

PECEM INDUSTRIAL AND PORT COMPLEX DEVELOPMENT PLAN IN THE FEDERATIVE REPUBLIC OF BRAZIL



**FINAL
REPORT**

SUMMARY

MARCH 2006

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

BRAZILIAN COOPERATION AGENCY (ABC), MINISTRY OF EXTERNAL RELATION

SEPLAN - PLANNING AND COORDINATION SECRETARIAT OF STATE OF CEARA (CEARÁPORTOS)

SDE – STATE SECRETARIAT OF ECONOMIC DEVELOPMENT (CIPP/GTP)

SEINFRA - INFRASTRUCTURE SECRETARIAT OF STATE OF CEARA

FINAL REPORT

FOR

THE STUDY

ON

PECEM INDUSTRIAL AND PORT COMPLEX DEVELOPMENT PLAN

IN

THE FEDERAL REPUBLIC OF BRAZIL

SUMMARY

MARCH 2006

INTERNATIONAL DEVELOPMENT SYSTEM Inc. (IDS)

NIPPON KOEI Co., Ltd. (NK)

PREFACE

In response to a request from the Government of the Federative Republic of Brazil, the Government of Japan decided to conduct a study on Pecem Industrial and Port Complex Development Plan and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Kobune of International Development System Inc. and consists of International Development System Inc. and Nippon Koei Co., LTD. between February, 2005 and March, 2006.

The team held discussions with the officials concerned of the Government of the Federative Republic of Brazil 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 Federative Republic of Brazil for their close cooperation extended to the study.

March 2006

KAZUHISA MATSUOKA,
Deputy Vice President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

March 2006

Mr. Kazuhisa MATSUOKA
Deputy Vice President
Japan International Cooperation Agency

Dear Mr. MATSUOKA,

It is my great pleasure to submit herewith the Final Report of “Pecem Industrial and Port Complex Development Plan in the Federative Republic of Brazil”.

The Study Team comprised of International Development System Inc. and Nippon Koei Co., Ltd. conducted studies in the Federative Republic of Brazil over the period between February 2005 and March 2006 according to the contract with the Japan International Cooperation Agency (JICA).

The Study Team compiled this report, which proposes the long-term development plan to the target year 2022, the short-term development plan to the target year 2012 and the strategic port management and operation plan for Pecem Port, through close consultations with officials of the Federal Government, Ceara State Government and other authorities concerned.

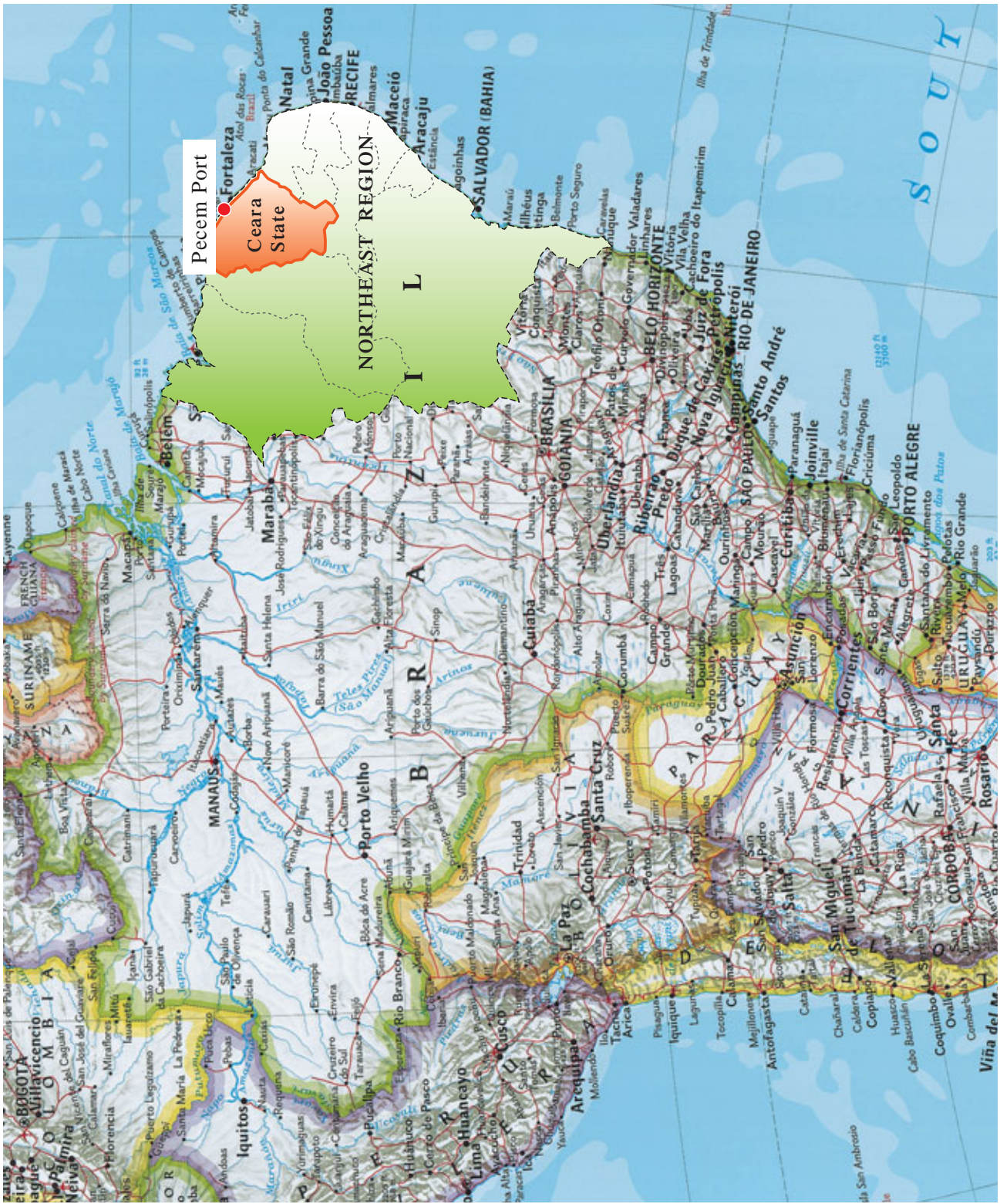
On behalf of the Study Team, I would like to express my sincere appreciation to the Federal Government, Ceara State Government and other authorities concerned for their cooperation, assistance, and heartfelt hospitality extended to the Study Team.

We are also very grateful to the Japan International Cooperation Agency, the Ministry of Foreign Affairs, the Ministry of Land, Infrastructure and Transport, and Embassy of Japan in the Federative Republic of Brazil for valuable suggestions and assistance during the course of the Study.

Yours faithfully,



Koji KOBUNE,
Team Leader
Pecem Industrial and Port Complex Development Plan
in the Federative Republic of Brazil



Location Map of the Study Port



Pecem Port and its Surroundings

Abbreviation

AAE	Strategic Environment Evaluation
ABC	Brazil Cooperation Agency
ABRATEC	Brazil Association of Public use Container Terminal
AL	Alagoas
AM	Amazonas
ANTAQ	National Agency of Waterway Transport
ANTT	National Terrestrial Transport Agency
AP	Amapá
ASEAN	Association of Southeast Asian Nations
ASSFAP	Pecem's Families Association
Av.	Average
B/C	Benefit/Cost
b/d	barrels/day
B/water	Breakwater
BA	Bahia
BACTSSA	buenos aires container terminal services S.A.
BEC	State Bank of Ceara
BNB	Bank of Northeast of Brazil
BNDES	National Bank of Development
BOI	Board of Investment
BR-xxx	Designation of Brazilian federal highway
C.Y.	Container Yard
C/S	Central/South
c1	Type of Petroleum Chemical Product
c2+	Type of Petroleum Chemical Product
C3	Type of Petroleum Chemical Product
C4	Crude Gasoline
C5+	Type of Petroleum Chemical Product
CAGECE	Water and Sewer System Company of Ceara
Cap	Capita
CCT	Colon Container Terminal
CE	Ceará
CE xxx	Ceara State highway
CEDIN	State Industrial Development Board
CEGAS	Ceara Gas Company
CFN	Companhia Ferroviária do Nordeste
CFS	Container Freight Station
CFSL	Conversion Factor for Skilled Labor
CFUL	Conversion Factor for Unskilled Labor
CGTF	Thermoelectric generated energy Plant of Fortaleza
CHESF	Hydroelectric Company of São Francisco River
CIF	Cargo, Insurance and Freight
CIPP	Pecem Industrial Port Complex
CIS	Commonwealth of Independent States
CMA CGM	Compagnie Maritime d'Affrètement & Compagnie Générale Maritime
CNT	National Transport Confederation
COELCE	Ceara Electric Company
COEMA	State Environment Council

COGERH	Hydrologic Resources General Company
CONAMA	National Environment Council
CRAS	Reference Center for Social Assistance
CSX-WT	CSX World terminals
CTO	Ceara Terminal Operator
CVM	Valores Formuladatur's Commission
CVRD	Companhia Vale do Rio Doce
CVT	Technological Training Center
DECON	Consumer Rights Department
deg	Degree
DERT	State Highway Department
DHN	Bureau of Hydrogeology and Navigation
DNER	National Transport Infrastructure Department
DNIT	National Transport Infrastructure Department
DRI	Direct Reduced Iron
DWT	Dead Weight Tonnage
E	East
EAS	Simplified Environmental Study
EDI	Electronic Data Interchange
EIA	Environmental Impact Study
EIRR	Economic Intern Return Rate
EMBRAPA	Brazilian Livestock and Agriculture Company
ENE	East-North-East
EPZ	Environment Protection Zone
ES	Espirito Santo
ESE	East-South-East
EVA	Environmental Viability Study
F/D	Floating Dock
FAO	Food and Agriculture Organization
FDI	Industrial Development Fund
FIEC	Federation of the Industries of Ceara State
Fig.	Figure
FINOR	Fund of Investment of Northeast Region
FIRR	Financial Intern Return Rate
FMR	Fortaleza Metropolitan Region
FOB	Free On Board
FUNCEME	Ceara State Foundation of Meteorology and Hydrologic Resources
GASFOR	Gas Pipeline
GDP	Gross Domestic Production
Gis	Geographic Information System
GL	Ground Level
GM	Metacenter to the Center of Gravity
GRT	Gross Registered Tonnage
GTP	Participative Group of Work
GW	Gigawatt
GWT	Gross Weight Tonnage
H	Height
H/Hi	Wave height at point of interest over incident Wave height ratio
há	Hectare
HHWL	Highest High Water Level

HP	Horsepower
Hs	Wave Height
HWL	High Water Level
Hz	Hertz
IALA	International Association of Lighthouse Authorities
IBAMA	Brazilian Institute of Environment and Renewable Natural Resources
IBGE	Brazilian Institute of Geography and Statistics
ICMS	Brazilian Excise Tax
ICTSI	International Container Terminal Services Inc.
IDACE	Institute of Rural Development of Ceara
IDB	Inter-American Development Bank
IDM	Municipality Development Index
IDS	International Development System
IEE	Initial Environment Evaluation
IMO	International Maritime Organization
INEMET	National Institute of Meteorology
INPH	National Institute of hydrologic Research
IPECE	Institute of Economic Research of Ceara State
IR	Infrared
ISPS	International Ship and Port Facility Security
J2	Jota Dois
JICA	Japan International Cooperation Agency
Kd	Stability Coefficient
Kg	Kilogram
KN	KiloNewton
kV	kilovolt
KWh	Kilowatt/hour
Kxx	Radius of Gyration
Lat	Latitude
LI	License of Installation
LLDPE	Linear Low Density Polyethylene
LLWL	Lowest Low Water Level
LNG	Liquefied Natural Gas
LO	License of Operation
LOA	Length Over All
Long	Longitude
LP	Previous License
LPG	Liquefied Petroleum Gas
LS	Lump sum
LT	Lifting Tonnage
LWL	Low Water Level
m	Meter
m/s	meter/second
m ³	Cubic meter
MA	Maranhão
Max	Maximum
MDF	Medium Density Fiber
MG	Minas Gerais
MHWN	Mean Higher High Water Neap
MHWS	Mean Higher High Water Spring

MISC	Miscellaneous
MIT	Puerto manzanillo International Terminal
MLWN	Mean Lower Low Water Neap
MLWS	Mean Lower Low Water Springs
mm/ye	millimeter/year
MMA	Ministry of Environment
MMBTU	Million British Thermal Units
MOL	Mitsui O.S.K. Lines, Ltd
MS	Mato Grosso do Sul
MSL	Mean Sea Level
MT	Mato Grosso
MTC	Manzanillo International Container terminal
MTI	Ministry of Trade and Industry
MW	Megawatt
N	Newton
N/A	Not available
NAVIS	Navy Automated Video Information System
NE	North-East
NGO	Non-Governmental Organization
NK	Nippon Koei
NNE	North-North-East
NNW	North-North-West
NPV	Net Present Value
Nqgc	Number of Quay side Gantry Crane
Nr	Number
Nrtg	Number of Rubber Tyred Gantry Crane
Ns	Stability Number
NUTEC	Industrial Technology Center
NVOCC	Non-Vessel Operating Common Carrier
NW	North-West
O&M	Operations & Maintenance
OOCL	Orient Overseas Container Line
P&O	Peninsular & Oriental (shipping company)
PA	Pará
PAIF	National Plan for Family Assistance
PB	Parnaíba
PCA	Environmental Control Plan
PDR	Rational deforestation Plan
PE	Pernambuco
PET	Polyethylene Terephthalate
PI	Piauí
PIANC	Permanent International Association of Navigation Congresses
PMF	Forest Management Plan
PP	Polypropylene
PPA	Pluriannual Plan
Pqgs	Productivity of Quay side Gantry crane
PR	Paraná
PRAD	Plan of Recovery of Degraded Areas
PROARES	Social Reforms Support for Children and Adolescent Development Program
PROVIN	Industrial Development Incentive Program

