

Ministry of Transport
The Republic of Madagascar

The Feasibility Study
On
Toamasina Port Development
In The Republic Of Madagascar

FINAL REPORT

December 2009

JAPAN INTERNATIONAL COOPERATION AGENCY

The Overseas Coastal Area Development Institute of Japan (OCDI)

ECOH CORPORATION

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PREFACE

In response to a request from the Government of the Republic of Madagascar, the Government of Japan decided to conduct the Feasibility Study on Toamasina Port Development and entrusted the study to the Japan International Cooperation Agency (JICA) .

JICA selected and dispatched a study team headed by Mr. Kunita of OCIDI consists of OCIDI, ECOH CORPORATION, and Ides Inc., between January, 2009 and December, 2009.

The team conducted field surveys at the study area, numerical simulation, and held discussions with the responsible persons concerned of the Government of Madagascar and SPAT.

Upon returning to Japan, the team prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of prosperous relationship between two countries.

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

December 2009

Toshiyuki Kuroyanagi
Director General
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Toamasina Port (Urgent Development Plan)



LIST OF ABBREVIATIONS

A	ANGAP	National Association for Management of Protected Areas
	APMF	Agence Portuaire Maritime et Fluviale
B	BOT	Build Operate Transfer
	BP	Balance of Payment
C	CF	Conversion Factor
	CIF	Cost, Insurance and Freight
	CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
	CO2	Carbon dioxide
	CTE	Technical Evaluation Committee
	CY	Container Yard
D	DEE	Department of Environmental Evaluation
	DISE	Direction of Social and Environmental Impacts
	DSA	Debt Sustainability Analysis
	DSR	Debt Service Ratio
	DWT	Deadweight Tonnage
E	EA	Environmental Assessment
	ECOHE	Environmental Consultants for Ocean and Human
	ECP	Environmental Commitment Program
	EIA	Environmental Impact Assessment
	EIRR	Economic Internal Rate of Return
	EMP	Environmental Management Plan
	EUR	Euro (Currency Unit)
F	FIRR	Financial Internal Rate of Return
	FOB	Free on Board
	FS	Financial Statements
	F/S	Feasibility Study
	FTM	Foiben Taosarintanin' I Madagasikara (Institut Geographique et Hydrographique de Madagasikara)

G	GDP	Gross Domestic Product
	GDP	Gross Domestic Product
	GT	Gross Tonnage
	GTR	Global Trade Atlas (Database of JETRO)
I	ICTSI	International Container Terminal Services Inc. (Parent Company of MICTSL, Philippines)
	IDA	The International Development Association
	IEA	International Energy Agency
	IEE	Initial Environmental Examination
	IMF	International Monetary Fund
	IRR	Internal Rate of Return
	IUCN	International Union for the Conservation of Nature
J	JBIC	Japan Bank for International Cooperation
	JETRO	Japan External Trade Organization
	JETRO Study	The Study On the Urgent Necessity of the Expansion Project for Toamasina Port in the Republic of Madagascar, March 2008, JETRO
	JICA	Japan International Cooperation Agency
	JPY	Japanese Yen (Currency Unit)
M	MAP	Madagascar Action Plan
	MECIE	Code in Compatibility of Investment with Environment
	MGA	Madagascar Ariary (Currency Unit)
	MICTSL	Madagascar International Container Terminal Services Ltd.
	MINENVEF	Ministry of Environment, Water and Forest
	MOB	Ministry of Budget
	MOF	Ministry of Finance
	MOT	Ministry of Transport
N	NGOs	Nongovernmental Organizations
	NOx	Nitrogen Oxides
	NPV	Net Present Value

O	OCC	Opportunity Cost of Capital
	OCDI	Overseas Coastal Area Development Institute of Japan
	ODA	Official Development Assistance
	OM	Operation and Maintenance
	ONE	National Office for the Environment
P	PNAE	National Environmental Action Plan
R	RAP	Resettlement Action Plan
	Ro/Ro vessel	Roll on / Roll off vessel
	RTG	Rubber Tired Gantry Crane
S	SCF	Standard Conversion Factor
	SDR	Social Discount Rate
	SMMC	Société de Manutention des Marchandises Conventionnelles
	SO2	Sulphur Dioxide
	SPAT	Société du Port à Gestion Autonome de Toamasina Toamasina Autonomous Port
T	TEU	Twenty Feet Equivalent Unit
	TOR	Terms of Reference
V	VAT	Value Added Tax
W	WB	World Bank
	WHO	World Health Organization
	WWF	World Wildlife Fund

Cost Estimation Base: as of September 2009

Exchange Rate: 1 EUR=132.79 Yen, 1 Ariary=0.0492 Yen

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Executive Summary

Following the JETRO study in 2008, the current study team visited Madagascar to carry out “The Feasibility Study on Toamasina Port Development in the Republic of Madagascar.” The study has been funded by JICA for the purpose of clarifying the environmental impact and viability of the project.

In spite of the sudden change of political leaders in 2009, the team is hopeful that a stable and open economic policy will be realized and that poverty reduction can be achieved.

The study team forecast cargo volumes up to 2020 on the assumption that the global economic climate will eventually improve and that Madagascar’s economy will experience growth.

Based on forecast results, the volume of containers will reach 3 times the present level.

To meet the demand, the new quay at the top of C3 berth is proposed in the Urgent Development Plan. And to ensure safe operation, the extension of the breakwater (345m) is also proposed. A Container Yard to support the container handling, an overpass to enable the sooth traffic at the railway crossing, and relocation of the facilities, etc. are included in the Urgent Plan.

The influences of the extension of breakwater are examined by numerical simulations which can be found in this report.

The team reached the overall conclusion that the Urgent Development Plan is technically sound, economically feasible, and financially viable.

Conclusions and Recommendations

● Urgent Development Plan

Urgent Development Plan was formulated by extracting the most-required and minimum-cost facilities from Middle Term Development Plan, in order to cover the predicted cargo demand in 2020. Urgent Development Plan is indicated in Table 1.

C4 Quay will be constructed to meet the container demand. C4 Quay will have a draft of -14m, length of 320m which can accommodate 40,000dwt container vessels with 3,200 TEUs containers.

The length of the extension of breakwater is 345m. In spite of the open mouth which extends for 150 m, the workable days at the quay will reach 95%.

To make up for the lack of space behind the quay, the Hastie Reef will be reclaimed and utilized as a container yard (10 ha), although the distance from the C4 quay is 1,000m.

The traffic bottleneck will be removed by the relocation of the facilities. The deepening of the existing C1,C2,C3 berth to -13~-14m will be implemented. An overpass will be created at the No1 gate because the railroad wagons laden Anvatovy freight would interfere with the car traffic.

A container volume of 420,000TEU will be handled in 2020 by the above arrangement.

According to the opinion for the draft final report from SPAT, 470 m long C4 container berth and 26 ha wide container yard should be covered by the Urgent Development Plan. However the team recommends 320m berth and 10 ha yard so that SPAT should minimize initial investment which will give SPAT the better financial condition.

SPAT also commented on draft final report that the helps to navigation with the cost 0.6 million EUR should be covered by the Urgent Development Plan. The team recommends it should be covered by next phase development by the same financial reason as above.

