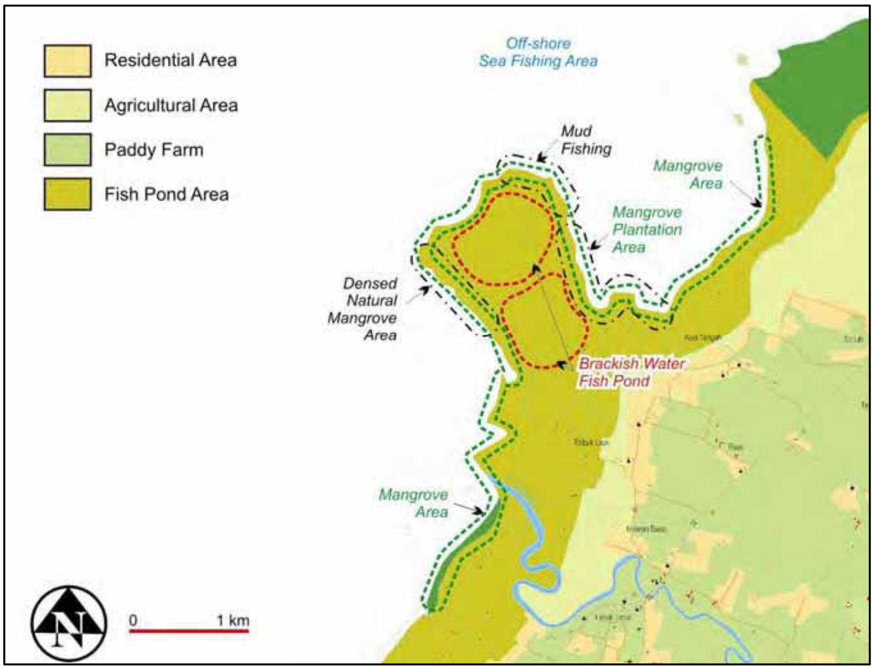
i) Drinking water is mostly supplied by well. Usually, at least one healthcare centre is located in each village. There are schools up to junior high school in the village.

ii) In Ko'ol village, around 120 families (around 20 % of the population) are categorized as "very poor", who are entitled to subsidies from the government.

Anticipated Environmental Impacts: Both sea fisherman and land fisherman will be affected because their fishing ground will be deprived of due to reclamation of the bay. Mangrove plantation area will also be affected.

However, as long as the result of the consultation meeting, the villagers have positive perception towards the port development on the condition that their livelihood would be improved, and that they would be provided with new jobs opportunities and skills.

Figure 8.4.5 Ecological Resources and Land Use (Tg. Bulupandan)



Source: JICA Study Team

b. Tanjung Bumi

Baseline Data Collection Methodology: No past environment report is available while secondary data available on a district basis is limited. In order to obtain environmental as well as socio-economic condition of the area, a preliminary socio-environmental survey (in form of public consultation) was carried out at Telaga Biru village with an attendance of the village head and local villagers (including fishermen). The report descriptions below are based on afore-mentioned information.

Physical Environment: The sub-district of Tanjung Bumi has a total area of 67.49km^2. Tanjung Bumi comprises 14 villages, of which 4 are facing the coastal area of the Java sea. Among the four, Telaga Biru village falls into the site for one of port candidates. The Tanjung Bumi port area consists of old commercial area and a small port for traditional shipping and fishery together with mainly residential area. The adjoining area along the coast is composed of fishponds.

Ecological Resources: Since the port area is mainly composed of residential and commercial area, no endangered or protected species were identified through field observation. Villages next to Telaga Biru comprises fishpond and mangrove plantation, which are typical sites for coastal landscape in the area.

Social Environments: Although no labor distribution data is available on a district base, based on the survey at Telaga Biru Village, inter-inland trading represents the largest group (40%), followed by fisheries (20%) and batik-handy craft (mostly women) (10%). The rest (10%) are migrant workers. Most of the income is generated through trading livestock (cattle, goats etc.), log between inter-islands. No major agriculture activities are carried out in the village.

Main fisheries activities mainly comprise deep-sea fishing and fishpond aquaculture (tambak). As already mentioned, deep-sea fishing is the dominant fisheries in the area, where Tanjung Bumi has the largest production among all sub-districts (it accounts for nearly 30% of the fish production in the regency). Fishermen (with 5 to 7 crews on a boat) go as far as 30 to 40 km off shore towards north of East Java as well as east of Madura island. Main fish caught are: Tuna, squid, prawns, small shrimp (for making terasi) etc. Average income generated from deep-sea fishing is around Rp 1million to 3million per trip (around Rp 120,000 day/person).Production level by type of fishing is presented in the below table.