Prtg	Productivity of Rubber-Tyred Gantry crane
PS&D	Production, Supply & Distribution
PU	Polyurethane
PVC	Polyvinyl Chloride
QSGC	Quay Side Gantry Crane
R\$	Brazilian Real
RAA	Environmental Consulting Report
RAS	Simplified Environmental Report
RCA	Environmental Control and Monitoring Report
Re	Brazilian Real
Rec	Recession
REFAP	Refinery Alberto Pasqualini
RIMA	Environmental Impact Report
RJ	Rio de Janeiro
RLAM	Refinery Landulpho Alves/Mataripe
RMF	Metropolitan Region of Fortaleza
RMG	Rail-Mounted Gantry crane
RN	Rio Grande do Norte
RO	Roráima
RO/RO	Roll on/Roll off
RPBC	Refinery President Bernades/Cubatão
RS	Rio Grande do Sul
RTG	Rubber-Tyred Gantry crane
S	South
S.B.R.	Styrene Butadiene Rubber
Samp	Sample
SBF	Secretariat of Forest and Biological Diversity
SC	Santa Catarina
SCA	Secretariat of Amazon Coordination
SCF	Standard Conversion Factor
SDE	Secretariat of Economic Development
SE	Sergipe
SE	South-East
SEBRAE	Brazilian Support Service for micro and small companies
SECULT	Secretariat of Culture
SEINFRA	Secretariat of Infrastructure
SEMACE	Secretariat of environment of Ceara
SENAC	National Service of trade training
SEPLAN	Secretariat of Planning and coordination
SESC	Trade Social Service
SINE	National employment System
SOMA	State Secretariat General of Environment
SP	São Paulo
sq.m	Square Meter
SQA	Quality in the Human Settlement
SRH	Secretariat of Water Resources
SSA	Stevedore Service of America
SSE	South-South-East
SSW	South-South-West
SUDENE	Superintendency of Development of Northeast Region

SW	South-West
TECON	Container Company S.A. (Terminal de Contêineres S.A.)
TEP	Temporary jetty
TEU	Twenty-foot equivalent unit
TOR	Terms of reference
Tp	Wave Period
TP&E	Tarcísio Pinheiros & Economistas
TPA	Third Party Administrator
Troll	Natural Period of Rolling of the Waves
TWH	Terawatt/hour
Tz	Mean Wave Period
U	Wind speed
U.S.A.	United States of America
UFC	Federal University of Ceara
ULCV	Ultra Large Container Vessel
US	United States (of America)
US\$	US Dollar
USBC	United States Border Control
USC	Ceara Steel Factory
USDA	United States Department of Agriculture
UVA	University of Vale do Acaraú
V	Volt
VAT	Value Added Tax
Vb	Lump Sum
Vel	Velocity
VSL	Vessel
VTMS	Vessel Traffic Management Services
WNW	West-North-West
WSW	West-South-West
YB	Year Book
ZPMC	Shanghai Zhenhua Port Machinery Co., Ltd.

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EXECUTIVE SUMMARY

1. Background

The development project of the Pecem Port and Industrial Complex (hereinafter referred to as “CIPP”) is in progress on the northeast coast facing the Atlantic Ocean at a distance of around 60 km from Fortaleza, the Capital of Ceara. The project aims mainly to expand job and income opportunities, and to mitigate interregional and inter personal inequalities existing in the comparatively underdeveloped Northeast Region in Brazil. The project is also evaluated highly by the State Government of Ceara in terms of infrastructure projects. In the industrial zone of CIPP adjacent to Pecem Port, a steel mill, a petroleum refinery, petrochemical plants and thermoelectric power plants have been identified as the key industries to attract according to the land use plan which has allocated an industrial site of around 8,000 ha. Among the key projects, the steel mill and thermoelectric power plants have already taken shape.

On the other hand, Mucuripe Port in Fortaleza, which has been the principal commercial port in Ceara, has constraints on water depths and space for the expansion of the port land, and hence it will be difficult for the port to meet increasing demand for handling cargo to and from its hinterland. In this regard, Pecem Port is expected to shoulder an important role as a commercial port by substituting a part of the functions of Mucuripe Port, especially in container-handling through setting up a container terminal. Since the opening of Pecem Port in November of 2001, regular container services for Europe and North America have started, and the number of containers through the port has been sharply increased. In addition, Pecem Port is also expected to be an embarkation port for agricultural products such as soybeans. Under such circumstances, there is a fear that the capacity of Pecem Port would not meet the increasing cargo traffic demand.

Taking into consideration the ambiguity of the strategic development plan for the whole CIPP over the coming years and the fact that a long-term development plan is lacking, it is quite vital and urgent to elaborate a long-term development plan to sustain the competitive power with the cooperation with Mucuripe Port over the competing ports in the Northeast Region.

Under this circumstance, the Government of the Federative Republic of Brazil (hereinafter referred to as “GOB”) requested the Government of Japan (hereinafter referred to as “GOJ”) to conduct a study on “Pecem Industrial and Port Complex Development Plan” (hereinafter referred to as “the Study”). Upon the request, GOJ sent a preparatory study team through Japan International Cooperation Agency (hereinafter referred to as “JICA”) to conduct a preliminary study and the arrangement of the scope of the study (hereinafter referred to as “the Scope of Works”) in August, 2004. Both Brazilian and Japanese sides agreed the Scope of Works and based on the scope this study was conducted from February, 2005 to March, 2006. The results of the study were incorporated in this report.

2. Objectives of the Study

The objectives of the Study are:

- i) to formulate the long-term development plan for Pecem Port (target year 2022),
- ii) to formulate the short-term development plan (target year 2012),

iii) to formulate a strategic port management and operation plan.

3. Outline of the Study

3.1 Long-Term and Short-Term Development Plans of Pecem Port

The projected cargo volumes, facility plans and construction costs of the port development plans are outlined in the table below

Items of the Plans		1st Phase Project (Short-Term Plan)	2nd Phase Project	Completion (Long-Term Plan)
1	Project period	Up to 2012	2013 - 2022	Up to 2022
2	Projected cargo volume in the final year			
	Conventional cargo '000 tons	5,734	27,487	27,487
	Containers '000TEUs	447	784	784
3	Facility components			
3.1	Access channel			
	width	210 m	210 m	210 m
	water depth	16.5 m	16.5 m	16.5 m
3.2	Basins			
	water depth	16 m	16 m	16 m
3.3	Breakwaters			
	length	2,710 m	970 m	3,680 m
3.4	Revetment			
	length	270 m	804 m	1,070 m
3.5	Container terminal			
	berth length	540 m	360 m	900 m
	water depth	16 m	16 m	16 m
	terminal area	14.6 ha	9.5 ha	24.3ha
	container cranes	2 units	4 units	6 units
3.6	Multi-purpose terminal (Pier 3)			
	berth length	520 m		520 m
	water depth	16 m		16 m
	terminal area	4.2 ha		4.2 ha
	sheds	7.500 sq.m	7.500 sq.m	15,000 sq.m
3.7	Fruits terminal (Pier 3)			
	berth length	160 m		160 m
	water depth	16 m		16 m
	terminal area	1.3 ha		1.3 ha
	sheds	5.500 sq.m		5.500 sq.m
3.8	Grain/fertilizer terminals			
	berth length		320 m	160 m
	water depth		16 m	16 m
	ship loaders/unloaders		2 units	2 units
	silos (grains)		230,000 tons	230,000 tons
	warehouse (fertilizer)		76,000 tons	76,000 tons
3.9	New access bridge			
	length		1,510 m	1,510 m
3.10	New gates			
	In and out gates	2 units		2 units
4	Construction costs			
	million BR	616	819	1,435

3.2 Management, Operations and Institutional Matters

The following measures to improve port management, operations and institutional matters have been proposed:

- Adequate sharing of the roles between the Federal/State Governments and CEARAPORTOS to contribute to both the national and regional interests
- Establishment of a Port Council with a membership including port users and the knowledgeable members
- Strengthening of the functions of CEARAPORTOS by setting up divisions specialized for port planning and marketing.
- Support in attracting industries to CIPP including preferential port services for investors at CIPP
- Fund raising for the port development from both the public and private sectors based on the adequate and reasonable demarcation between those sectors
- Improvement of operation systems including safety operations at the container terminal, equipment maintenance system and oil pollution prevention system and introduction of one-stop-service-window system

4. Environmental and Social Considerations

4.1 IEE for Long-Term Development Plan

Both positive and negative impacts were predicted with the long-term development plan, though the negative impacts would only be slight if adequate mitigation measures are adopted.

A negative impact could occur from shoreline change. However, it would be mitigated with the application of some measures. On the other hand, positive impacts were predicted, especially from economic activities. In comparison to the without-the-project alternative, social conditions would be improved.

4.2 EIA Level Examination for Short-Term Development Plan

IBAMA should require the project proponent to undertake an environmental impact assessment (EIA) for the proposed port extension as part of their short-term development plan. In order to assist the project proponent, the JICA Study Team carried out detailed examinations of items containing shoreline, marine water quality and life quality among the environmental and social impact items that were thought to be important.

It was predicted that the shoreline would accumulate around the tip of Pecem and retreat from the west side of the tip to Pecem village. Therefore, a sand bypass was recommended and planned. The retreat will not occur with this measure applied. It was predicted that the operation of the facilities would not deteriorate the marine water quality. Regarding the quality of life, an increase in job opportunities and acceleration of tourism were predicted. The above three items were not considered to have a significant impact.

5. Appraisal of the Short-Term Plan

5.1 Economic Appraisal

A comparison between the “Without-the-project” case and the “With-the-project” case has been carried out to evaluate the economic feasibility of the port development project composed of the construction of breakwaters, the terminals of containers, multi-purpose and fruits proposed in the Short-Term Plan from the viewpoint of the national economy of Brazil. The main economic benefits of the project are (1) saving in container land transportation costs, (2) saving in container transshipment costs and (3) saving in sea transportation costs. The resulting economic internal rate of return (EIRR) for the above mentioned project is 22.5% which exceeds the general criterion to assess the economic feasibility.

5.2 Financial Appraisal

The financial revenues are generated from the existing port dues and charges set up by referring to the tariff level of the neighbouring ports. The resulting financial rates of return (FIRR) for the Short-Term project is 11.4% which exceeds the weighed average interest rate (8%) of assumed fund raising and hence the project has been considered to be financially viable.

6. Proposed Measures for Project Implementation

The following matters need to be considered in the implementation of the said project so as to ensure smooth implementation:

- Adequate linkage between the off-shore port facilities and the land port facilities connected by the access bridge, based on the coordination with port users or among port users, so as to make the most of their potential capacities
- Reasonable demarcation of investment in railway yard between CFN and SEINFRA (CEARA PORTOS) through the coordination between them,
- Adequate coordination with the construction works of the steel mill in CIPP,
- Settlement of potentially generated conflicts of interests between the current or newly participating port users due to the emergence of the new off-shore port facilities,
- Attraction of Private Investment in the Project according to PPP (Public and Private Partner ship) principle,
- Minimization of the potential negative social impact on the residential areas in the vicinity of the project site through the collaborative works with the Municipality

ORGANIZATION OF THE STUDY TEAM

The study team is composed of the following specialists. The name and responsibilities are listed below.

<u>Name</u>	<u>Responsibilities</u>
Koji Kobune	Team Leader (IDS)
Shinnchiro Tanimoto	Environmental and Social Considerations (NK)
Yugo Otsuki	Port Planning (IDS)
Shinich Tezuka	Management/Operations (IDS)
Susumu Onaka	Natural Conditions/Port Facility Design
Tomoo Amano	Demand Forecast (IDS)
Mitsuo Sato	Industrial Development (IDS)
Kunimasa Nishigaya	Economic and Financial Analyses (IDS)
Yokogawa Masahiro	Construction Planning /Cost Estimate (NK)
Shuichi Tsuda	Shipping Trend Analysis/ Transport Planning (IDS)
Carlos Kimura	Interpretation (IDS)
Nobuhide Miyawaki	Coordination (IDS)

CONCLUSIONS

1. Necessity of the Development of Pecem Port

1. Since the opening of Pecem Port in November of 2001, the volume of cargo passing through the Port has been increasing year by year, reaching 1.1 million tons (399 ship calls) in 2005 a 14% increase (54% increase in ship calls) over the preceding year.
2. Although it is not long since the opening of the Port, the hinterland of the Port already extends from Ceara State to the neighbouring states in the Northeast Region of Brazil and beyond. Thus, the Port is contributing to economic activities in its hinterland as a principal port in the Northeast Region.
3. The main port cargoes through the Port are agricultural and industrial products and the recent brisk enlargement of their production levels in fruits farmlands or industrial areas including Maracanau is said to be triggered by the opening of the Port as a deep-sea port with the provision of efficient cargo-handling services.
4. Currently all the cargoes excluding steel products through the Port are being transported by containers and a container service network linking mainline, feeder and cabotage services is gradually being formed involving Pecem Port to meet ever increasing container traffic through the Port.
5. In addition to the above-mentioned current cargoes, grains, mainly soybeans produced in Cerrado agricultural region, are considered to be a promising potential cargo to be shipped from the Port in the future.
6. Thus, to meet the ever increasing demand for handling various cargoes containing containers, break-bulk, dry bulk and liquid bulk cargoes originating or being destined from its hinterland extending to the Northeast Region and beyond as well as CIPP in the future, it is necessary to develop Pecem Port through the provision of required port facilities as well as the provision of efficient and economical cargo-handling services based on an adequate management and operation system.

(1) Handling of Containers

7. Pecem Port is functioning as a principal container port in the Northeast Region as well as Suape Port in Pernambuco State and Salvador Port in Bahia State, in which main line services are provided to West/North Europe, North America, East Asia, South America, etc. The volume of exported container cargo far exceeds that of imports and the main export item is fresh fruits. Exports from the Port have great advantages deriving from shorter access to Europe and North America as the major markets. In 2005, Pecem Port was ranked as the first among Brazilian ports in fruits export in both volume and value. The opening of Pecem Port has resulted in increased production at fruit farmlands in its hinterland and has led to the recent sharp increase in the volume of containers through the Port, a 24% increase in 2004 (83,000 TEUs) and a 25% increase in 2005 (105,000 TEUs) from the respective preceding years.
8. The largest industrial area in and around Fortaleza Metropolitan Area is Maracanau followed by Caucaia and they have good access to Pecem Port (around 60 km and 20 km respectively). By taking advantage of the location closer to Pecem Port, the manufacturers in those industrial areas have been accelerating their exports such as textile-related products, footwear, etc. as well as the imports of intermediate materials since the opening of the Port. In addition to the enlargement of the production level in

the existing factories, the number of setting up of new factories in those industrial areas has recently been increasing.

9. To cope with brisk container traffic through Pecem Port, currently large container vessels of Post-Panamax type (so-called “L-Class” type) with a laden capacity of 5.500 TEUs are calling at the Port to provide regular container services.
10. In addition to the so-called “main line services” for overseas trade, cabotage services for providing coastal shipping services was started at the Port in September, 2005, and the volume of container traffic has been increasing month by month since then. Having a linkage with cabotage services, transshipment services have already begun. Furthermore, container transit services by railways connecting Itaquí Port in Maranhao State are in operation at present.
11. Thus, Pecem Port is presently functioning as a regional hub port in the Northeast Region. The Port has, however, no full-scale container terminal equipped with quayside container gantry cranes and with container stacking yard just behind a berth. To meet the increasing demand for handling containers at the Port in the foreseeable future, it is necessary to prepare a full-scale container terminal.