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Table 1 Urgent Development Plan

Facility	Cost: EURO(million)	Responsible Organization
(Urgent Development Plan)		
Breakwater (345m)	42.7	SPAT
C4 Quay(-14x320m)	55.4	SPAT
Reclamation 10ha	25.6	SPAT
Relocation & Paving	15.3	SPAT
Dredging (143,000m3)	3.8	SPAT
Deepening (C1,C2,C3)	9.8	SPAT
Over Pass (at No1 gate)	10.5	SPAT
Environment Protection	4.2	SPAT
Engineering Cost(Civil)	11.7	SPAT
Hargo Handling Machine	41.1	MICTSL
Total (Urgent Development Plan)*	220.1	

* Escalation is not included, base=2009 price

The implementation schedule is indicated in Figure 1.

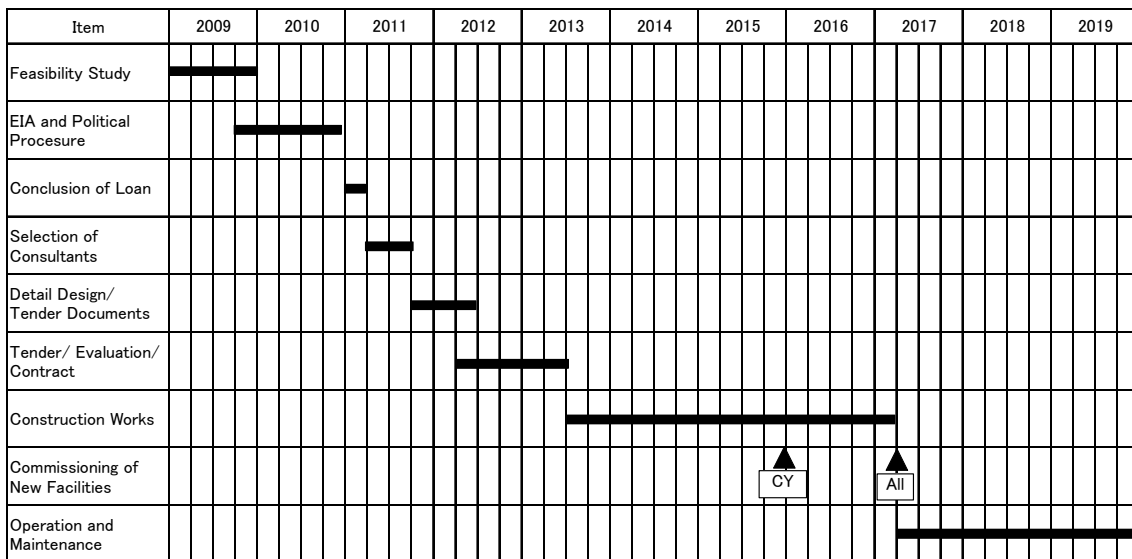


Figure 1 Implementation Schedule of Urgent Development Plan

The layout is indicated in Figure 2.

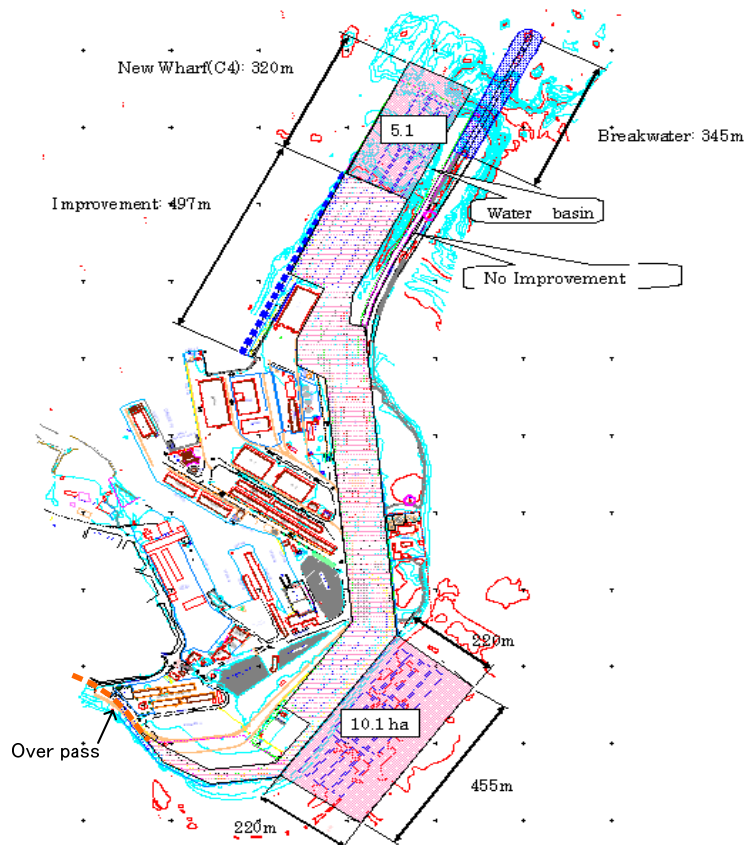


Figure 2 Urgent Development Plan

● **Necessary Funds**

To implement the Urgent Development Plan, the escalation and contingency should be included in the Fund Plan.

The chronological Fund Requirement including escalation and contingency is indicated in Table 2.

Table 2 Fund Requirement (in EURO million)

Organization	Year	2011–2012	2013	2014	2015	2016	2017	Total
SPAT	Total	2.1	2.2	48.5	65.2	81.9	35.1	235.3
	Foreign	1.5	1.6	35.0	46.7	58.2	18.4	
	Local	0.5	0.6	13.5	18.5	23.7	7.7	
	Contingency						8.9	
MICTSL	Total				14.7	15.1	22.8	52.7
	Foreign				14.7	15.1	20.8	
	Local				0	0	0	
	Contingency						2.0	
Grand Total								288.0

*escalation: 1.03per annum for foreign Portion, 1.06 for local portion

SPAT should apply the yen loan equivalent to EURO 235 million (=JY 31,245 million).
MICTSL should formulate the investment plan corresponding to the above Urgent Development Plan.

- **Overall Feasibility**

The Urgent Development Plan is technically sound, economically feasible, and financially viable.

- **Technical Feasibility**

- Breakwater

Extension of the breakwater is 345m. The workable days will be 95%.

The breakwater can be constructed that is sufficiently stable to withstand waves generated by a cyclone using the appropriate weight of Dolos Blocks.

- Quay

Steel Sheet Pile type is suitable for a -14m quay.

On the other hand, the gravity type is also applicable to C4 berth because there are favorable conditions such as no earthquakes, sufficient water depth at the quay site, and a solid sub-base.

SPAT should compare the proposals by bidders to obtain the best solution.

- Shore Protection

The 400 m extension and 200 m extension have almost the same influence on shore transformation. Accordingly, the extension of 345m will have the same impact as the 400m extension.

The erosion will be unchanged. The place of the sedimentation differs from the present area. The beach at the Pangalane canal area will be extended, and there will be few changes to the shore at the bottom part of the bay.

After the completion of the Urgent Development Plan, the state of the shore line should be observed. Based on any changes, countermeasures should be determined. Study team proposes tentatively the shore protection plan in 2020.

- **Economic Feasibility**

- EIRR for the Urgent Development Plan is calculated as 14.6%.

- The cargo demand increases with the development of the economy. If the expansion of the port is implemented before ship waiting occurs, the economic loss of the nation can be avoided.

- There is no port which can substitute for Toamasina port. If the berth occupancy rate reaches almost 100%, the waiting time will easily become 10 days. The ship waiting will cause a very big loss and the economic activities will be paralyzed.

- **Financial Feasibility**

- The FIRR of the SPAT for the Urgent Development Plan is calculated as 6% based upon the current tariff structure

- The share of the profit among SPAT and operators will change in future when freight increases. SPAT should revise the tariffs so that the operators can make a sufficient profit and SPAT may increase the return.