Table 8.4.6 Type of Fishing and Its Production (Tanjung Bumi)

(ton)

	Sea fishing	Fishpond	Others	Total
Tanjung Bumi	3,232	50	5	3,287
Bangkalan Regency	23,088	1,520	38	24,646

Source: Bangkalan in figure (2005/2006)

Other remarkable social indicators are introduced as follows:

i) Drinking water is mainly supplied by well. Usually, at least one healthcare centre is located in each village. There are schools up to junior high school in the village.

ii) In Telaga Biru village, around 100 families (around 13 % of the population) are categorized as “poor”, who are entitled to subsidies from the government.

Other Environmentally Sensitive Issues: A natural gass station is located off shore of Sepulu (next to Tanjung Bumi sub-district). The gas station is now in operation under PT. Kodeco. There is a risk that the offshore platform will be exposed to shipping traffic along the new channel, which might be involved in a powered collision. Location of gas pipelines as well as offshore gas station should be accurately identified and carefully considered for the development of this area.

Anticipated Environmental and Social Impacts: At the consultation meeting at Telaga Biru village, the perception towards port development in the area is positive. It is noted that since the villagers have long co-existed with the port activities through trading, they have no anti-feeling towards new port development. However, a development plan should be prepared incorporating development benefits of the local economy including provision of job opportunities which are strongly desired.

The present port area is composed of residential and small commercial areas, where resettlement will be required in case of port development. The port land area itself belongs to DGST.

Since most of the fishermen are engaged in deep-sea fishing, fisheries activities are not anticipated to be severely affected if their passages to the fishing grounds are not disturbed. However, some small scale-sea fishermen and land fishermen may be affected due to development.

As mentioned above, the existing gas station poses a high risk against port operation particularly ship access to the port and thus it should be carefully counted in port planning.

4) Overall Assessment in the Group

Among the two candidates, the Study Team recommends Tanjung Bulupandan to be further studied as a deep water container port. The superiority of Tanjung Bulupandan to Tanjung Bumi includes its shorter distance from SURAMADU Bridge, calm surface water, sparse inhabitants and having some distance to the existing road.

As already stated, a further study must investigate potentials and constraints of Tanjung Bulupoandan more specifically. During the study so far, some issues have been raised and thus those will be further analyzed:

i) Vary shallow water within Ko'ol Bay and sedimentation pace;

ii) Underground soil conditions since the FS report (2005) found the existence of hard rock layer;

iii) Necessity of breakwater and port access channel and its periodical maintenance;

iv) Social and natural environmental consideration particularly resettlement of the existing fishery communities; and

v) Land infrastructure development and integrated area development where the use of scattered government lands including army property must be strategic.

On the other hand, Tanjung Bumi is a historical trading town but the existing Telaga Biru Port suffers from broken breakwater and sedimentation inside the port area. It is suggested that the port be improved as a local trading port such as shipping out live animals.

8.5 Results of Comparative Analysis

1) Summary of the Results

The Study selected six candidate places at the inception stage, i.e. Lamong Bay, South Gresik, North Gresik on Java Island and Socah, Tg. Bulupandan and Tg. Bumi on Madura Island. This chapter has analyzed those six sites from various port development and operation viewpoints. They are broadly divided into development planning views, engineering views, and environment impact point of view.

a. Development Planning Views

Shipping demand will increase at a constant pace. The Study's projection shows that future metropolitan ports will have to meet an aggregated seaborne traffic of 115 million tons in 2030 compared with the current traffic of 45 million tons which are handled at two public ports, i.e., Tanjung Perak and Gresik in 2006. By package type, sharp increase in container cargo and moderate increase in bulk and general cargo are projected.

The existing two ports will improve their performance by additional investment and operational improvement as PELINDO III plans. Even so, new ports will be needed and the committed project – Lamong Bay Port, is not sufficient to meet the demand in 2030. Since port and area development are interactive, the Study employs an approach in discussing new port development in a metropolitan growth management scope.

The long-term regional development directs a multi-nucleus regional structure according to the East Java Spatial Plan. A gateway port project can provide an opportunity to stimulate regional development and create a growth pole area. In this sense, the access channel free sites are located exactly on an appropriately designated area on the provincial spatial plan. The middle-distance access channel sites are also expected to generate considerable regional development impact in association with vast underdeveloped hinterland. But due to its hinterland underdeveloped nature, substantial infrastructure and public utilities investment is required besides port, particularly Madura Island.

Each port has different inherent conditions and thus the most suitable port construction and management method varies one from others. The government decided to develop the Lamong Bay project through PPP. It is so far the best way to develop a public container port particularly to receive international shipping lines. Since PELINDO III owns part of the Gresik South site, there are choices that the site will be operated as a private-owned bulk port or a public bulk port.