(2) Handling of Conventional General Cargoes

12. On the other hand, Pecem Port, composed of CIPP together with the industrial area behind the Port was originally designed and constructed to attract key heavy industries such as steel mill, petroleum refinery, petrochemical plants and thermoelectric power plant. Among the key industries, the construction of the steel mill is scheduled to be started on March, 2006 and to be completed in mid 2008. The production and subsequent shipment from the Port of its products, viz. thick slabs, is said to start with the amount of 1.5 million tons in mid 2009. This means that Pier 1 currently used for various cargoes including steel coils, billets and containers needs to be surrendered for handling thick slabs from the steel mill at CIPP in mid 2009, and consequently, substitutional berths are urgently required. Furthermore, even steel products from CIPP are likely to be overflowed from Pier 1 in the stage of full-swing operation of the steel mill because Berth No.2 of Pier 1 is narrow and lack of sufficient stacking places and manoeuvring space for forklift trucks on dockside, which is needed to ensure swift and economical cargo-handling on dockside.
13. Thus, it is necessary to prepare a multi-purpose terminal with sufficient space just behind berths to receive the conventional general cargoes (break-bulk cargoes) to be overflowed from Pier 1.

(3) Handling of Fresh Fruits

14. Fresh fruits including mango, melon, banana and papaya are one of the most promising port cargoes exported from Pecem Port. Although fresh fruits are currently solely transported in reefer containers, there is a tendency for mega-exporters to prefer a reefer ship rather than a reefer container when the volume of exports reaches some level.
15. Thus, it is essential to prepare a fruits terminal equipped with a cold storage just behind a berth so as to attract more fresh fruits to be shipped from the Port.

(4) Handling of Grains (Soybeans)

16. Brazil is the second largest exporter in the world market and is increasing its share year by year. Within Brazil, the share of the northeast region in soybean production recently showed a sharp increase as a result of accelerated exploitation in the Cerrado region extending in the south of Piauí, Maranhão, in the west of Bahia and in the east of Tocantins which has a great production potential as an agricultural frontier.
17. The soybeans to be produced in the above-mentioned Cerrado region are planned to be exported from the principal ports in the northeast region, viz. Itaquí, Pecém, Suape and Ilheus by sharing with each other. Pecém is planned to be connected to Eliseu Martins in Piauí State by the new railway line with broad-gauge by CFN.
18. Thus, it is necessary to prepare a dedicated grain terminal equipped with ship-loaders connected to silos through belt conveyors with a sufficient loading capacity to ensure a quick turnaround times. Receiving facilities from railway sidings are also required.

(5) Handling of Fertilizers

19. In the back haul on the new railway line from the Port to the Cerrado region, fertilizers to be used for grain production are considered to be potential cargoes to be handled at the port. To handle such fertilizers it is necessary to prepare a fertilizer terminal. The same berth will be also used for grain handling.

2. Long-Term Development Plan (Target Year: 2022)**(1) Handling of Containers**

20. In the target year of the Long-Term Development Plan, 2022, 784,000 TEUs of containers is planned to be handled at Pecém Port. To handle the planned volume of containers, it has been proposed to establish a full-scale off-shore container terminal with a length of 900 m and a water depth of 16 m, which can accommodate container vessels of post-Panamax type with a laden capacity of over 9,000 TEUs. In addition, it has been planned to construct a dedicated railway container terminal so as to achieve swift handling of transit containers by railways.

(2) Handling of Conventional General Cargoes

21. In the year 2022, the volume of conventional general cargoes that will need to be received at the Port has been estimated at 3.9 million tons. To meet the increasing demand for handling conventional general cargoes and to receive the cargoes that will overflow from Pier No.1, it has been proposed to construct a new multi-purpose terminal with a length of 520 m and a water depth of 16 m and sheds just behind the berth.

(3) Handling of Fresh Fruits

22. In the year 2022, the volume of fresh fruits that will need to be shipped by reefer ships from the Port has been estimated at 327,000 tons. To meet the requirement, it has been proposed to construct a new fruits terminal with a length of 160 m and a cold storage just behind the berth.

(4) Handling of Grains

23. In the year 2022, the volume of grains that will need to be shipped from the Port has been estimated at 4.5 million tons. To meet the requirement, it has been proposed to construct a new grain terminal having an off-shore berth with a length of 320 m and a water depth of 16 m, which can accommodate Cape-sized bulk carriers of over 110,000 DWT.

(5) Handling of Fertilizers

24. In the year 2022, the volume of fertilizers that will need to be unloaded at the Port has been estimated at 1 million tons. To meet the requirement, it has been proposed to construct a new fertilizer terminal with a horizontal warehouse on land.

(6) Access to the New Off-shore Terminals from the Outer Sea

25. It has been proposed to create a new access channel with a width of 210 m and a water depth of 16.5 m, through which vessels will have accesses to the planned new container and grain/fertilizer berths.

(7) Access to the New Off-shore Terminals from the Land

26. It has been proposed to construct a new access bridge to have an access to the planned off-shore terminals.

(8) Protection from Waves Penetrating from the Outer Sea

27. It has been proposed to construct new breakwaters and to extend the existing breakwater to protect the off-shore new or the existing berths from the penetrating waves from the outer sea as well as inner basins.

(9) Project Cost

28. The total project cost of the Long-Term Development Plan has been roughly estimated at R\$ 1,435 million.

(10) Initial Environmental Examination

29. Both positive and negative impacts were predicted with the long-term development plan, though the negative impacts would only be slight if adequate mitigation measures are adopted.
30. A negative impact could occur from shoreline change. However, it would be mitigated with the application of some measures. On the other hand, positive impacts were predicted, especially from economic activities. In comparison to the without-the-project alternative, social conditions would be improved.

(11) Management, Operations and Institutional Matters

31. The following measures to improve port management, operations and institutional matters have been proposed:
- Adequate sharing of the roles between the Federal/State Governments and CEARAPORTOS to contribute to both the national and regional interests
 - Establishment of a Port Council with a membership including port users and the knowledgeable members

- Strengthening of the functions of CEARAPORTOS by setting up divisions specialized for port planning and marketing.
- Support in attracting industries to CIPP including preferential port services for investors at CIPP
- Fund raising for the port development from both the public and private sectors based on the adequate and reasonable demarcation between those sectors
- Improvement of operation systems including safety operations at the container terminal, equipment maintenance system and oil pollution prevention system and introduction of one-stop-service-window system

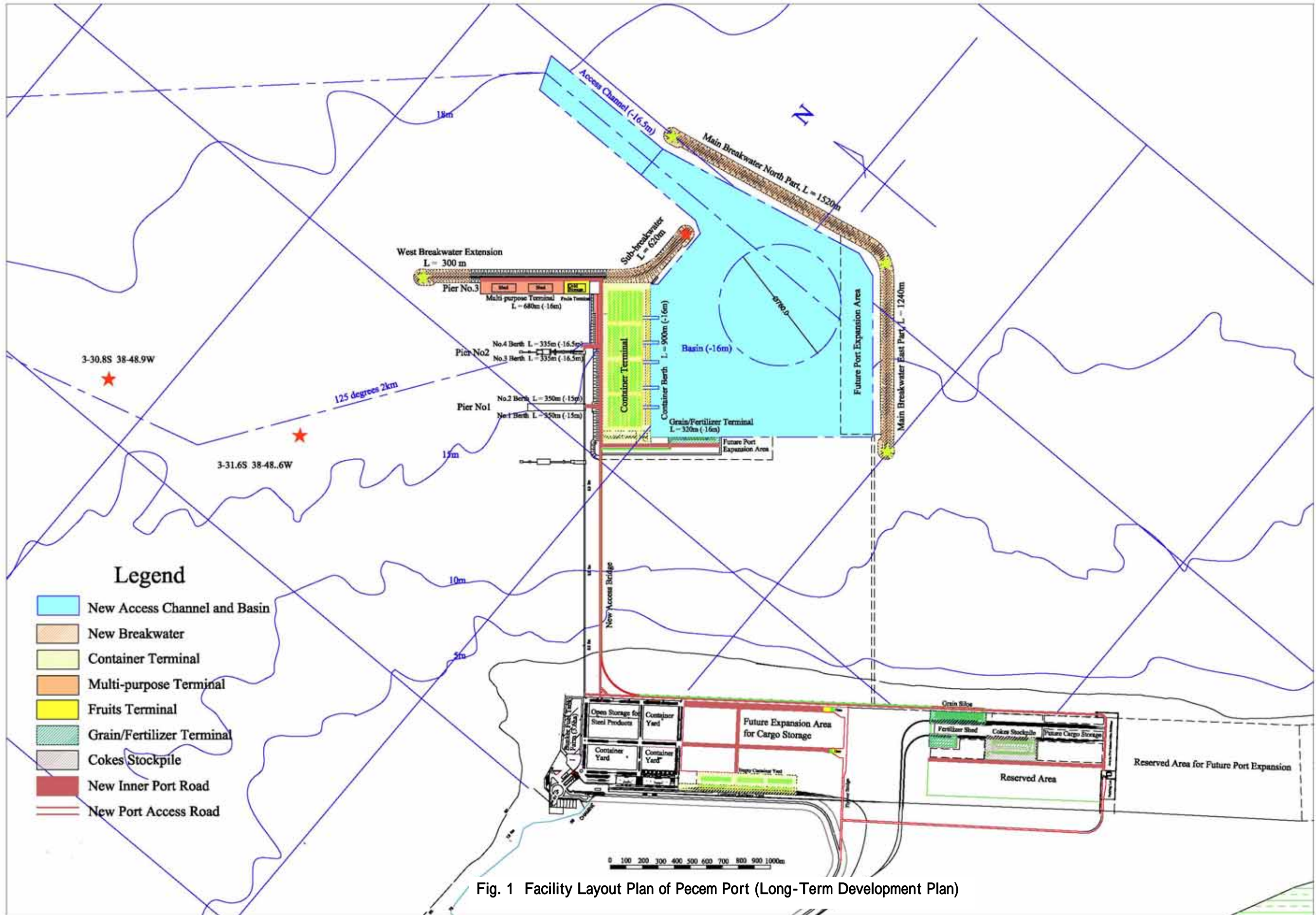


Fig. 1 Facility Layout Plan of Pecem Port (Long-Term Development Plan)

3. Short-Term Development Plan (Target Year: 2012)

(1) Handling of Containers

32. In the target year of the Short-Term Development Plan, 2012, 447,000 TEUs of containers is planned to be handled at Pecem Port. To handle the planned volume of containers, it has been proposed to establish a full-scale off-shore container terminal with a length of 540 m and a water depth of 16 m, which can accommodate container vessels of post-Panamax type with a laden capacity of over 9,000 TEUs. In addition, it has been planned to construct a dedicated railway container terminal so as to achieve swift handling of transit containers by railways.

(2) Handling of Conventional General Cargoes

33. In the year of 2012, the volume of conventional general cargoes that will need to be received at the Port has been estimated at 2.0 million tons. To meet the increasing demand for handling conventional general cargoes and to receive the cargoes that will overflow from Pier No.1, it has been proposed to construct a new multi-purpose terminal with a length of 520 m and a water depth of 16 m and a shed just behind the berth.

(3) Handling of Fresh Fruits

34. In the year of 2012, the volume of fresh fruits that will need to be shipped by reefer ships from the Port has been estimated at 227,000 tons. To meet the requirement, it has been proposed to construct a new fruits terminal with a length of 160 m and a cold storage just behind the berth.

(4) Access to the New Off-shore Terminal from the Outer Sea

35. It has been proposed to create a new access channel with a width of 210 m and a water depth of 16.5 m, through which vessels will have accesses to the planned new container berth.

(5) Protection from Waves Penetrating from the Outer Sea

36. It has been proposed to construct new breakwaters or to extend the existing breakwater to protect the off-shore new or the existing berths as well as inner basins.

(6) Project Cost

37. The total project cost of the Short-Term Development Plan has been estimated at R\$ 616 million.

(7) Environmental and Social Considerations

38. IBAMA should require the project proponent to undertake an environmental impact assessment (EIA) for the proposed port extension as part of their short-term development plan. In order to assist the project proponent, the JICA Study Team carried out detailed examinations of items containing shoreline, marine water quality and life quality among the environmental and social impact items that were thought to be important.

39. It was predicted that the shoreline would accumulate around the tip of Pecem and retreat from the west side of the tip to Pecem village. Therefore, a sand bypass was

recommended and planned. The retreat will not occur with this measure applied. It was predicted that the operation of the facilities would not deteriorate the marine water quality. Regarding the quality of life, an increase in job opportunities and acceleration of tourism were predicted. The above three items were not considered to have a significant impact.

40. The shoreline was predicted to be accumulated around the tip of Pecem, and retreated from the west side of the tip to the Pecem village; therefore, sand bypass was recommended. The retreat will not occur if this measure is taken. It was also forecast that the port operations would not give significant impact on the water quality. Regarding the quality of life, increment of job opportunity and acceleration of tourism were predicted. No significant impact was considered regarding above three items.