- **Protection of the Environment**

- Protection of the coral

- ① Part of the coral may be crushed by the construction of the port facility. Precious kinds of coral should be transplanted to an appropriate site.

- ② Muddy water should not reach the coral area during the construction.

- ③ Muddy water of the drainage should not reach the coral area after the construction.

- **Maintaining a Clean Environment**

- ① By controlling the times at which trucks are allowed to pass through the city, noise, exhaust gas and congestion can be avoided.

- ② The tender document should state that the constructor should bring in new vehicles to

avoid air pollution.

- ③ The filling material of Hastie Reef should be the sand in the port whenever possible.
 - 1. The road congestion will be avoided.
 - 2. The depth of the port basin will increase.
 - 3. The mud content is small.
 - ④ Soil which contains PCB or heavy metals shall be confined to the water tight wall and capped.
 - ⑤ Muddy water should not reach to the coral while the dredging work is being conducted.
 - ⑥ The noise of the pile driver should be reduced using the less-noise type pile driver.
- **The influence of the extension of the breakwater on the aggravation of the water quality**
 - There is little change in eutrophication even the breakwater closes the open mouth according to the numerical simulation.
 - However, when a water hyacinth and garbage flow in a port from a canal, the bottom of the sea suffers from a lacking oxygen. Therefore, a canal is proposed in 2020 plan.
 - **Water quality management after the completion of the construction**
 - International regulations should be applied for the waste water discharge from the vessels and the discharge should be inspected.
 - The regulations for the waste water discharge from a factory should be agreed among factories and SPAT. The inspection of discharge should be conducted.
 - Rain water should not be able to drain into the sea directly. The oil and the sand should be removed by traps.
 - Purifier tanks for the lavatory should be furnished at the toilets in the port.
 - **Measures for the noise and exhaust gas generated by trucks after the commissioning of the wharf.**
 - A bypass, a parking lot and an inland depot will help to reduce traffic congestion, harmful exhaust gas, and CO₂. These measures are proposed in the 2020 plan.

- **Implementation Agencies**

The implementation agencies for this project will be as follows.

- 1) Responsible agency for tender
Société du Port a Gestion Autonome de Toamasina
- 2) Responsible agency for project implementation
Société du Port a Gestion Autonome de Toamasina
- 3) Responsible agency for the supervision of construction
Société du Port a Gestion Autonome de Toamasina
- 4) Management authority after completion of the facilities
Société du Port a Gestion Autonome de Toamasina
- 5) Assistance and advice Authority
Ministry of Transport, Agence Portuaire Maritime et Fluviale

- **Organization of Implementation Body**

SPAT

- For the smooth progress of the project, SPAT should hold the regular meeting headed by the Director General to exchange information among directors.
- Two people should be assigned to assist the Planning and Development Director. The person should be university graduate, English / French reading and writing, and technical academic background.

Ministry of Transport

- The Ministry of Transport should assist SPAT by forming a steering committee, composed of APMF, Ministry of Finance, and ONE to solve problems in concluding loan agreement, allocation of funds, and implementation, etc.
- **The number of lots for the procurement**
 - The procurement of the civil portion through international competitive tender should be one package, since the construction machine, work vessels, dump trucks, etc. can be commonly used for the construction of the breakwater, quay, dredging.
 - Employment of the consultant should also be one contract throughout the project, whenever possible.
- **Advantageous implementation**
 - Mobilization/Demobilization
 - Mobilization is unavoidable for the Urgent Phase, but it is not necessary to spend money for demobilization. It should be stipulated in the contract that vehicles, boats and barges shall be turned over to SPAT, and that the new vehicles should be brought in so that they may be usable after the project.
 - Quay structure
 - ✧ Occasionally there is a sudden rise in the price of steel materials and there is a risk that the bid could be suspended if such a price hike occurs.
 - ✧ On the other hand, the gravity type structure mainly uses concrete and thus is less affected by such price hikes. The block type in particular requires only a small amount of steel materials. Therefore, the risk of the bid suspension is low. The gravity-type quay also increases the number of employment opportunities for local persons.
- **Efficient Construction**
 - In order for trucks loaded with containers or vehicles for the construction to pass smoothly, it is desirable to build an overpass at the beginning of construction. Even a temporary structure is acceptable.
 - The temporary quay for construction at the sand beach may be proposed by a bidder. SPAT should conduct negotiations and should obtain the area beforehand. In addition, SPAT should enclose the site so that the constructor can use it immediately after the contract.
- **Expediting implementation**

According to the opinion for the draft final report from SPAT, the completion of the container yard should be hurried in particular. On the other hand, there is an advice to take enough allowance in the time schedule for the implementation of the project, because the implementation of the loan is generally very slow according to the past experiences. Although it is necessary to reserve time for the implementation of the project because of the loan procedure, the preparatory actions can also expedite the project.

 - SPAT should finish all procedures of ONE regarding EIA before the appraisal of JICA.
 - After the appraisal of JICA, SPAT should proceed to the selection of consultant in accordance with the JICA guidelines.
- **Operation and Maintenance**
 - One of the most important problems of this project is how to handle an increasing container smoothly. MICTSL should make the plan of the operation system and the implementation schedule before the appraisal team of the yen loan arrives.
 - The examination of the concession of the new quay and the container yard should start as soon as the LA is concluded. An ideal method of harbor tariff is indicated in case 4 of the Chapter 8.
 - Because JICA has a scheme of the technology transfer including expert dispatch, SPAT can utilize it for the study on the concession and tariff system.

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Summary

Located in the Indian Ocean in the Southern Hemisphere, Madagascar is separated from the southeastern coast of Africa by Mozambique Channel (400km). Madagascar, with an area of 592 km², is the fourth big island in the world. The distance from the north of the island to the south is 1,580 km, and 590 km from east to the west.



Figure 3 Location of Madagascar

Toamasina port is sheltered by two reefs. The shape of Toamasina bay is oval; the major axis is 2km, and the minor axis is 1.5km.

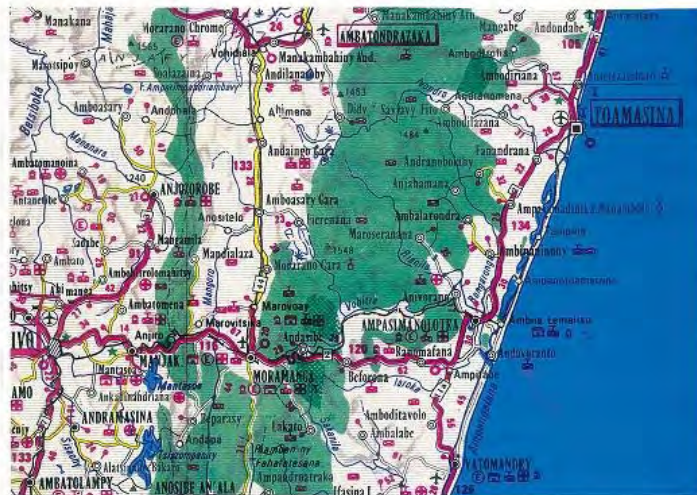


Figure 4 the Rout Map of the RN2

The port has a vast hinterland which includes Antananarivo, the capital of Madagascar. The port and the capital are connected by road (2 traffic lanes, 380km), and the railroad.

The shore line, directly facing to the open sea, stretches 1,000km southward the Toamasina. Because of high waves generated by storms, it was impossible to construct a port on the

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east coast of Madagascar. Only Toamasina, thanks to the blessing of the natural topography in which the Grand Reef and the Hastie Reef of shelter, could be constructed.