The sites of Gresik North, Socah, Tanjung Bulupandan and Tanjung Bumi enable integrated port and hinterland development. There may be scattered land titles among farmers and fishermen at other four sites but local conditions are slightly different. At Tanjung Bulupandan, the area was once public land and thus still many public land titles are registered including army's land. Tanjung Bumi is a small trading town and population density is a little bit higher than the other three. In any cases, local government's initiative must be addressed to combine scattered land right holders for a port and adjoining area development project. Otherwise, private investors may not show interest.

Furthermore, each site has different ecological resources and environment sensitive factors. Adequate mitigation measures against environment degradation must be taken. Since Lamong Bay and Gresik South are located in the midst of urbanized areas, more careful environmental management is required. Those two areas are reclamation land and bankrupted factory land, massive resettlement will not happen. But, in any case of other four sites, as a combined project area expands, an implementing body has to deal with more families to be resettled. Judging from consultation meetings with local residents and interviews with local government officers, social acceptance to port development is commonly high with the expectation of job opportunity issues.

b. Engineering Views

The characteristics of these sites are compared in Table 8.5.1 from the technical point of view.

The former sites located along the Madura Strait have similar natural conditions. They are located at swampy muddy delta, where the foundation has deep soft soils. It is necessary to construct long trestles/causeways to reach a deep water such as 14m contour. They have to use the Surabaya West Access Channel which shall involve maintenance dredging.

The remaining two, Tg. Bulupandan and Tg. Bumi, are on the north coast of Madura Island. The foundation is sandy/silty materials. There is hard rock layer at shallow depth in some places, which can hinder dredging work. It is necessary to construct breakwater to protect the basin against waves generated in the Java Sea during the west and east monsoons.

Natural conditions are compared for these candidate places from technical point of view in Table 8.5.2.The four places in the Madura Strait have considerably high tidal current, low wave, soft seabed, and experience siltation. In Tg. Bulupandan and Tg. Bumi, current is low, wave is high, bed material is sandy, and has littoral drift at near-shore water.

Hence, the characteristics and natural conditions of these two areas are quite different from technical point of view and it is premature to judge and conclude which is the best location at this stage, when additional site surveys and analyses are yet to be conducted.

Within the three location groups, the inner access channel sites of Lamong Bay and Gresik South share many similarities. On the other hand, the middle-distance access channel sites of Gresik North and Socah show different conditions at coastal geology, available front water space and underwater obstacles. As results, Gresik North is not preferable to develop a busy public port. The access channel free sites of Tg. Bulupandan and Tg. Bumi show similar conditions except for habitation and vegetation.

Table 8.5.1 Major Technical Characteristics of Candidate Sites of New Port

Comparison Items	Java Island				Madura Island	
	Inner Access Channel Sites		Middle-distance Access Channel Sites		Access Channel Free Sites	
	Lamong Bay	South Gresik	North Gresik	Socah	Tg. Bulupandan	Tg. Bumi
Location	Lamong Bay In the Modula St.		Miring Bay In Modula St.	Tg. Bali in Madura Str.	Bulupandan Bay facing the Java Sea	Tg. Bumi facing the Java Sea
Coastal Geology	Muddy river delta of the Lamong Riv.		Muddy river delta of the Miring Riv.	Muddy delta in the Madura St.	Sandy/silty coral beach	
Coastal land Utilization	Fish/Salt ponds and fishing activities					Town
Underwater Obstacles	None	Power cable line on the upstream	Oil/Gas pipeline along the shore	Old mines shall be checked	Shallow bed rock shall be confirmed	
Restricted/ Prohibited Area	None			None	Madura Oil Terminal to the East	Madura Oil Terminal to the West
Required Facilities	Long trestles/ Causeways				Breakwater	
Required Maintenance	Maintenance dredging of West Channel				Maintenance dredging of Approach Channel	
Port Dev Plan	Available	None			Available	None

Source: JICA Study Team

Table 8.5.2 Natural Conditions among Candidate Sites of New Port

Comparison Items	Java Island				Madura Island	
	Inner Access Channel Sites		Middle-distance Access Channel Sites		Access Channel Free Sites	
	Lamong Bay	South Gresik	North Gresik	Socah	Tg. Bulupandan	Tg. Bumi
Rainfall	Tropical monsoon (Annual rainfall = 1,390 mm / year)				Tropical monsoon	
Wind	East and west monsoons				E and W monsoons>25 kt	
Tide	Semi-diurnal (MHHW=2m)				Diurnal (MHHW<1.4m)	
Tidal Current	Maximum 2 knots				Not strong (< 2 knots)	
Wave	Always relatively calm				High in Dec. to Apr.> 6m.	
Sea Bed	Silty clay				Silty sand	
Foundation	Deep soft mud				Shallow rock or coral	
Sedimentation	Siltation				Sand drift at near-shore	
Vegetation	Mangrove				Poor	

Source: JICA Study Team

a. Environmental Impact Point of Views

Because of its different socio-environmental characteristics that each site posses, the scale and boundaries of possible impacts are also anticipated to be different from one another. Although more in-depth studies and analysis may be required in assessing some of the impacts, possible environmental and social impacts analysis compared among theses sites are listed in the below table.