(8) Management, Operations and Institutional Matters

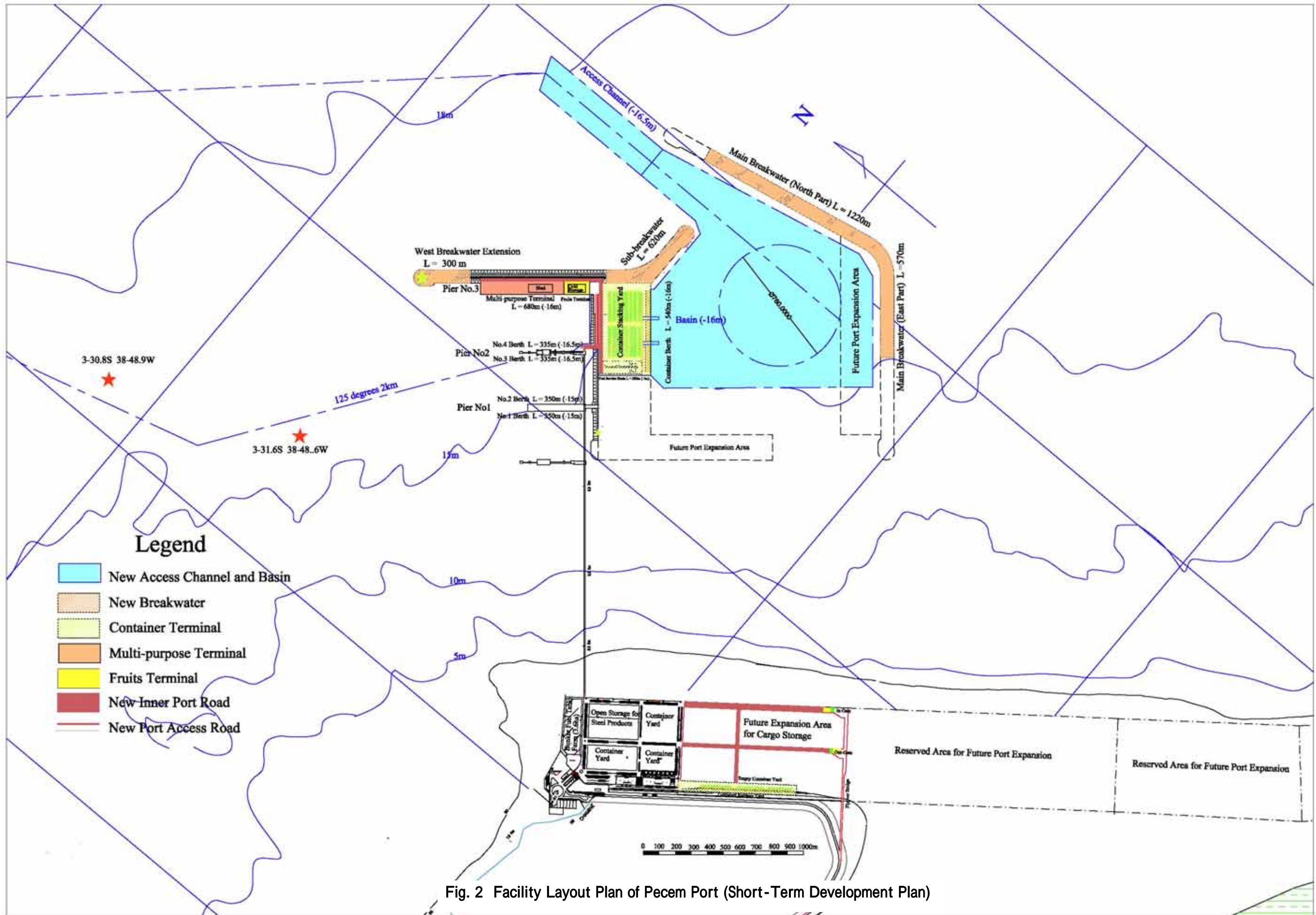
41. The same proposals in management and operations mentioned in “Long-Term Development Plan (Paragraph 11 of Section 2) are recommended to be implemented from the stage of the Short-Term Plan..

(9) Economic Appraisal

42. A comparison between the “Without-the-project” case and the “With-the-project” case has been carried out to evaluate the economic feasibility of the port development project composed of the construction of breakwaters, the terminals of containers, multi-purpose and fruits proposed in the Short-Term Plan from the viewpoint of the national economy of Brazil. The main economic benefits of the project are (1) saving in container land transportation costs, (2) saving in container transshipment costs and (3) saving in sea transportation costs.
43. The resulting economic internal rate of return (EIRR) for the above mentioned project is 22.5% which exceeds the general criterion to assess the economic feasibility.

(10) Financial Appraisal

44. The financial revenues are generated from the existing port dues and charges set up by referring to the tariff level of the neighbouring ports.
45. The resulting financial rates of return (FIRR) for the Short-Term project is 11.4% which exceeds the weighed average interest rate (8%) of assumed fund raising and hence the project has been considered to be financially viable.



RECOMMENDATIONS

In accordance with the study, it has been recommended that the Government of Brazil implement the development project of Pecem Port to contribute to the Brazilian economy. The project has been divided into two phases; the first phase project is the proposal in the Short-Term Development Plan with the target year 2012 and the second phase project is that to be completed by the target year of the Long-Term Development Plan with the target year 2022

1. The First Phase Project

The main components of the first phase project are summarized as follows:

1.1 Construction of Breakwaters

(1) Main breakwater north part:	1,220 m
(2) Main breakwater east part:	570 m
(3) Sub-breakwater:	620 m
(4) West breakwater (extension):	300 m
Total:	2,710 m

1.2 Construction of a Full-scale Container Terminal

(1) Berth length:	540 m
(2) Water depth:	16 m
(3) Quayside gantry cranes:	2 units
1) Out reach (for 18 rows):	50 m
2) Rail span:	30 m
(4) Rubber tired gantry cranes (RTG):	4 units
(5) Terminal area	
1) Length alongside:	540 m
2) Width:	300 m
(6) Container railway yard (on land)	

1.3 Construction of a Multi-purpose Terminal

(1) Berth length:	520 m
(2) Water depth:	16 m
(3) Shed (floor area)	7,500 sq. m
(4) Terminal area	
1) Length alongside:	520 m

- 2) Width: 100 m

1.4 Construction of a Fruits Terminal

- (1) Berth length: 160 m
(2) Water depth: 16 m
(3) Cold storage (floor area) 5,500 sq. m
(4) Terminal area
1) Length alongside: 160 m
2) Width: 100 m

1.5 Construction of New Gates

- (1) In-gate: 1 unit
(2) Out gate: 1 unit

1.6 Management, Operations and Institutional Matters

The following measures to improve port management, operations and institutional matters have been proposed:

- (1) Adequate sharing of the roles between the Federal/State Governments and CEARAPORTOS to contribute to both the national and regional interests
- (2) Establishment of a Port Council with a membership including port users and the knowledgeable members
- (3) Strengthening of the functions of CEARAPORTOS by setting up divisions specialized for port planning and marketing.
- (4) Support in attracting industries to CIPP including preferential port services for investors at CIPP
- (5) Fund raising for the port development from both the public and private sectors based on the adequate and reasonable demarcation between those sectors
- (6) Improvement of operation systems including safety operations at the container terminal, equipment maintenance system and oil pollution prevention system and introduction of one-stop-service-window system

1.7 Engineering Matters

Recommendations of engineering matters are as follows.

- (1) Improvement of the Existing Wave Monitoring System
 - Change of measuring method and mode for the existing wave monitoring system in order to obtain the useful wave data for the future analysis of coastal impact, design, etc.
 - Expansion of the function for the existing system to apply the navigation and mooring control supporting system for the vessels, and a real-time monitoring system for the offshore implementation work.
- (2) Detailed Study for the Implementation Schedule and Method

- Determination of the suitable location of the temporary wharf for the working craft at offshore area.
 - Detailed study of the construction method and schedule to relieve the congestion of transportation for the general cargo and for the construction material on the existing access bridge.
- (3) Countermeasures for the Mobile Dune
- Execution of countermeasures to prevent the intrusion of wind-blown sand and to stabilize the mobile dune at the surrounding port area.

1.8 Environmental and Social Considerations

Recommendations of environmental and social considerations are as follows.

- (1) Shoreline
- Carrying out continuous and effective shoreline monitoring and analysis for the shoreline impact evaluation of the breakwater construction.
 - Construction of a feedback system for carrying out appropriate shoreline conservation measures (sand-bypassing etc.) immediately.
- (2) Marine Water Quality
- Continuation of water quality monitoring and evaluation.
 - Appropriate treatment of sewage and turbid water, and discharge to the ocean.
 - Implementation of education and training for the prevention of accidents, provision of an oil fence, etc.
- (3) Life Quality
- Provision of integrated arrangements for education, employment, health, etc. for functional improvement of the village.
 - Carrying out discussion and evaluation by public participation and monitoring, and appropriate adaptive measures.

2. The Second Phase Project

The main components of the second phase project are summarized as follows:

2.1 Construction of Breakwaters

- | | |
|---------------------------------|-------|
| (1) Main breakwater north part: | 300 m |
| (2) Main breakwater east part: | 670 m |
| Total: | 970 m |

2.2 Construction of a Full-scale Container Terminal

- | | |
|-----------------------------|--------|
| (1) Berth length: | 460 m |
| (2) Water depth: | 16 m |
| (3) Quayside gantry cranes: | 4 nits |
| 1) Out reach (for 18 rows): | 50 m |

- 2) Rail span: 30 m
- (4) Rubber tired gantry cranes (RTG): 11 units
- (5) Rail-mounted gantry cranes (RMG): 1 units

2.3 Construction of a Multi-purpose Terminal

- (1) Shed (floor area) 7,500 sq. m

2.4 Construction of Grain/Fertilizer Terminals

- (1) Berth length: 320 m
- (2) Water depth: 16 m
- (3) Ship loaders/unloaders: 2 nits
- (4) Silos (storage capacity): 230,000 cub. m
- (5) Horizontal warehouse: 76,000 cub. m

2.5 Construction of a new access bridge

- (1) Length: 1,510 m
- (2) Lane: 2 lanes

SUMMARY

1 INTRODUCTION

1.1 Background

The State of Ceara is one of the under-developed states in the Northeast Region and the per capita GDP is below average of whole Brazil. The state government has been making great efforts in the expansion of irrigated farm lands by constructing reservoirs and canals and in attracting light industries such as footwear, leather textile, steel work by providing industrial estate in various locations in the state. In line with the decentralization policy of the state, these agricultural zones, which are called “Agropolos”, and industrial zones are located in remote areas as well as near Fortaleza, the state capital to achieve the goal to reduce the inter-regional and interpersonal inequalities. The infrastructures such as highways, electricity, and water supply system are also upgraded to encourage the investment. With scenic dunes along its coast, the state of Ceara is also well-known as the tourist destination.

To promote further the attraction of industries, a concept of the development of the Pecem Industrial Port Complex (CIPP), which is an integrated industrial zone with anchor industries of steel mill, oil refinery and petrochemicals, was brought to the economic development plan of the state. The construction was started in 1996 in Pecem, which is located about 60 km to the west of Fortaleza City. The land use plan of 33,500 ha of CIPP was prepared and in line with the plan infrastructures, access roads and railways, a deep sea port, water supply system and power stations been ready to accept the anchor industries. Pecem Port, which is a supporting infrastructure for steel mill and oil refinery, was opened in November 2001.

However, establishment of the anchor industries has been delayed and none of the schedule of setting up these anchor industries seemed to start soon. In this circumstance, the study on Pecem Industrial and Port Complex Development Plan has been carried out from February, 2005 to March, 2006 in line with the Scope of Work agreed upon in August 2004 between Federal and State Governments of Brazil and the Japan International Cooperation Agency (JICA).

1.2 Situation

While the establishment of anchor industries in CIPP had been delayed with no definite schedule, Pecem Port started its operation of the Multipurpose Pier (Pier No. 1, water depth of -14m) and the Oil Pier (Pier No. 2, water depth of -15m) in 2001. As soon as the port started its service, container carriers called on the port. After three years of operation, the volume of general cargoes handled at the port has been reaching that handled at Fortaleza Port.

The rapid increase of the cargo volume at Pecem Port does not result only from the shift of cargoes from Mucuipe Port to the Former. Among the principal commodities handled at Pecem Port, there are some commodities that were not seen among those had been handled at Mucuripe before the opening of Pecem Port. There are some other commodities that have shown big leaps in volumes since the opening of Pecem Port. In addition, the origins and destinations of cargoes exported and imported at Pecem port are not limited only within Ceara State. Substantial amount of cargoes are originated from or destined to outside of Ceara State (26% of import cargoes and 36% of export cargoes). Thus, the hinterland has been expanding.

Such a rapid increase of the cargo volumes at Pecem Port seems to result from the facts that Pecem Port is the sole deep sea port within Ceara State and adjacent states and that the container handling charge is the lowest among the ports in Brazil. In fact, the container handling charge was set at US \$80 at the beginning of operation of Pecem Port.

Thus, the new port that was constructed with the purpose of the exclusive use by the Steel Mill and Oil Refinery has been recognized by the public as a gateway to the international markets and encouraged investments in the existing and new industries and businesses in the hinterland. In fact, investments in agribusiness, especially fruits growing, have been under way by foreign and local investors. In addition, the Northeast Railway Company that has been privatized is about to start the implementation of a plan to modernize its facilities and upgrade its service to transport those agricultural products produced in the land locked states to the gateway ports: Itaquí Port, Maranao State, Suape Port. Pernambuco State and Pecem Port, Ceara State.

Now, the construction of the steel mill started in November, 2005. When the steel mill starts operation in 2008, Pier No. 1, which is currently used for the public, will be almost exclusively used by the steel mill company for its importation of iron ore and exportation of its products. Thus, it is very urgent to construct an alternative pier for public use.

So far, Pecem Port has been able to provide its services with very competitive tariff level. This highly owes to the availability of port infrastructures with free of charge, because these facilities were constructed for the industries to be established CIPP and the state government has not claimed any charge or repayment of the construction costs to the port management. However, the port management will no longer enjoy such a privilege as it currently does, since the construction of alternative port facilities for the public use requires new investment that should be repaid partially, if not fully, by the revenue of the port management. Thus it is one of the key elements of the port development plan to ensure both the financial soundness and competitiveness.

1.3 Structure of the report

The report consists of the summary and the main report. The main report is divided into three volumes. The summary includes the Executive Summary, Conclusions and Recommendations. The first volume of the main report, viz. Volume 1, covers the background data and review of the socioeconomic situation, natural conditions, the discussion of the strategy of the CIPP development, the port traffic demand forecast. Volume 2 covers the long-term development plan of Pecem Port. Volume 3 covers the short-term development plan and the feasibility study, while Volume 3 is the compilation of the appendices that are background and supporting data of the main text.

1.4 Implementation of the Study

For the implementation of the study, the counterpart of the study team was formulated in such a manner that the Secretariat of Planning and Coordination (SEPLAN) was the principal counterpart that coordinates the other secretariats concerned to this study such as Secretariat of Economic Development (SDE), Secretariat of Infrastructure (SEINFRA), Secretariat of Agriculture (SEAGRI), Secretariat of Local and Regional Development (SDLR), State Superintendence of Environment (SEMACE), CEARAPORTOS and other agencies concerned.

2 REVIEW AND ANALYSIS OF THE ECONOMIC INFORMATION

2.1 The Republic, the Federal Government

(1) General information

This section describes the Brazilian territory, the population and the process of economical growth in a brief way. It also presents the defined basic politics in the “Plano Plurianual. PPA 2004-2007.” The basic politics of PPA-2004-2007 are: a) social inclusion and improvement in income distribution, b) environmentally sustainable growth, c) reduction of the regional disparities, d) expansion of the market of mass consumption, investments, and elevation of productivity; and e) strengthening of the citizenship and democracy.