Figure 5 the Grand Reef(center left) and the Hastie Reef(center right)

Toamashina is connected to Atsinana, Alaotramango, Analamanga, Bongolava, Itasy, Vakinankaratra, etc. by national highways or railroads, and Maroantsuetra, Mananjary, Toliara by sea.

The population of the hinterland is 2,800,000 in Atsinana where the capital is located, 1,580,000 in Vakinankaratra, 1,100,000 in Atsinana where Toamasina is located.

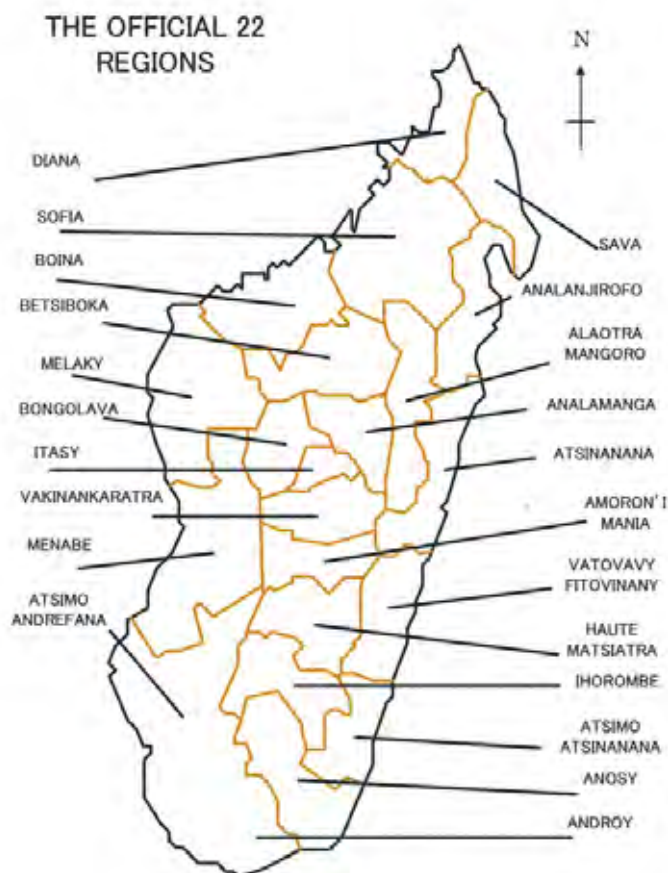


Figure 6 Regions of Madagascar

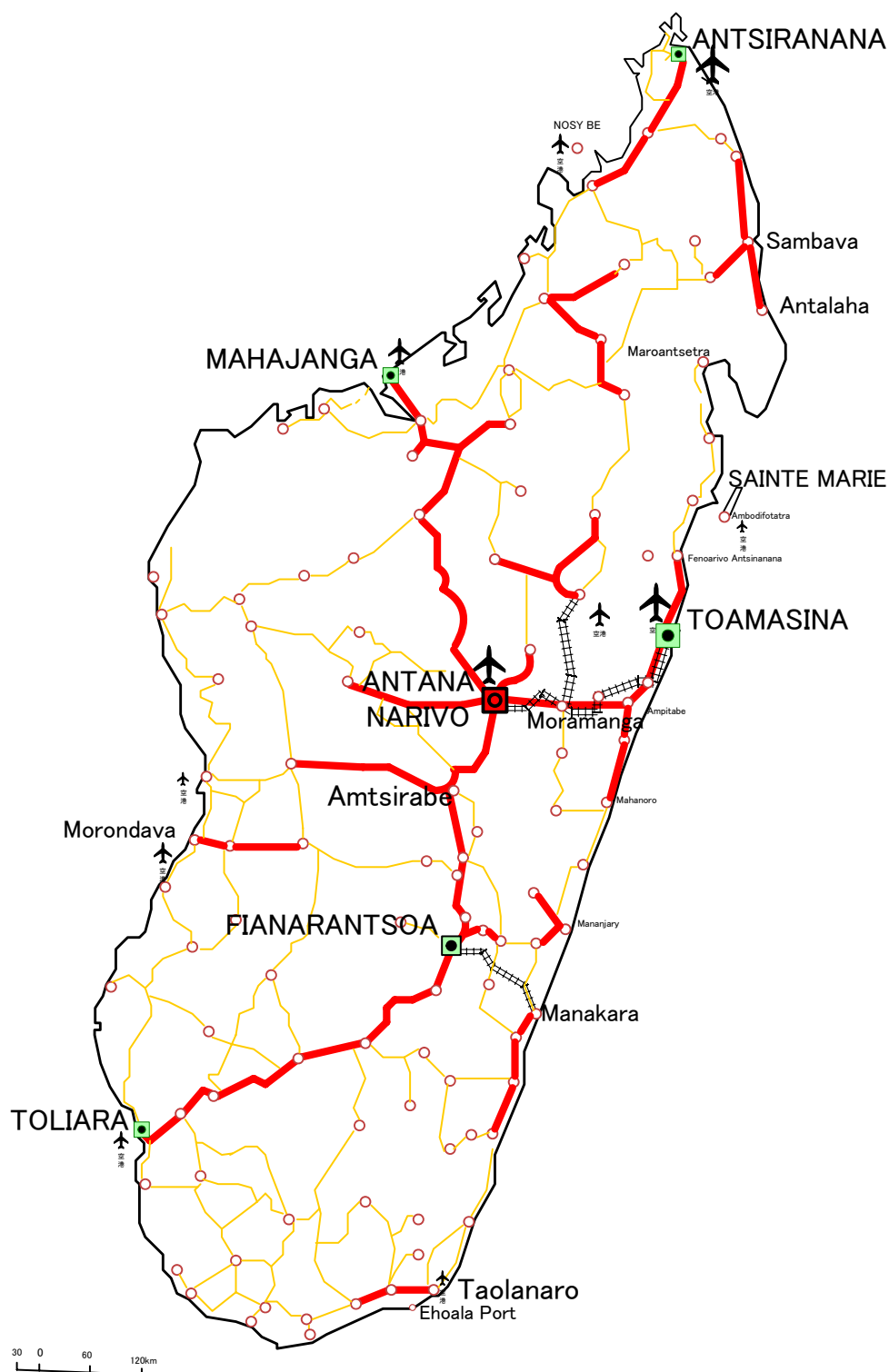


Figure 7 National Roads and Major Cities

Industry and commercial functions have already accumulated in the capital and the neighboring area of Toamasina. If a new port is to be constructed as an alternative to Toamasina, a huge investment will be necessary and it will take a long time. The heretofore untouched ecosystem will also be impacted.