Physical Environment: Since Lamong bay and Gresik South are located in the midst of urbanized area, waste water/air pollution is an increasing problem. Since Gresik North is located on the north of Gresik industrial area, it shares a similar pollution problem. Port development and hinterland industrial development is anticipated to induce further adverse impacts. On the other hand, three sites located in Madura, because of their mostly rural and underdeveloped geo-economical features, the impacts caused may not be of a significant-scale.

Land Use: No significant change in land use pattern is anticipated in Lamong bay and Gresik South, where available land for port development area is limited. For Gresik North, since most of the possible required land area is comprised of fishpond and wetland area, a change in land use is anticipated to take place to a certain extent. On the other hand, on the Madura side, where its land use pattern is agro-fishery based, the change in land use is anticipated to be quite significant.

Biological Environment: Lamong bay and Gresik South, because of their urbanized characteristics, special environmental protection efforts have been made to protect certain mangrove area along the coastline. Some ecological sensitive areas in Gresik North have been designated as conservation areas. On the Madura side, the three sites along the coastlines, most notably Tg Bulupandan where the bay is fringed with diversity of mangroves, are blessed with naturally grown fauna/flora. Ecological impacts are anticipated to be significant as a development consequence.

Social Environment: Resettlement impacts on Lamong Bay and Gresik South may not be significant, because land preparation is done by mostly reclamation for the former and conversion of old factory for the latter. However, a lack of sufficient land area and the densely populated surroundings would become a critical problem for land acquisition and resettlement in considering access road and possible industrial development. No-large scale resettlement shall take place in Gresik North because most of the affected lands are wetlands and fishponds. In Socah, several alternative designs have been considered and the impacts are yet to be studied, however, if densely populated residential area along the coastline will be subject to land acquisition, its adverse impacts may be significant and extensive. Tg. Bulupandan is anticipated to have minimum adverse resettlement impacts, since the area required is mostly fishponds and farming land. On the other hand, Tg. Bumi may encounter larger-scale resettlement impacts because of a number of settlements facing the existing port area.

Although the economic/labor structure is not expected to alter greatly in the urbanized area, the impacts on the local economy in Madura side would induce two-side impacts, i.e. the new employment opportunities on one hand and possible loss of current livelihood and income generating activities on the other.

Safety: Pipelines built/to be built on the bottom of the strait that is /will be extended on to the off shore Madura island possess a high risk of maritime accidents. The impacts induced will be significant and extensive.

Table. 8.5.3 Presumed Environmental and Social Impacts of the Candidate Sites

Comparison Items	Java Island				Madura Island	
	Inner Access Channel Sites		Middle-distance Access Sites		Access Channel Free Sites	
	Lamong Bay	Gresik South	Gresik North	Socah	Tg. Bulupandan	Tg. Bumi
Physical Environment/Pollution	A	A	B	C	C	C
Land Use	C	C	B	A	A	A
Biological Environment	A	C	A	A	A	B
Social Environment						
Resettlement	B	B	B	B	B	A
Economic activities/Labor	C	C	B	A	A	A
Maritime Safety Issues	A	A	A	A	A	B

Source: JICA Study Team

Note: A- Significant environmental and social impact is expected

B- Environmental and social impact is expected to some extent

C: environmental and social impact is minimum

D: Environmental and social impact is less significant

U: Environmental impact Unknown

2) Conclusions for Metropolitan Ports Development Strategy

In conclusion, the results of candidate analysis indicate the following to the metropolitan port development strategy:

i) In addition to the existing ports, Lamong Bay Container Port will commence its operation around 2012 with access channel improvement. Even with incremental capacity of Lamong Bay, the metropolitan ports system will not meet all container traffic demand in 2017 and the capacity shortage will grow up to 60,000 TEU in 2020. Therefore, by 2020, a new deep water container port will be opened at either Socah or Tanjung Bulupandan in Madura Island. To concretize this scenario and finally choose one port site, further detailed site assessment with port development planning will be done at the two sites in the later study stage.

ii) Although Tanjung Perak and Gresik expand their bulk handling capability, capacity shortage will occur to some degree. Such capacity-demand gap will be offset by new public or private bulk ports at the Gresik side. Gresik South, a bankruptcy factory site, is good for a bulk port. There is a possibility to use Gresik North to meet this port demand segment in line with hinterland industrial development on condition that necessary coordination is done with submarine pipelines and access channel’s traffic management.

iii) Lastly, Telaga Biru Port at Tanjung Bumi will be improved to enhance local trading.

Figure 8.5.1 Role Sharing of Metropolitan Ports System