These policies highlight the subjects of regional social disparities and the environmental protection in the promotion of the industry. The key factors to maintain a stable macroeconomic regime are identified to be based on three foundations: a) solid foreign accounts, b) fiscal consistence characterized by a sustainable path for the public debt and c) low and stable inflation.

The action plans in the transport sector foresees the reduction of the costs of transports, development of the multimodal transport, and the integration of the transport networks with the neighbouring countries. The characteristic policy of the current government is to focus the expansion of the internal market as an important factor for the promotion of the economical growth. With the increase in the income of the workers by the promotion of the industry, the demand of the internal market will expand, especially processed foods, clothing, shoes, nutrition, medicines, appliances, construction of building, furniture, supermarkets, transports, electricity, communication, and entertainment.

The federal government's economical plan foresees the annual GDP growth rate increasing from 3.5% of the year of 2004 to 5% in 2007. Among the sectors, industries (manufacturing industry) are expected to grow at a higher rate, followed by the farming and the one of services, in this order.

Fig. 2.1 GDP forecast of the Federal Government

	2004	2005	2006	2007
GDP	3,5	4,0	4,5	5,0
Agriculture	3,7	4,0	4,4	4,9
Industry	4,1	4,6	5,0	5,6
Services	3,2	3,6	4,2	4,6

The federal government's PPA-2004-2007 proposes 374 programs for implementation.

(2) Production and external Trade

Agricultural production

Among the main Brazilian agricultural products such as soybean, corn, rice, wheat, bean, the produced volumes of corn and soybean are predominant, and the production volumes of these two are about 40 million tons. The volumes of other products are ranging from 3 to 10 million tons (all the data refer to 2002). The corn production has kept on growing every year: the production of 2002 is double of the production of 1996.

Besides cereals, other important agricultural products are vegetables, sugar cane, cassava, cotton, etc. The production of some types of fruits such as cashew and banana production has been growing. The growth in the Northeast Region over the past few years is remarkable. The main areas of the producers are still the Southeast, South and Central-west Regions, but the State of Bahia, in the Northeast area, has been blunting as important producer.

Industrial production

The main products are automobiles, passenger cars, trucks and their parts, iron ore, petroleum, etc.

External trade

Export

Until the year of 2002, the main export product, in terms of value, was iron ore, but the soybean export exceeded iron ore in 2004 and reached about US\$ 5,4 billion (F.O.B.). Other export products are automobiles, soy residues, aircrafts, crude oil, chicken meat, semi-manufactured metal products, metallurgical products, motors of automobiles, frozen meat, car spare parts, shoes, coffee, cellulose, sugar, tobacco, clothing, etc. While these products showed growing trends in export, the textile and apparel recorded reduction in 2004 and exports dropped to a lower level than that in 1999.

Import

The principal import commodity in terms of value has been the petroleum and its products (US\$ 670 million, F.O.B. in 2004). It is followed by car spare-parts, integrated circuits, medicines, and other industrialized products and semi-products. It should be noted that the agro-chemical products, which are related to fertilizers and that were not among the major import products up to 2002, took the 16th position in 2004, with the value of about US\$800 million.

(3) Infrastructure

Electricity, petroleum, gas

In Brazil, more than 90% of the energy source is hydroelectric power. From the experience of the lack of energy caused by the drought in 2001, the production of thermo-electric energy was hastened. Most of the thermo-electric power plants use natural gas. Brazil tends to become a self-supplying country for domestic consumption of petroleum by increasing the petroleum production within Brazil. The privatization of the petroleum industry and electric power generation has been implemented since 1995.

Hydraulic Resources

In Brazil, except for the Northeast Region, with substantial precipitation of rains, there have not been serious problems of drought. The state of Ceará, in the northeast area, has been making efforts to cope with shortage of water and drought by constructing reservoir and water distribution system. With the newly completed Castanhão Dam and distribution system, Fortaleza has now enough water resource.

2.2 Socioeconomic conditions of the state of Ceará

The state of Ceará is one of the poorest states in Brazil. This is because a larger part of the state is sandy or rocky dry, and, without large river, there is not enough water to irrigate the farmland. Thus, the larger part of the lands of the state is not appropriate for the agriculture.

According to the population census of 2000, the population of the Northeast Region was of 47,7 million, and the states with larger population are, the state of Bahia (13 million), Pernambuco (7,9 million), Ceará (7,4 million), Maranhão (5,7 million). The population in other states varies from 2 to 3 million. The average GDP growth rate of Ceará between 1999 and 2004 was of 1.1%. Per capita GDP of 2004 of the state of Ceará was of R\$ 3.516, which is about half of the average of the whole Brazil.

The sector contributions in GDP of the state of Ceará were of 6,1% from the agriculture sector, 36,8% from the industry and building site and 57% from the services (in 2002). In the industry sector manufacturing and the construction are the major industries. Regarding the service sector, the contribution of the public administration is the largest, representing 1/3 of the sector (21.3% of the total). Thus, it is recognized that the main industries of the Ceara State are the iron, clothing, shoe manufacturing industries, together with public administration and construction.

Perspective of growth of GDP

As a perspective of GDP growth up to the year of 2007, the Planning Secretariat of the state of Ceará estimates 4,6% over the year from 2004 to 2009. In consideration of the establishment of industries in CIPP and the certainty of hydraulic resources for the agricultural production, it is expected the annual growth will be of 5,0% from 2009 up to 2012, and about 3,6% from 2012 to 2022.

Plan of Regional Development

The state of Ceará elaborated “Ceara Cidadania” in 2003, which is the State Government’s draft plan. After the discussion held at about 20 locations in the state, the state government finalized the “Plano Plurianual –PPA 2004-2007”.

Plan Plurianual-PPA 2004-2007 publishes the economic development plan of the states. It placed the largest importance on the participation citizen's of Ceará in the process of economical development. The PPA 2004-2007 defines four axes that will drive the development plan: 1) incentive of the industry, 2) improvement of the life conditions, 3) integration of the regional economy with the neighbouring states, and public services), where the development of CIPP is one of the important points of the first axis.

Besides the key industries of CIPP, the state government intends to promote and attract investments in such sectors as textile, leather, shoes, foods, furniture, metallurgist and agro-industry.

2.3 Situation of the section of transports

Transport Policy

The federal government basically continues the previous government's policy in transport infrastructure development. It focuses on the importance of the improvement of the transport network and the promotion of the inter-modal transport. For the

improvement of the infrastructures of transports, the federal government has been promoting the investment and the management by private initiative, through concession contracts.

Situation of the road transport

While about 100,000 tons of cargoes were transported from Ceara overland to other Regions, more than one million tons of cargoes were brought to Ceara overland from other Regions, mainly from Southeast Region.

Inside of the northeast area, the volume transported from the state of Ceará is small: the cargoes transported to the states of Pernambuco and Rio Grande do Norte were 20 to 30 thousand tons, respectively. On the other hand, more than 100 thousand tons of cargoes were brought to Ceara from Pernambuco State.

2.4 Port activity

The total volume of cargo throughput of Brazilian ports was 520 million tons in 2002. The average growth rate between 1995 and 2002 was 4,5%. The growth rates of the domestic cargo volumes of the ports were high in North and Central-west Regions (8%), while that of Northeast Region was low (3.3%) during this period.

The port of Mucuripe (Port of Fortaleza, Ceará) is ranked at fifth in terms of cargo throughput, after the ports of Itaqui, Natal Areia Blanca and Suape. In 2002, the entrance volume and exit of loads of the port they added, together, 4 million tons.

From the start of the operation of the port of Pecém in 2001, a change has been observed in the commodities of the general cargoes (including containers) handled at the port of Mucuripe. Cotton and reels of steel, which have been the main commodities handled at Mucuripe Port, have transferred to Pecém Port. Cashew nuts,

one of the main export products of export of the State of Ceará, have been exported at both Mucuripe and Pecém Ports.

The unloading of rice and the loading of salt were not influenced by the opening of Pecém Port, Mucuripe is continuing to handle almost all these two commodities.

In addition, since the opening of Pecém Port, new port cargoes appeared. Among the export cargoes, banana, mango, melon, semi-industrialized products (bars of steel) and granite are the commodities that drastically increased their volumes.

Beside those commodities that were already being handled at Mucuripe, there are some commodities that have suddenly grown in volume since the opening of Pecém Port, such as export of shoes and cotton threads, and the import of chemical products.

The development of the port of Pecém has given a great impact on the economic activities in the region.

Current situation of the port of Pecém

The report presents the results of the survey of existing situation and the operation of the port of Pecém.

Situation of the activities of CIPP

The following are the observations of the activities of the industries in Ceara:

- The companies that settled in the state of Ceará indicated that the biggest advantage of opening a business in Ceara is the lower labor cost.
- The contribution of the agriculture sector in the GDP of Ceará is low.
- The major destinations of the exports are the USA, Europe and Latin America, while the major origins of the imported products are Argentina, the USA, Europe and Saudi Arabia.
- The main exported products are: cashew nut, leathers, textile, shrimp, lobsters and fruits. The main imported products are products petroleum, wheat, cotton, Steel sheets and polyester.
- There is a concentration of the industries and jobs in the metropolitan area.
- Among the principal targets in its development plan, the state government focuses on the importance of the decentralization of the industries currently concentrated in the metropolitan, the improvement of the competitiveness of small and medium scale industries, the promotion of the technological science, and the promotion of the business vision and support to the industrial development.
- The state incentives are vital elements for the creation of jobs, the support to the small and medium scale companies, the use of natural resources of the state, the social and economical impact, the regional development and decentralization, the strengthening of the supply chains among the key industries. The strategy to support the installation of companies is the reduction of the ICMS, income and municipal taxes, besides the financings from BNDES, BNB etc.

3 NATURAL CONDITIONS

3.1 Meteorological and Hydrological Conditions

(1) Wind

- The wind direction is almost constant from ENE to ESE throughout the year with a frequency of 90%.
- The strong wind appears from July to November. Due to this, the wave height in dry season becomes higher than in rainy season.

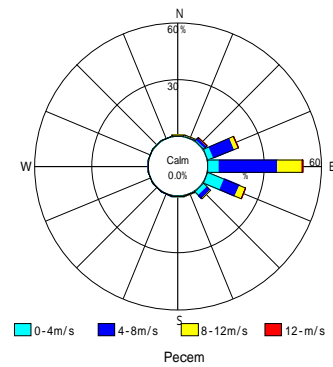


Fig. 3.1 Wind Rose in Pecém

(2) Rainfall

- The yearly rainfall greatly changes within a range of about 1,000mm to 2,800mm. This is one of the main characteristics for rainfall in the Northeast region of Brazil.
- The tendency of São Gonçalo do Amarante, which is 20km away from Pecém, is almost the same as that of Pecém. However, the rainfall at the two locations is about 60% of that in Fortaleza.

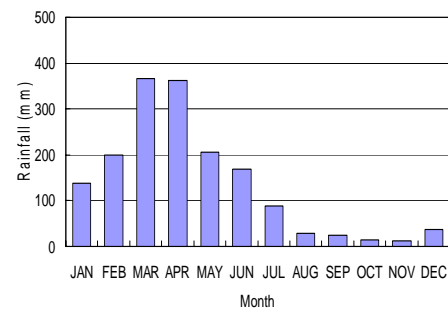


Fig. 3.2 Seasonal Rainfall

(3) Air Temperature

The air temperature on the coast area in Ceará state is almost constant about at 27 degree centigrade throughout the year.

(4) Tide

The tidal range is of the order of 3.0m. From the observation result, it was recorded +3.14m and -0.26m as the maximum and minimum water level, respectively.

(5) Waves

- The wave observation was conducted from 1991 to 1995 in Mucuripe port. In Pecém, it has been conducted since 1997 at the depth of -18m and is still ongoing.
- The significant wave height with dominant frequency is 1.25 to 1.50 m and the cumulated frequency of wave height not exceeding 1.0m is 7.2%, 1.5m is 66.3% and 2.0m is 96.8%. The dominant wave period is about 5 to 6 seconds. However, long period waves of more than 10 s appear with the frequency of about 20%. The dominant wave direction is ESE with the frequency of 40.3%.

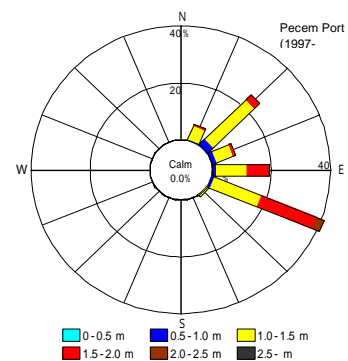


Fig. 3.3 Frequency Distribution of Wave Height (H_s) for Each Direction

- During the rainy season, the wind is relatively small and swell wave is predominant. Due to this, the wave height becomes smaller and the wave period longer. The dominant wave direction in this season is mostly NE (perpendicular to the offshore breakwater). During the dry season, the wind is relatively strong and sea wave is predominant. Due to this, the wave height becomes higher and the wave period becomes shorter. The wave direction changes E to ESE.

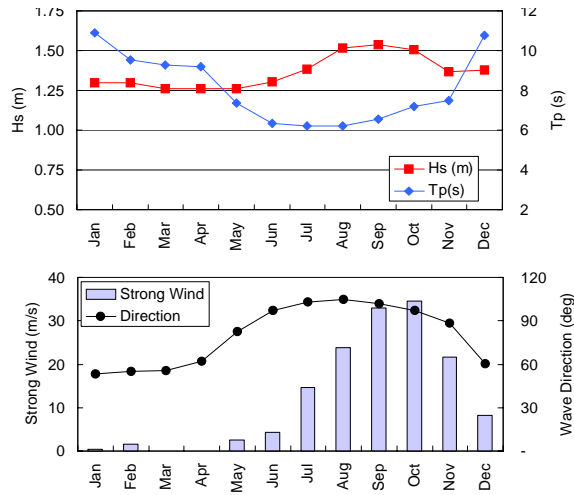


Fig. 3.4 Monthly Change of H_s , T_p , Direction and Frequency of Strong Wind ($U > 10\text{m/s}$)

- Generally, the wave spectrum in Pecém has two obvious peaks for swell and sea wave component and the components of swell waves exist throughout of the year. The representative value (H_s , T_p ,) changes for each season due to the change of magnitude of peak energy.