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Table 3 Population of the Regions

REGION	Estimated Population	Population Density (Person/km ²)
DIANA	485,800	25.2
SAVA	805,434	31.6
ITASY	642,967	91.9
ANALAMANGA	2,811,490	166.3
VAKINANKARATRA	1,589,810	95.8
BONGOLAVA	326,612	19.6
SOFIA	940,678	18.8
BOENY	543,222	17.5
BETSIBOKA	236,285	7.9
MELAKY	175,515	4.5
ALAO TRA-MANGORO	877,880	27.5
ATSINANANA	1,116,986	50.9
ANALANJIROFO	860,930	39.3
AMORINI MANIA	693,058	42.9
HAUTE MATSIATRA	1,128,833	53.5
VATOVAVY-FITOVINANY	1,097,750	56.0
ATSIMO-ATSINANANA	621,330	32.9
IHOROMBE	189,344	7.2
ATSIMO-ANDREFANA	1,018,556	15.4
MENABE	390,864	8.5
ANDROY	476,400	24.7
ANOSY	544,173	21.1
TOTAL	17,573,917	

Table 4 Cargo Handled at Ports in Madagascar (2007)

Name of Port	International	Domestic	Coastal	Total (ton)
ANTALAHA	0	15,477	11,727	27,204
ANTSIRANANA	52,482	183,703	0	236,185
ANTSOHIHY	0	19,253	5	19,258
MAHAJANGA	56,159	223,126	36,108	315,393
MAINTIRANO	0	4,181	291	4,472
MANAKARA	0	2,683	0	2,683
MANANJARY	0	0	0	0
MAROANTSETRA	0	0	9,747	9,747
MOROMBE	0	0	3,052	3,052
MORONDAVA	0	9,688	3,370	13,058
NOSY BE	28,870	45,510	170	74,550
PORT ST LOUIS	0	1,067	0	1,067
TOAMASINA	2,285,482	61,292	86,885	2,433,659
TOLAGNARO	1,374	74,919	0	76,293
TOOARA	90,069	42,585	1,984	134,638
VOHEMAR	7,290	57,703	180	65,173
Total	2,521,726	741,187	153,519	3,416,432

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Table 5 Port Facilities in Madagascar

Port	Quay		Sheds (m ²)	Open Yards (m ²)
	Length (m)	Depth (m)		
Toamasina	706	8.5-10.5	45,070	75,225
	314	6-8		
	-	12		
Antsiranana	301	8.5	8,379	5,638
	62	4.5		
	51	2		
Mahajanga	586	2	16,713	5,290
Toliara	150	7-8	4,496	7,450
	60	3		
Morobe	-	-	2,319	3,681
Maroantsetra	-	-	450	
Morondava	107	2	3,000	2,028
Vohemar	100	5-7	1,400	7,521
Antalaha	-	-	1,085	4,443
Maintirano	18	1	40	500
Antsohihy	180	0-3	600	8,894
Port St.Luis	198	3	9,997	2,000
Nosy-be	290	2-3.5	3,484	10,431
Mananjary	180	2.5	3,295	880
Manakara	365	1.5	7,365	5,718
Tolagnaro	145	2.5	2,896	3,500

Toamasina Port Company (SPAT) administrates Toamasina port. Toamasina port handles 75% of the total volume of the port cargo in Madagascar. Toamasina port has a large-sized quay (-12m) and a large water basin.

The current utilization rate of the quay of the Toamasina is 50%. If the freight increases without the expansion of the harbor facilities, a long queue of ships will be formed. The damage this would cause to industry, lives, and trade are immeasurable.



Figure 8 Quays in the Toamasina Port

However, Toamasina port has sufficient space for the development. There are also sufficient water resources, uncontaminated air, etc., along the route to the capital city.

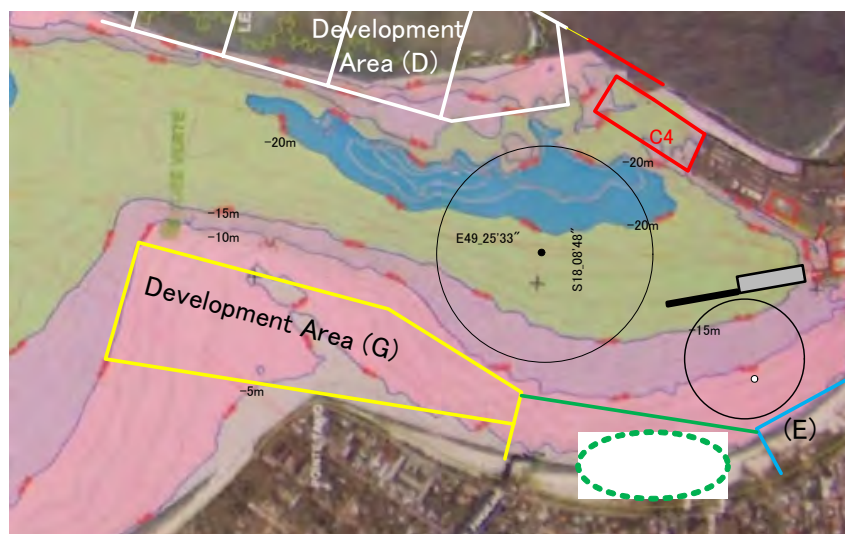


Figure 9 Areas which have Development Potential in Toamasina Port

Some parts of the coral of the Grand Reef, and the Hastie Reef will be lost to develop Toamasina port. However, there are three untouched coral reefs in the vicinity of Toamasina port. There is also the Coral barrier that stretches 300km in the southern part of Madagascar. Considering the important role of Toamasina Port in the nation's economy, utilization of the two coral reefs should be granted.

- **The necessity of port expansion**

Madagascar receives support from the IMF, the World Bank and the global community, and aims at becoming a self-sustaining economy. The action plan is shown in Madagascar Action Plan 2007-2012(MAP2007-2012).

The rehabilitation of the transportation infrastructure and the promotion of foreign investment are identified as key issues for achieving this aim. The rehabilitation of the function of the government office, rehabilitation of the financial system, and the rehabilitation of the education system are also important.

So far the rehabilitation works have been successful.

However, due to the influence of Lehman Brothers shock and the confusion caused by the sudden political change of Madagascar in 2009, the economy of Madagascar has been in decline.

As of November, 2009, the Malagasy Action Plan is in a state of suspension.

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Table 6 Targets of MAP and the Economic Indicators

Indicators	2005	2012
Annual Inflation rate (%)	11.4	5
Budget deficit (% of GDP)	4.3	3
Central Bank credit to government (% fiscal revenue of the last year)	10	5
Foreign currency reserves (in imports month)	2.9	6
Current account balance (% of GDP)	-11.7	-8
Total public debt (% of GDP)	81.4	60
Economic growth rate (%)	4.6	7 to 10
Investment rate (% of GDP)	22.5	30
GDP per capita (USD)	309	476

However, the current recession is a short-term phenomenon. From the long term view, economic growth of Madagascar will be realized, if the government aims at a stable and open economy.

The development of Toamashina port has a very important role in allowing Madagascar to become a self-sustaining economy.

● **The Target Year**

The target year of the study is 2020. Accordingly, the port facilities corresponding to the freight demand and port system is examined. The urgent components are selected based on the results.

The public private partnership (PPP) will play an important role in this project in providing both funds and know-how. The Port of Toamasina has already cooperated with the mining project of Anvatovy, and the container project of MICTSL. Oji Paper will start plantation of woods and exportation of the wood chips.

● **Cargo demand**

The cargo demand estimated by the study team is indicated in Table 7. The container volume in 2020 is estimated at 420,000 TEUs which is three times the present volume.

Table 7 Cargo Demand in 2020

Item		Unit	Present Figure		Growth Rate (%)	Forecast		
			Throughput	(Year)		2015	2020	
Congtainer Cargo		TEU	143,307	(2008)	10%	264,562	426,079	
Bulk & General Cargo	Conventional Cargo	TON	566,148	(2007)	3%	848,535	983,685	
	New Project	Ambatovy Pro.	TON	—	—	—	3,100,000	3,100,000
		Oji Paper Pro.	TON	—	—	—	—	201,600
	(Subtotal)		TON	(566,148)	(2007)	—	(3,948,535)	(4,285,285)
Liquid Cargo		TON	621,923		2%	728,682	804,524	

● **The Urgent Development Plan**

C4 Quay will be constructed to meet the container demand. C4 Quay will have a draft of -14m, length of 320m which can accommodate 40,000dwt container vessels with 3,200 TEUs containers.