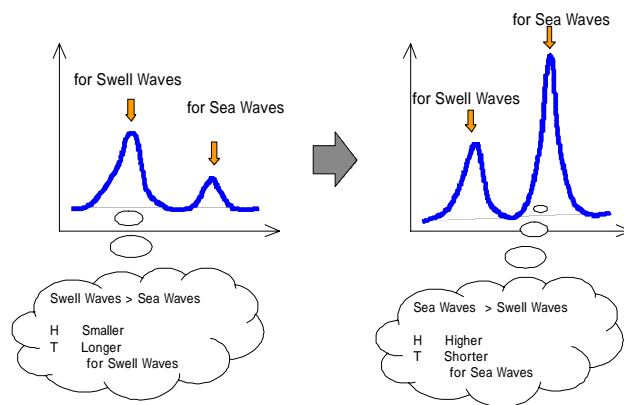


Fig. 3.5 Characteristics of Wave Spectrums for Each Season

(5) Currents

The current speed and direction are distributed around 0.1 to 0.2 m/s and 285° to 315° (W to NW) regardless of each tide condition.

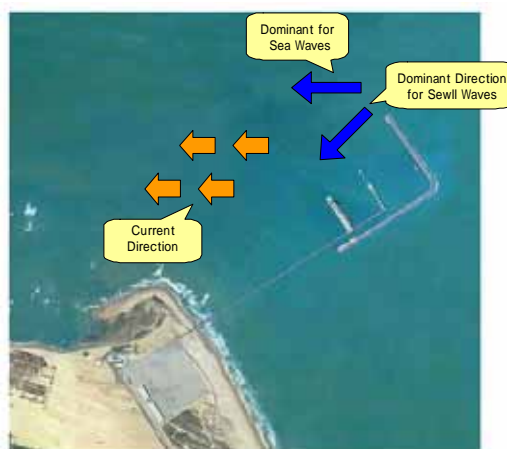


Fig 3.6 Predominant Direction for Wave and Current

3.2 Geological and Geographical Conditions

(1) Land Side (Coastal Dune)

- Along the entire coastline in Ceará state, the coastal dunes are spreading several kilometres away from the coast. There are three kinds of coastal dune area; free mobile, semi-fixed and fixed dunes.
- The coastal dunes are formed by the wind-blown marine sand due to constant directional wind with E direction. The width of coastal dunes is related to the orientation of coast line.
- From the result of comparison of coastal dunes for both 1968 and 1996, the dunes migrate with the speed about 3 to 10m per year (average speed of migration is 6.6m/year).
- To stabilize the dunes artificially around the port area and access road, the dunes contention project with 150ha has been conducted at the upwind side to the port area.



Fig. 3.7 Coastal Dune

(2) Sea Side

- The bottom topography is greatly mild. The slope up to the depth of -10m is about 1/100 at the east side and 1/200 to 1/250 at the west side. The slope from -10 to -15m is about 1/200 and the slope deeper than -15m is about 1/600 – 1/700.
- The depth contours are more or less parallel around the -5m depth due to the deposition of sand. The contour line around the depth of -10 to -12m becomes irregular due to exposing of rock.
- The thickness of sediment layer varies irregularly from 0 to -16m corresponding to the irregularity of boundary surface of rock. The average grain size for sand is about 0.2mm.
- From the bottom sampling conducted by JICA Study Team, the components of the bottom material are mainly divided for four categories, which are sand, rock, silt and fragment of shell. In the basin, all the samples are composed of silt.

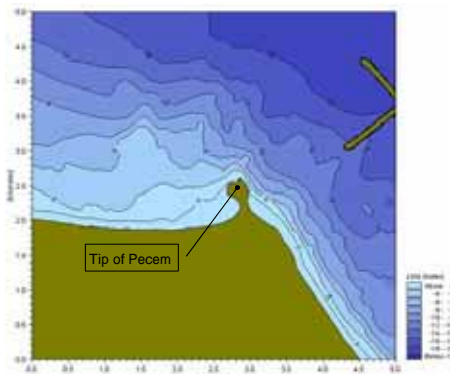


Fig. 3.8 Contour lines in the vicinity of Pecem Port



Fig. 3.9 Sampling Line and Area

4 PLAN OF DEVELOPMENT OF CIPP

4.1 Development Concept of the CIPP and Current Situation

(1) Development Concept

The development of CIPP was published in 1995. The CIPP was elaborated as integral part of program for the promotion of the economic development of the state of Ceará. The plan aimed at promoting the job and to elevate the income, and to decentralize the economical activity of whole state.

For the attraction of the key industries to the CIPP such as the steel industry, refinery, petrochemical and directly related industries, it is vital to promote the mutual advantage among the industries established in this industrial area. This project doesn't just limit to the development of the CIPP area only, but also aims at expanding the market of the light industries of (mainly manufacturing industries) small and medium scale, which have been playing an important part in the economy of Ceará, as well as the market exporter of agricultural products of the state. However, there is no specific plan has not been proposed in the CIPP development plan and the land use plan for the promotion of agriculture or light industries. The original concept of CIPP development is schematically shown in Fig. 4.1.

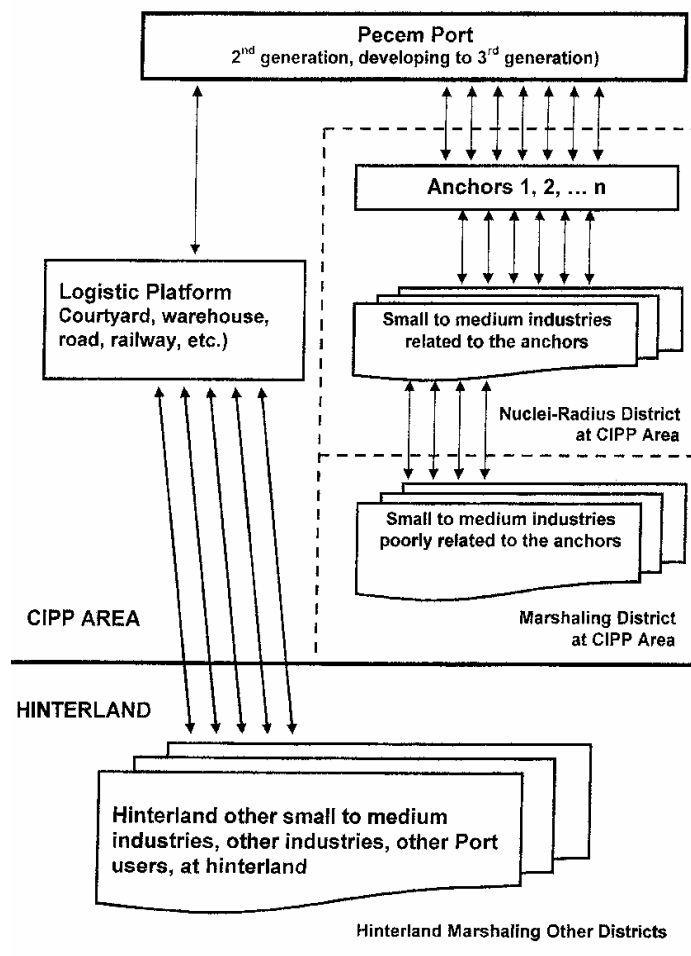


Fig. 4.1 Schematic showing of the Original Development Concept of CIPP

(2) Current Situation of CIPP

The area of CIPP is of 33,500 ha and is located in the coastal portion of the municipal districts of Caucaía and São Gonçalo of Amarante. The development vision foresees the installation of steel industry, refinery, petrochemical industry, tank-reservoir of petroleum, logistics base of LNG as key industries.

The Federation of the Industries of the State of Ceara (FIEC) proposed the plan of transferring EPZ of the industrial area of Maracanaú to the CIPP area. However, due to the delay in the installation of the key industries, there are some groups who have such opinion that the concept of development of the CIPP should be changed and that it should serve as an organizing district (Marshalling district) of a conglomerate of small and light industries.

Efforts have been made in the coordination between the CIPP development and the urban development of the adjacent municipalities, to avoid unfavourable consequent results from urbanization such as what had happened in the past in Rio de Janeiro and São Paulo, where the lack of appropriate coordination among the development plans led to the formation of slums and the increase of the crime rates.

To take advantage of the intimate relationship with Port of Pecém, the possibility of installation of warehouses closely related to the port, transhipment (logistic base) industry, repacking industry, bulk of soybeans originated from the interior and production bio-diesel made from MAMONA (the castor oil plant) that is produced in the state of Ceará should be pursued. It is necessary to adopt proper policies to select companies to be established in the CIPP and to prevent the area from illegal land occupancy over a long period in the light of the decentralization policy of the state government.

The movements currently observed in the installation of the key industries are as follows:

- 1 The steel mil project of the Korean south Dong Kuk foresees the annual production of 1,5 million tons of DRI and plates of steel. The raw materials, i.e., 2,5 million tons of pellets will be supplied annually by CVRD from Itaquí Port..
- 2 The oil refinery installation plan of the PETROBRÁS will determine the location of the installation of its refinery plant in the later part of this year. The candidate locations for its refinery installation are the CIPP and the Port of Suape. According to their plan, the refinery will produce 200 thousand barrels of petroleum products. It is most probable that the start of operation of the refinery at Pecem will be in 2009 or later.
- 3 Currently, three poles of petrochemical industry exist in Brazil. The fourth pole is now planned in Rio de Janeiro or São Paulo, and the study is underway. According to the plan, the installation of the petrochemical complex in the CIPP has to wait for the completion of the refinery. The production of the petrochemical industry in the CIPP, when it starts the operation, is estimated to be 500 thousand tons of ethylene, 200 thousand tons of propylene, C4 +, LLDPE, PP and entrance of Naphtha.

(3) Supporting infrastructures

The industrial water in the CIPP should be supplied by the Castanhão reservoir, which has been operational since 2003, and the distribution system, which is scheduled to start operation this year. The supply capacity is 22 tons per second. The electric power required in the CIPP can be guaranteed by the strengthening of the existing power distribution network of CHESF that operates hydroelectric power plants coupled with the increase of the capacity of the thermoelectric plant installed in the CIPP. The natural gas will be brought of Guamaré of the state of Rio Grande do Norte through the expansion of the gas pipeline that can supply 12 million cubic meters of gas.

4.2 Review of the development concept of CIPP

Pecem Port was constructed as one of the supporting infrastructure for the steel mill and oil refinery. Thus, the port has only two piers: Pier No.1 that was designed for unloading iron ore and loading the products of the steel mill and Pier No.2 that was designed for handling of liquid bulk cargos. While the establishment of the steel mill has been delayed, the CEARAPORTOS, which is the management body of Pecem Port., started handling of general cargoes and containers in November, 2001. The cargo volumes handled at Pecem Port has been increasing very rapidly and, within three years of operation, the total volume of general cargoes had grown as large as that of Mucuripe Port. Such a rapid increase owes to the deep draft berths (-14m) and the low tariff level: it has been often said that the tariff at Pecem Port was the lowest among Brazilian ports. It is also often cited that the handling charge per box used to be US\$ 80.

Since container liners plying between US East Coast/Europe and west coast of South America started calling on Pecem Port, the local industries such as agribusiness and light industries and Northeast Railway Company have been making their business expansion plans.

Thus, while the establishment of Steel Mill has been delayed, the container and general cargo handling service at Pecem Port has become to play a vital role to support the economic activities in its hinterland.

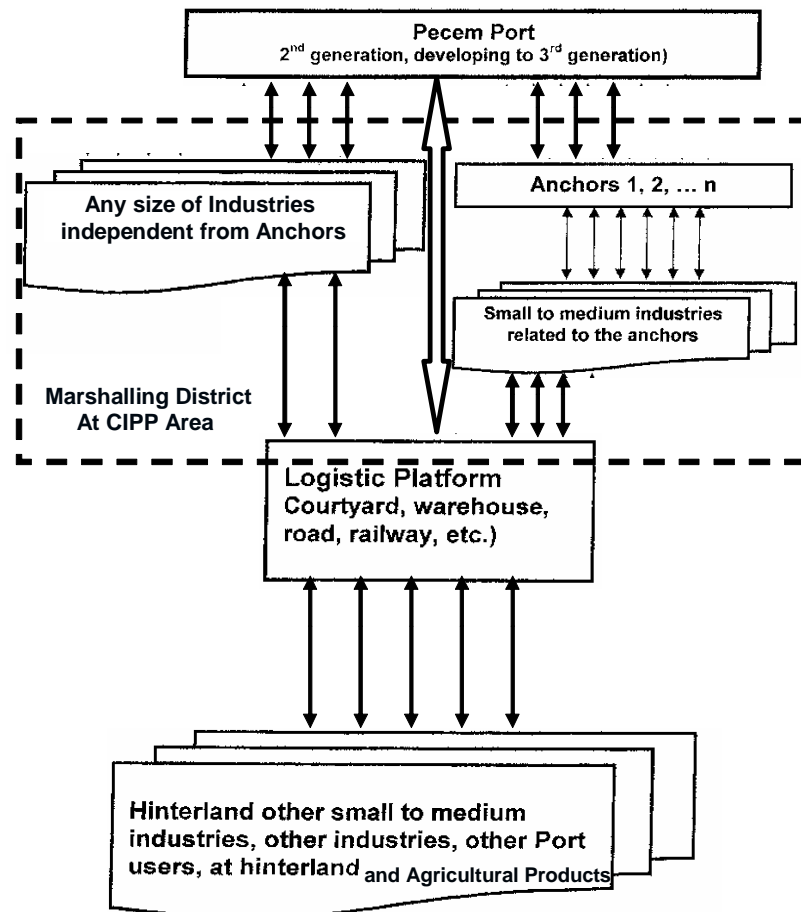
On the other hand, the realization of the original concept of the CIPP development, which envisaged the integrated industrial complex composed with the key industries and the related industries, would require some more years, since Recife has been chosen as the site of the first oil refinery in the Northeast Region and CIPP has to wait until the consumption of petroleum in the Region reaches to the level that requires another oil refinery. The steel mill that is finally coming true will produce mainly thick slabs for export and thus the impact of the steel mill on the related industries would not be as large as expected in the original CIPP development concept.

In the light of the situation mentioned above, the study team proposes that CIPP should provide a logistics function to promote further the export of the products of agro-industry and light industries. Due to the decentralization policy of the state government, the industrial zones and Aglopolos have been established in remote and under developed areas in the state as well as state capital zone. Thus, the logistics center that provides such services as storage, packing, finishing of the products and sorting and re-packing that would be beneficial for the industries located remote areas and that would also strengthen the commercial interaction among the industries in various industrial zones.

It should be noted that there are many stone mining companies throughout the state, which have been very active in the export of granite in blocks and that they have not yet introduced modern cutting machines to produce tiles that would make their products more competitive in the international markets. If a processing center is jointly established by these stone mining companies to process the granite with a high-tech cutting system, those companies will be able to add values to their products and thus they will be more competitive in the world markets.