The length of the extension of breakwater is 345m. In spite of the open mouth which extends for 150 m, the workable days at the quay will reach 95%.

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To make up for the lack of space behind the quay, the Hastie Reef will be reclaimed and utilized as a container yard (10 ha), although the distance from the C4 quay is 1,000m.

The traffic bottleneck will be removed by the relocation of the facilities. The deepening of the existing C1,C2,C3 berth to -13~-14m will be implemented. An overpass will be created at the No1 gate because the railroad wagons laden Anvatovy freight would interfere with the car traffic.

A container volume of 420,000TEU will be handled in 2020 by the above arrangement. The majority of the dry cargo except Anvatovy Cargo will also be handled at C1, and C2 quays.

The SPAT will implement the civil portion.

MICTSL will implement cargo-handling machines and ancillary facilities.

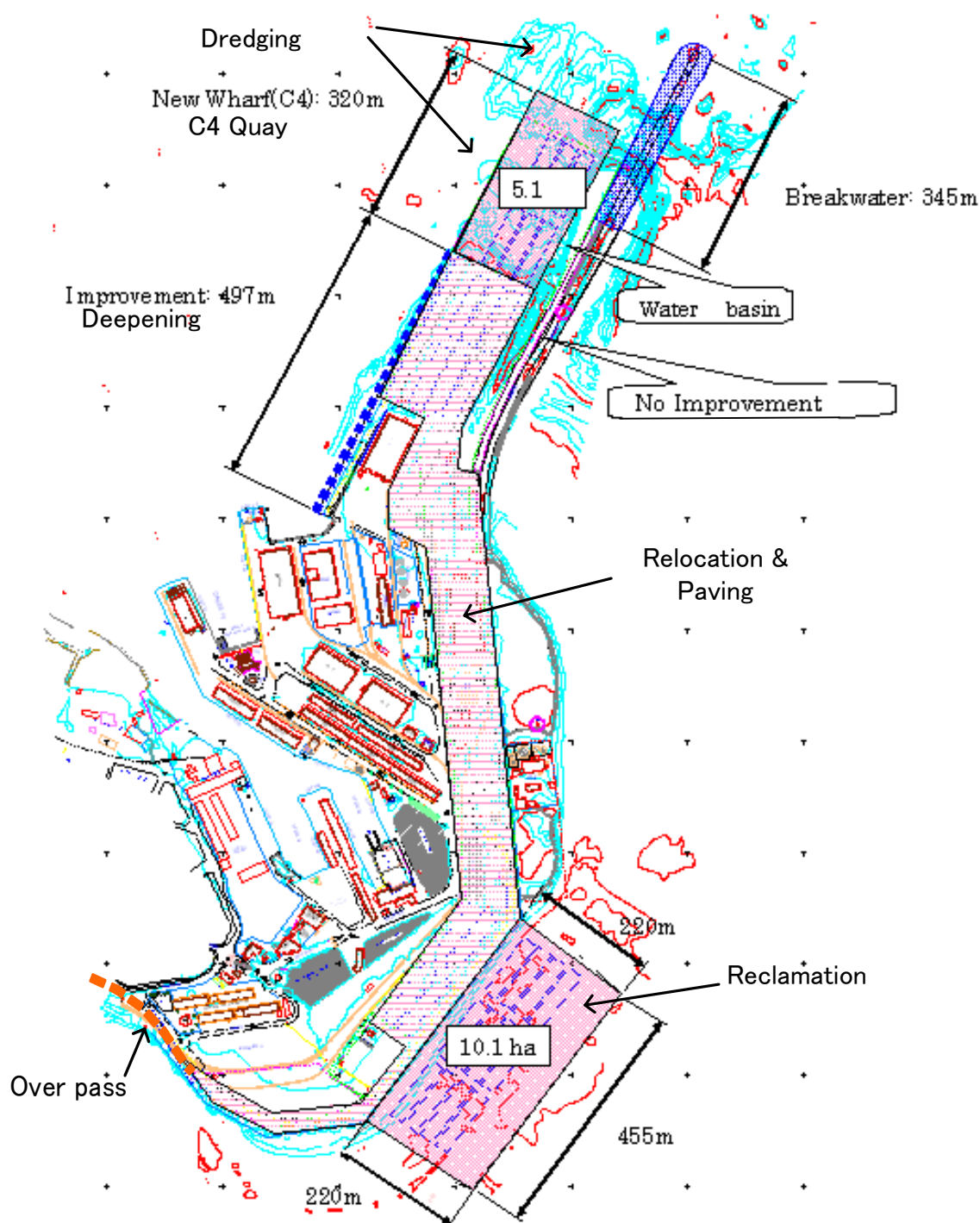


Figure 10 Urgent Development Plan

Table 8 Urgent Development Plan

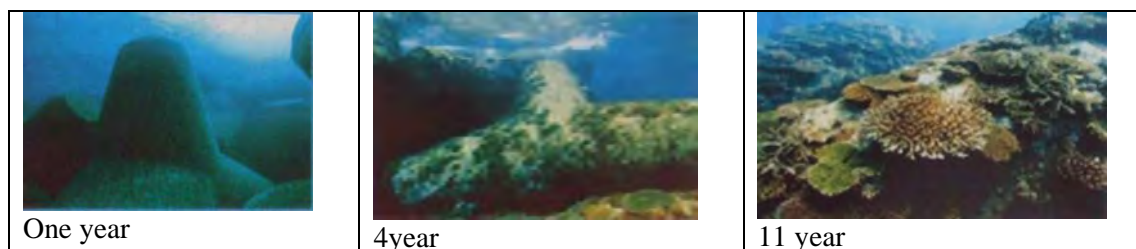
Facility	Cost: EURO(million)	Responsible Organization
(Urgent Development Plan)		
Breakwater (345m)	42.7	SPAT
C4 Quay(-14x320m)	55.4	SPAT
Reclamation 10ha	25.6	SPAT
Relocation & Paving	15.3	SPAT
Dredging (143,000m ³)	3.8	SPAT
Deepening (C1,C2,C3)	9.8	SPAT
Over Pass (at No1 gate)	10.5	SPAT
Environment Protection	4.2	SPAT
Engineering Cost(Civil)	11.7	SPAT
Hargo Handling Machine	41.1	MICTSL
Total (Urgent Development Plan)	220.1	

(Note) this table does not contain price escalation

The breakwater should be stable enough to withstand high waves because strong cyclones attack Toamasina. The quay has a deep draft. Accordingly, the construction cost will be high. However, the Urgent Development Plan is designed to obtain the biggest return from the smallest investment.

Based on the economic and financial analyses conducted by the study team, the Urgent Development Plan is economically and financially feasible. Economic internal rate of return (EIRR) is 14%. Financial internal rate of return FIRR is 6%. With the expected increase in freight, the balance of the income between the stakeholders will change in the future. The tariff structure of the port must be revised to ensure that operators and shipping companies as well as SPAT attain appropriate profits.

The construction work of the Urgent Development Plan will be carried out in a manner that will prevent the proliferation of muddy water, noise, and the harmful exhaust gas from the cars. When toxic substances such as PCBs are found in the dredging area, the soil containing those toxic substances will be dumped in an area surrounded by watertight walls, and capped to prevent leakage. When the coral of a precious type is going to be buried by a breakwater and quay, the stock should be transferred beforehand at an appropriate place. The blocks with the hollows or the mesh on which it is easy to form epiphytes will be used. The coral will regenerate in four years provided that the muddy water does not reach the area where the corals inhabit.



(Okinawa, Naha port)

Figure 11 The Ggrowth of Corals

The completion of the Urgent Development Plan is targeted for 2017. However, if the port becomes full, and waiting time increases again, the additional facilities must be built immediately after the Urgent Development Plan.

The 2020 plan

The additional project is called the 2020 plan. The contents are as follows

- Extension of C4 Berth (150m)
- Additional landfill (16ha)

By the above measure, bulk handling capacity and the container handling capacity will increase and queues will be alleviated.

Table 9 Cost for the Year 2020 Plan and Responsible Organization

Additional Port Facility (after 2017)		
C4-annex (+150m)	26.0	SPAT
Reclamation (+)16ha	41.0	SPAT
Engineering (Civil)	4.7	SPAT
Cargo Handling Machine	23.2	MICTSL
Total	94.9	

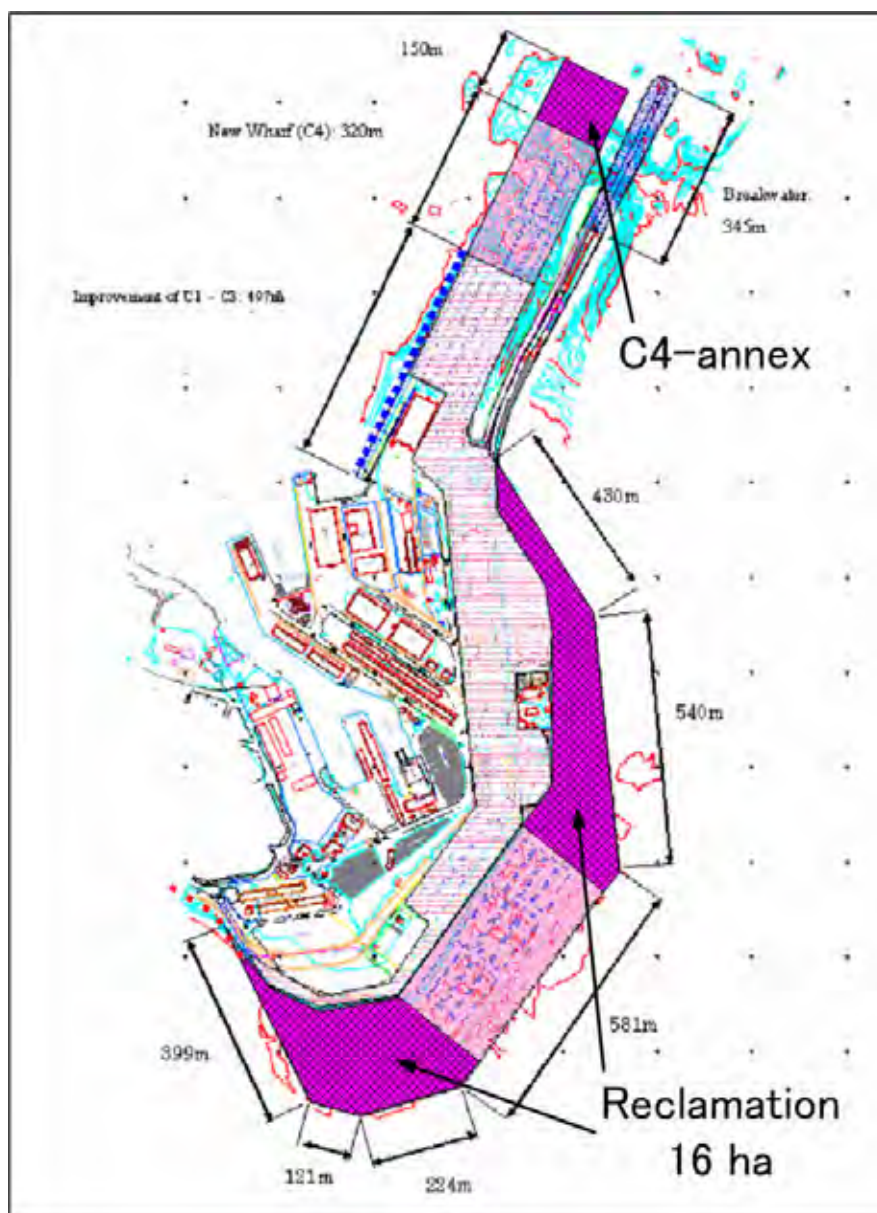


Figure 12 2020 Plan

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A proposal on improving the environment is included in the 2020 plan. The necessity of the plan should be re-examined after the completion of the Urgent Development Plan. The contents of the proposal are as follows.

- (1) To reduce traffic congestion and the exhaust gas, a bypass road (a toll road) of 10km will be constructed.
- (2) To avoid deterioration of the quality of water in the port, a canal (2km) along the beach will be excavated.
- (3) To prevent the erosion of the Tanio Point, an offshore groin / jetty (500m) will be constructed.