The import of car spare parts and export of parts, brake drums for example, have been expanding. It is advantageous for those car parts manufacturers to locate their factories in CIPP for the quick and timely delivery of semi-products and finished products. This would also make the car parts industry to be included in the production line of automobiles of foreign and local car industries.

To sustain the impact of Pecem Port on the state economy over the coming years, it is proposed that development concept of CIPP should include logistic functions as well as the establishment of key industries. The new concept of CIPP development is schematically shown in Fig. 4.2.



Source: JICA Study Team

Fig. 4.2 Proposed concept of CIPP development

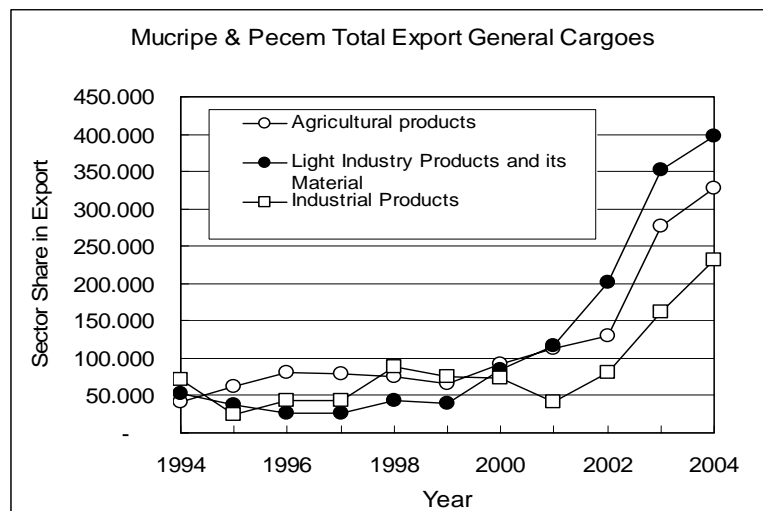
4.3 Development strategy of development of the Port of Pecém

(1) The activities of Pecem Port

The commodities handled at Pecem and Mucuripe Ports are classified into three categories: agricultural products, light industry related products and other industrial products. Figure 4.3 shows the export (outbound) volumes of the products of the three categories over the past 10, while Fig. 4.4 is drawn for the import (inbound) commodities in the same manner.

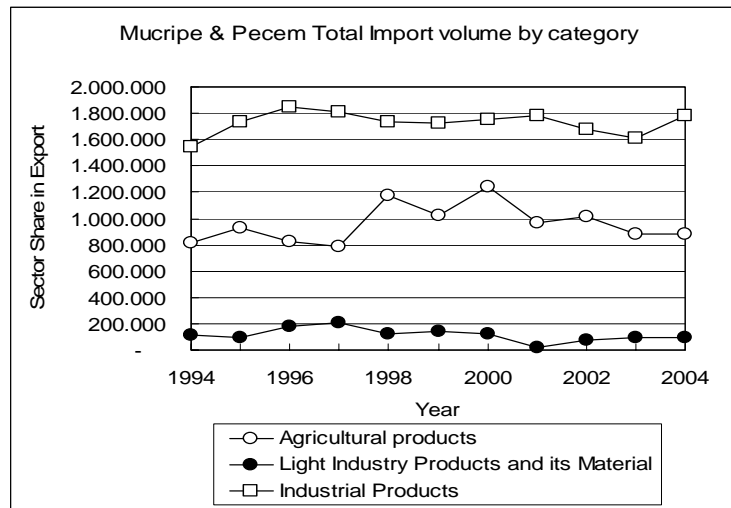
It is observed in Fig. 4.3 that the commodities of all the three categories have been increasing in higher rate since 2001. Especially the increase in export of light industry products and agricultural products is remarkable. On the other hand, the import volumes remain unchanged or rather tend to decrease. The principal import commodities among agricultural products were wheat and rice while those among other industry related products were petroleum products. The import volumes of these commodities are closely correlated with the consumption by the people in the hinterland rather than industrial activities.

It should be noted that for the light industry related commodities, the import volumes remain unchanged regardless of the rapid growth of export. This shows such characteristics of the light industries in Ceara State that utilize raw materials locally available. In fact, the largest export commodity among the light industry products is salt that is produced in the state of Rio Grande do Norte out of locally available, i.e., sea water.



Source: Mucuripe and Pecem Ports edited by Study Team

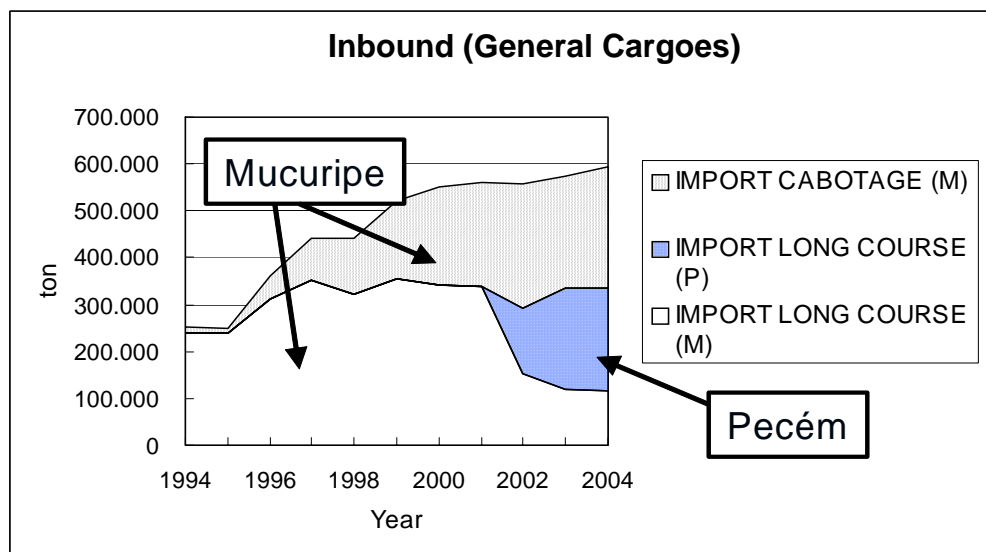
Fig. 4.3 Growth of export cargo volumes at Pecem and Mucuripe Ports



Source: Mucuripe and Pecem Ports edited by Study Team

Fig. 4.4 Annual variation of import cargo volumes at Pecem and Mucuripe Ports

Fig. 4.5 shows the volumes of import (inbound) general cargoes handled at Mucuripe Port and Pecem Port. The total inbound general cargoes has been gradually increasing due to the increase of domestic general cargoes at Mucuripe Port. However, the total volume of the import general cargoes tends to decrease since 1999.

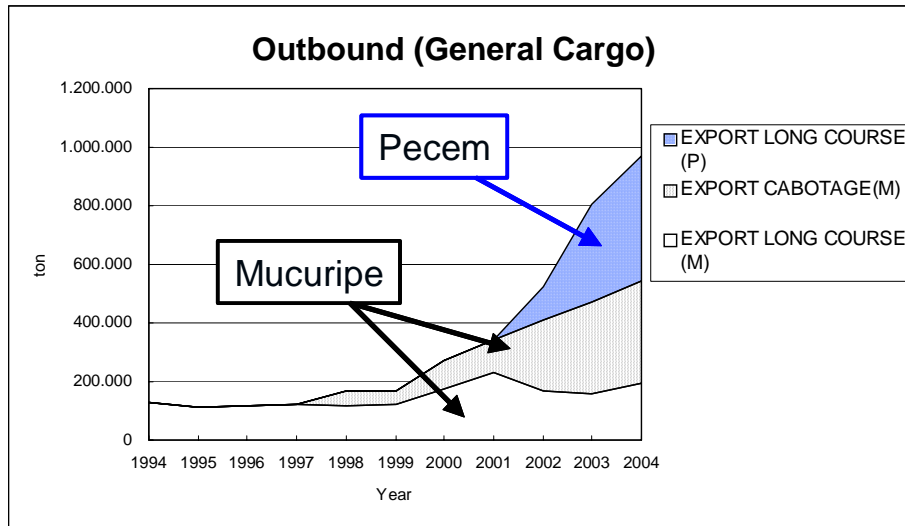


Source: Mucuripe and Pecem Port, edited by Study Team

Fig.4.5 Inbound general cargoes at Mucuripe and Pecem Ports

Since 2002, about a half of the import general cargoes have been handled at Pecem Port. This seems that those commodities used to be handled at Mucuripe Port shifted to Pecem Port. However, as described later, the import commodities have been changing since 2002 and the increase of import volumes at Pecem Port is not only due to the shift from Mucuripe Port.

The total export volume has been increasing drastically 1999 (see Fig. 4.6). The export in domestic trade has been increasing steadily at Mucuripe Port. The international cargoes are increasing at Pecem Port and remain the same level at Mucuripe Port. As observed for the import general cargoes, it would seem that Pecem Port took out international export cargoes from Mucuripe Port. However, as described later, some major import commodities currently handled at Pecem Port are new commodities and are not seen in the port statistics of Mucuripe Port.



Source: Mucuripe and Pecem Port, edited by Study Team

Fig.4.6 Outbound general cargoes at Mucuripe and Pecem Ports

The annual variations of import and export volumes of the principal commodities that had been handled at Mucuripe Port are shown in Fig. 4.7.

Import of Steel rolls tends to increase but it has shifted from Mucuripe to Pecem. Cotton also seems to be shifting to Pecem but the import volume tends to decrease. Import of rice and export of salt, which show a big leap, are increasing and they remain at Mucuripe Port regardless of the opening of Pecem Port. Thus, some commodities have moved to Pecem Port, while others remain at Mucuripe Port.

The yearly variations of the major commodities handled at Pecem Port are shown in Fig. 4.8. Those commodities shown in the figure exhibited big leaps in their export or import after the opening of Pecem Port. Export of Banana, Mango, Granite and Footwear has drastically increased while the import of chemical products keeps growing after the completion of Pecem Port in higher rate. The export of steel bar started only after the opening of Pecem Port.

It is obvious that the opening of Pecem Port, which has deep draft berths to accommodate ocean going carriers, gave considerable impacts on the economic activities in Ceara State. This is especially true for the international cargoes.

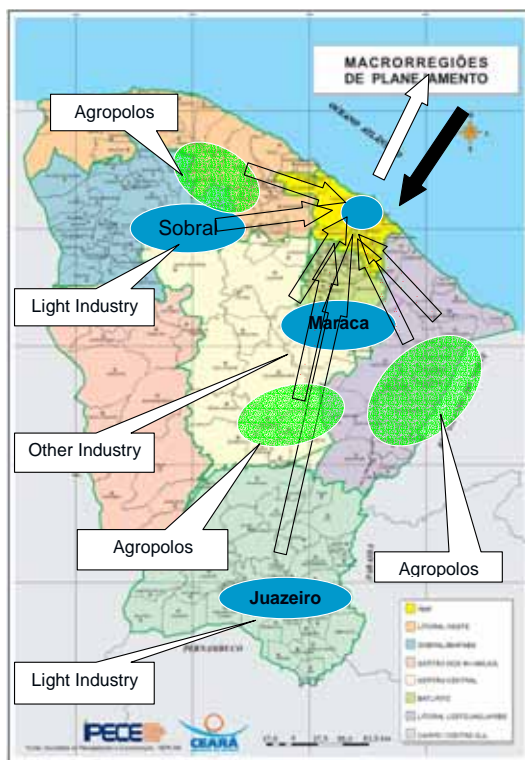
One of the reasons why the export has been increased must be the geographical advantage and the availability of deep draft berths of Pecem Port. Before the opening of Pecem Port, Ceara had a disadvantage to pay the cost of feeder service from Mucuripe Port to large international port in the Southeast Region. With deep draft port,

international container liners dock at Pecem Port as the last leg before the voyage to Europe or U.S. North coast.

The hinterland of Pecem Port expands beyond Ceara State. Thirty-six per cent of export cargoes are originated from other states in the Northeast Region: fruits from Rio Grande do Norte, Bahia and Pernambuco States, while 26% of import cargoes are destined to other states: industrial products consumed in Manhao, Gio Grande do Norte, Piaui States.

(2) Upgrading of land transport system in the hinterland

Ceara State Government has been upgrading its state highway system to improve the accessibility to and from the remote industrial estates and Agropols (see Fig. 4.9) as well as the development of the water supply system including reservoirs, dams and canals. The Northeast Railway Company (Companhia Ferroviaria do Nordeste) has a plan to upgrade the railway network and the capacity to transport agricultural products in Cerado area, especially soy beans, to the sea ports such as Itaquí, Pecem, Suape and Ilheus Ports: the potential capacity of soy bean production in Cerado area is estimated to be 18 million tons (see Fog. 4.10).



Source: Study Team
Fig. 4.9 Industrial zones and agribusiness bases



Source: Study Team
Fig. 4.10 Railway upgrading Plan

In the light of above mentioned background and environment of Pecem Port, the study team has concluded that the development plan of Pecem Port should be elaborated on the basis of the following basic concept:

(3) Objectives of the development of Porto of Pecém

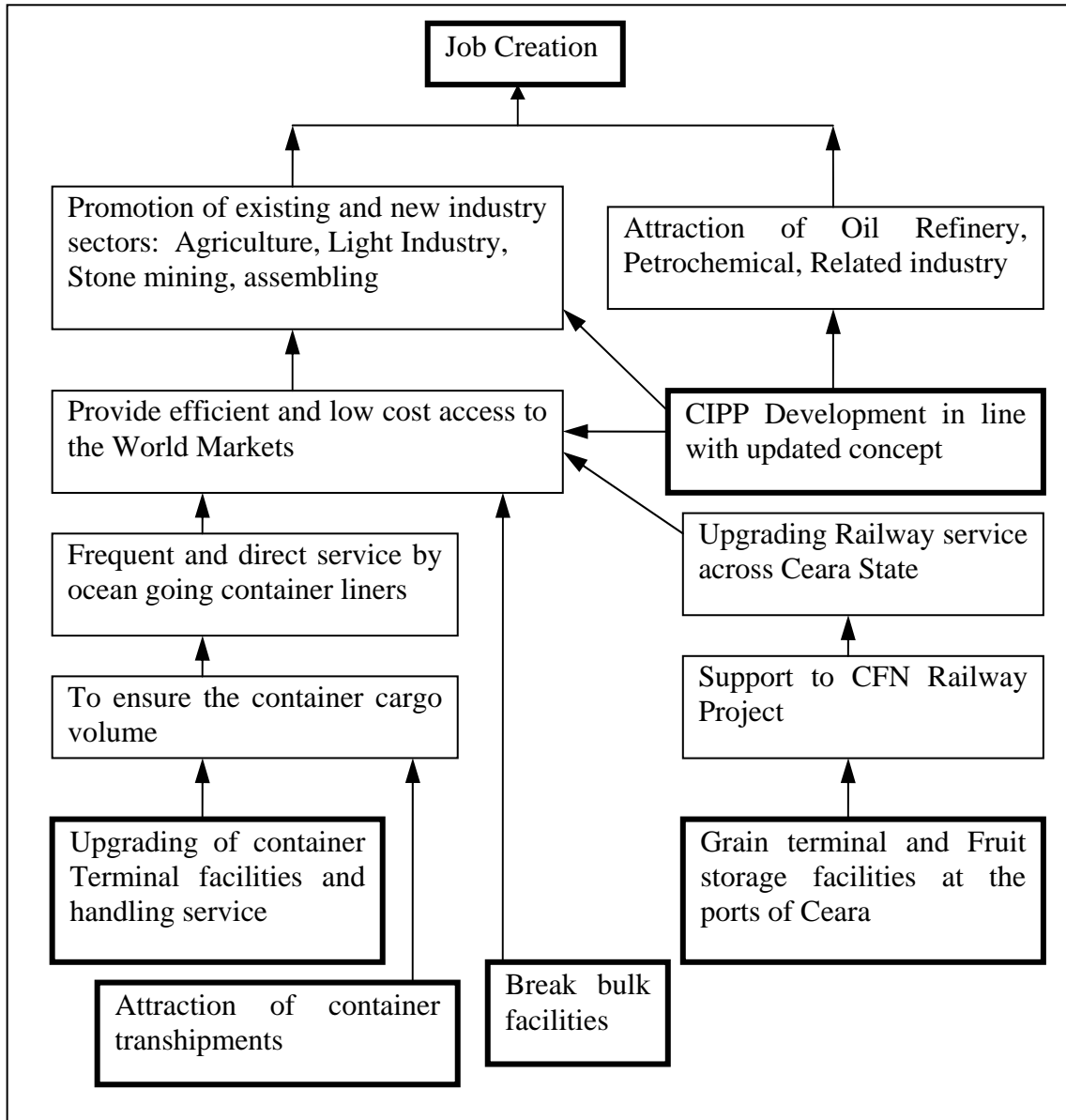
The objectives of the development of Pecem Port have been recognized to meet the future functional and quantitative demand to the Port so as to meet the following requirements:

- To serve the economic activities in the hinterland of the Port extending currently or potentially from Ceara State to the neighbouring states in the Northeast Region of Brazil and beyond.
- To give ripple effect on the surrounding region to trigger the economic stimulation in Ceara State, and consequently to narrow regional disparity in terms of inter- and intra- states as well as personal income inequality. In this regard, the following concrete roles that are expected from the Port are recognized:

To achieve the above requirements, the following functions are expected to Pecem Port:

- To serve coastal industries including the iron and steel manufacture, a refinery and petrochemical plants to be set up or to be attracted within the CIPP industrial zone after this that will import raw materials or intermediate products and will export finished products through the Port,
- To serve agro-industries in the hinterland of Pecem Port exporting their products currently mainly of fresh fruits, sea food and cashew nuts through the Port,
- To serve manufacturing industries in the hinterland of Pecem Port importing raw materials or intermediate products and exporting finished products currently mainly iron and steel products, and light industry products such as textile, foot wares through the Port.
- To serve residents in the hinterland of Pecem Port importing consumer goods through the Port.
- To function as a logistics centre placed at a node of inter-modal transport connecting sea and land through storing, processing and distributing various products such as petroleum products and steel products
- To function as a gateway towards overseas in the northeast region extending from Maranhao to Bahia and including the Cerrado region together with other principal deep-sea ports, viz. the ports of Itaqui and Suape linked by the land transport network composed of roads and railways.
- To function as a local hub port for container transshipment

The development concept of Pecem Port is schematically shown in Fig. 4.11.



Source: JICA Study Team

Fig 4.11 Schematic showing of the development concept of Pecem Port

5 TRAFFIC DEMAND FORECAST

5.1 Economic growth scenarios

The port cargo traffic at the two ports in Ceara has been increasing over the past three years. The trend is observed not only at the ports in Ceara but also at the ports in other states in the Northeast Region and whole Brazil. The export of fruit, which showed big leap at Pecem Port, is expected to increase as the world fruit market has been expanding in proportional to the growth of world population

Under this circumstance, the federal government estimated the GDP growth rate of the nation to be 5 % up to 2007 in its PPA 2003-2007, while the state government of Ceara published rather conservative GDP growth rate of 3.6% in its PPA 2003-2007.

The estimate of GDP growth rates beyond 2007 has not yet published. However, it is recognized that the increase in the export observed over the past three years is not temporary but sustained by the investment in various sectors. In agriculture sector, large scale investments are underway by foreign and local enterprises in Ceara State and adjacent states including inland states together with water projects such as Sao Francisco River diversion projects and the construction of reservoirs. In transport sector, the modernization of railways is in progress and the world famous container liners are calling on Pecem Port more frequently.

Three GDP growth scenarios are employed from 2005 through 2020:

- 3.6% (Forecast by Ceara State Government),
- 5.0% (Forecast of Federal Government),
- 5.0% up to 2012 and 3.6% from 2013 through 2022.

5.2 Cargo Forecast Methodology

The cargoes are classified into three categories by origin:

a. Cargoes generated within CIPP

So far, there is no industrial activities in CIPP, thus the cargoes generated by the industries shall be estimated on the basis of their operation planed by the industries and the import and export cargoes forecasted on the basis of the operational plans of the industries that have been published.

b. Cargoes generated in Ceara State (outside of CIPP)

Cargoes generated within Ceara State and adjacent states, which presently imported and exported at either Mucuripe or Pecem Ports. The cargoes of this category include the agricultural and industrial productions, raw materials and semi-products of the industries and various consumables for the household and business offices. Those cargoes generated by industries that will be established in the future are also included.

Basically, the correlation between the export/import volumes and GDP of Ceara State will be examined. The future cargo volumes shall be forecasted on the basis of the regression analysis. The major export commodities that are closely related to a specific industry and the increase (or decrease) in recent years are remarkable. Therefore, the simple regression analysis is judged to be inappropriate, because it is unlikely that such a big leap result from simple expansion of the business activities of

the existing industries. It seems to be realistic to recognize that, since 2001, some structural changes happened in Ceara's economy: new investment in commercial agro-industry and expansion of production lines in the traditional industries in some sub-sectors.

Thus, the export cargo volume shall start with identifying the commodities produced by those industry sub-sectors that increased export. Then the cargo volume generated by these growing sub-sectors shall be forecasted on the basis of available information and data such as those attained through company interviews, expansion of farmland, and other available information, while the other commodities shall be forecasted by regression analyses on the basis of the trend observed in the past ten years.

c. Specific cargoes generated in other States in the future

Products that are expected to be produced or brought in the adjacent states of Ceara in large volumes and to be handled at the Ports in Ceara State fall in this category. Soy beans from Piaui, fruits from Bahia and fertilizers for Soy and Fruit farms are the potential cargoes of this category. The cargo volume forecast has been done commodity by commodity. In addition, the transshipment container cargoes are also estimated with the assumption that a half of the container cargoes generated in the North Region (Belm and Manus Ports) will be transhipped at Pecem Port.

The result of the cargo traffic estimate at Pecem Port is shown in Tables 5.1. The estimate of dry cargo traffic at Mucuripe Ports is estimated with the assumption that the port handles domestic dry cargoes and import wheat (see Table 5.2).

Table 5.1 Cargo forecast at Pecem Port

('000 ton)

		2004	2012	2022
Dry Container Cargo	Import	96	464	801
Dry Container Cargo(ex. CIPP)	Export	178	511	682
Dry Container Cargo(CIPP)	Export			700
Reefer Container Cargo	Export	189	227	327
Reefer Container Cargo(From Bahia)	Export		150	300
Transshipment Container (North Region)	TEU		134	277
Container Total		463	1,202	2,810
Transshipment Container	TEU		134	277
Iron Ore Pallets	Import		2,500	5,000
Cokes	Import		120	200
Soybeans	Export			4,500
Fertilizers	Import			1,000
Solid Bulk Total		0	2,620	10,700
Thick slabs	Export		1,500	3,000
Steel Products (Pellet)	Import	123	147	180
Steel Products (Billet)	Export	60	75	90
Bagged Cements	Export		120	300
Fresh fruits (Reefer Ship)	Export		227	327
Break Bulk Total		183	2,069	3,897
Crude Oil	Import			8,800
Naphtha	Import			450
Refined Petroleum	Import	295	1,045	
C+ (Crude Gasoline)	Export			200
LNG				3,440
Liquid Bulk Total		295	1,045	12,890
Total Cargo		941	6,936	30,297
Transshipment Container	TEU	0	134	277

Source: Study Team

Table 5.2 Cargo forecast at Mucuripe Port (except liquid bulk)

(1000 ton)

		2004	2012	2022
Cargo Volume of Mucuripe Port		2.004	2.012	2.022
Dry container Cargo	Unload	177	274	412
Drt Container Cargo	Load	263	455	629
Wheat	Unload	722	993	1.099
Total Dry Cargo		1.162	1.722	2.140

Source: Study Team

6 LONG-TERM DEVELOPMENT PLAN OF PECEM PORT

6.1 Port Capacity Analysis

The Long-Term Development Plan has been made through the port capacity analysis using a computer simulation model. The computer simulation reveals the complicated movements of cargoes and their transport means comprising vessels, railway cars and trucks within the Port as outlined in Figure 6.1. The results of the simulation have been used to estimate the following scales of the port facilities that will be needed to meet the future demand to the Port.

- The required number of berths
- Required storage areas
- The number of lanes of the port access road and the port road
- The number of siding lines diverted from the principal railway lines
- The required access channel lanes (one-way or two-way)

The berth conditions as shown in Table 6.1. has been used. .

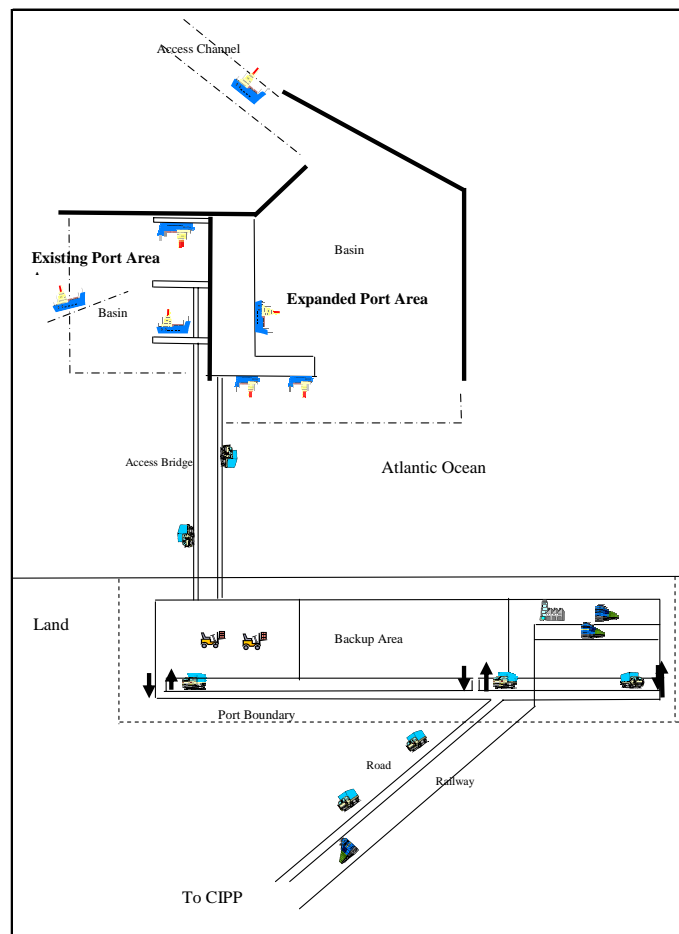


Figure 6.1 Movements of Cargoes within the Port

Table 6.1 Ship Sizes and Berth Allocation

Cargo Item	Ship Type	Ship Size	Representative Principal Dimensions				Annual Cargo Throughput in 2022 ('000)	Berth Allocation						Grain/ Fertilizer Berth					
			(DWT/ TEUs)	LOA (m)	Draft (m)	Beam (m)		Pier 1		Pier 2		Pier 3			Container Berths				
								No. 1	No. 2	No. 3	No. 4	No. 1	No. 2		No. 3	No. 1	No. 2		
Solid Bulk Cargo																			
Iron Ore Pellets	Ore Carrier	Panamax(L)	72,000	225.00	13.52	32.20													
Cokes	Bulk Carrier	Panamax(S)	51,000	182.00	12.00	32.20													
Soybeans	Grain Carrier	Capesize	114,000	266.00	14.52	40.56													
		Panamax(L)	72,000	225.00	13.52	32.20													
Fertilizers	Bulk Carrier	Handysize	45,000	186.00	10.95	30.40													
					Solid bulk total														
Liquid Bulk Cargo																			
Crude Oil	Petroleum Tanker	Aframax	107,000	245.10	15.00	43.00													
Naphtha	Petroleum Tanker	Aframax	106,000	240.99	14.90	42.00													
Refined Petroleum	Petroleum Tanker	Aframax	106,000	240.99	14.90	42.00													
C+(Crude Gasolin	Petroleum Tanker	Large1	47,000	182.50	12.65	32.20													
LNG	LNG Tanker		75,000	278.80	12.30	42.60													
					Liquid bulk total														
Break-bulk Cargo																			
Thick Slabs	Bulk Carrier	Panamax(S)	51,000	182.00	12.00	32.20													
Steel Rolls	Bulk Carrier	Handy Size	45,000	186.00	10.95	30.40													
Steel Billets	Bulk Carrier	Small 3	26,000	168.05	10.00	25.33													
Bagged Cement	Multi-purpose Ship	Multi-purpose	32,000	188.00	11.65	27.70													
Fresh Fruits	Reefer Ship	Reefer	6,100	133.92	7.60	15.80													
					Break- bulk total														
					Conventional total ('000 tons)														
Container																			
	Main Line Ship	Post-Panamax	9,200	346.98	14.50	46.00													
		Panamax (4th)	4,800	294.00	13.50	32.20													
		Panamax (3rd)	3,700	243.00	12.50	32.20													
					Main line total														
	Coaster		1,400	170.00	9.50	24.80													
	Feeder Ship		1,400	170.00	9.50	24.80													
					Container total ('000 TEUs)														

Source: JICA Study Team