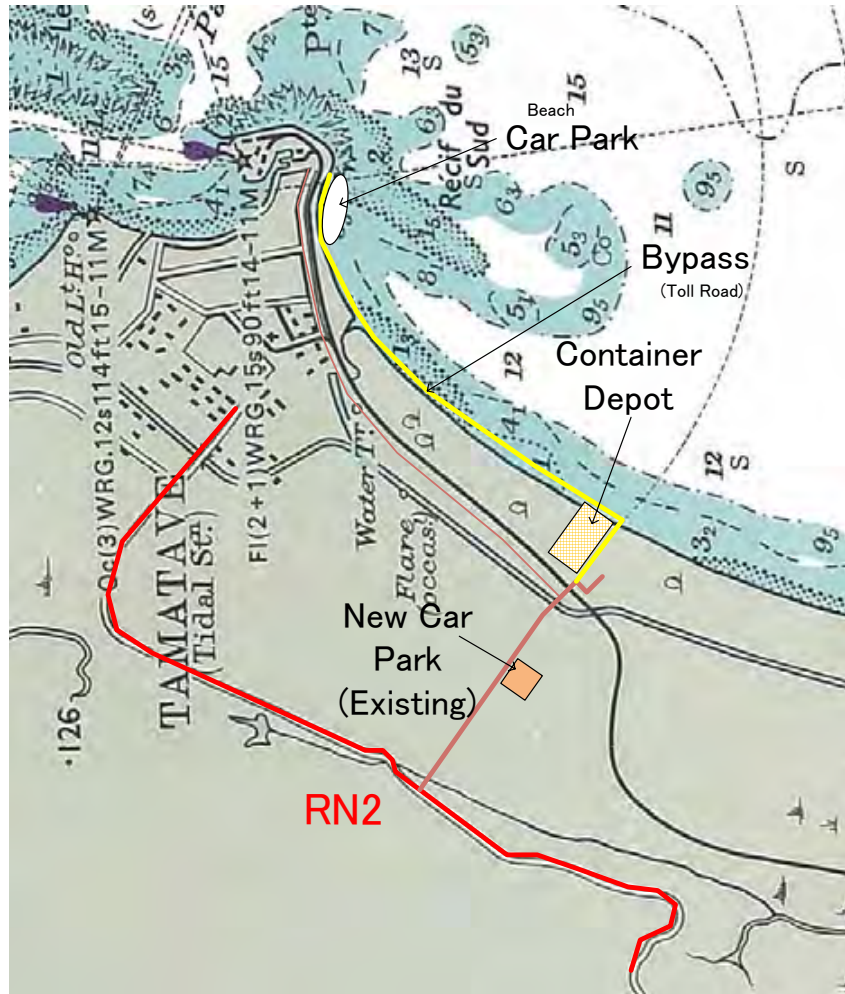


Figure 13 The Route of By-pass Road

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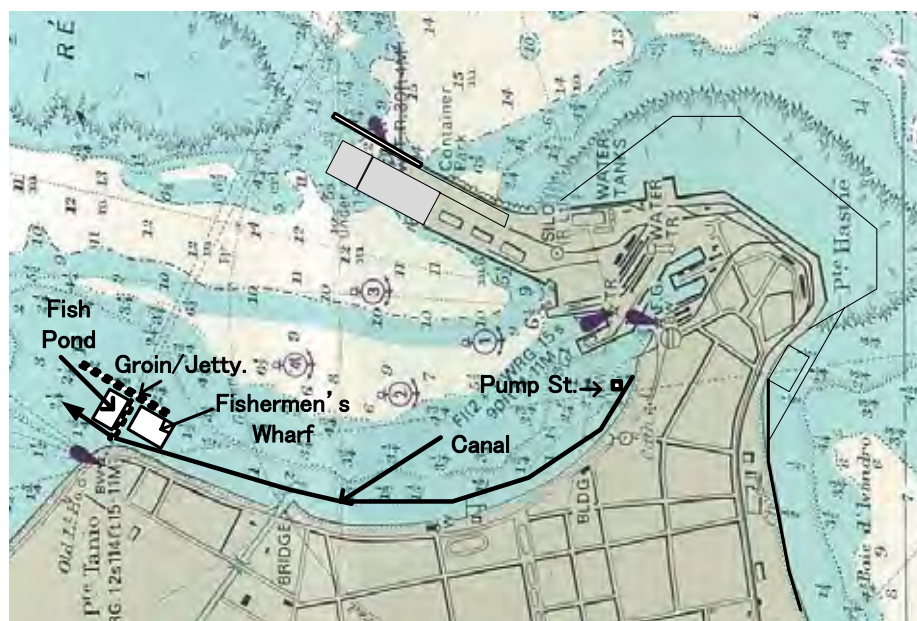


Figure 14 Canal Route

Table 10 The cost for the Related Project

Facility	Cost: EURO (million)
By-pass road (B=25mx10km)	51.8
Car Park and Beach	9.8
Canal (B=15mx2km)	5.8
Groin for erosion protection	1.8
Engineering	4.8
Total*	74.0

*Escalation is not included

The overall schedule is presented in Figure 15.

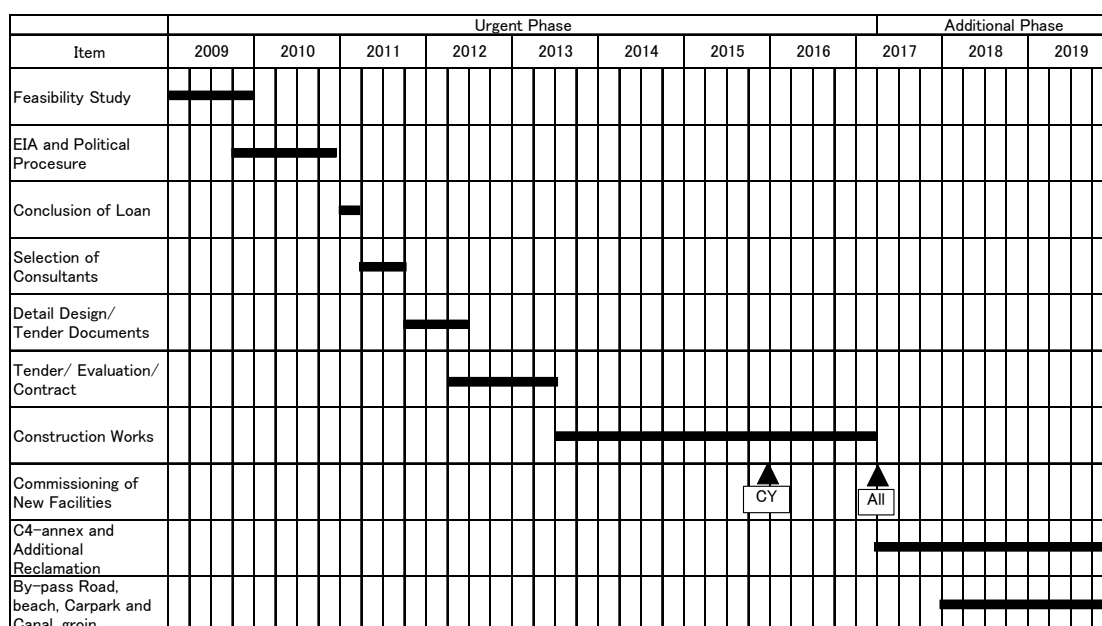


Figure 15 The Overall Schedule

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The effect index of the Urgent Development Plan should be as follows:

- Increase of the harbor freight,
- Decrease of the waiting time of ships,
- Increase of calls from large vessels

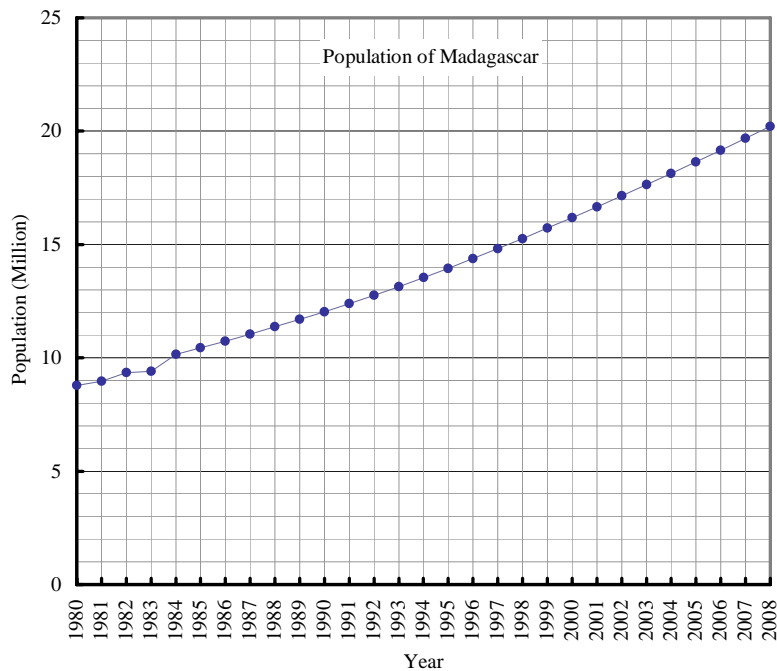
The financial status of the SPAT will remain sound.

However, the surplus should be used for the preparations for the next stage project (e.g., the acquisition of the site, compensation).

Chapter 1. Background of the Project

1-1 Overview of Social and Economic Conditions

Madagascar locates south-east offshore of African continent, and has 587,041 sq.km land area and 1.967 million populations (data source: WB 2007). Capital of Madagascar is Antananarivo which locates at center of the island and has approximately 1.5 million populations. Figure 1-1-1 shows the growth of population of the country. During the period from 1984 to 2008, the population has increased doubled. Recent growth rate shows approximately 3 %.



(Source : World Economic Outlook Database, April 2009, IMF)

Figure 1-1-1 Population of Madagascar

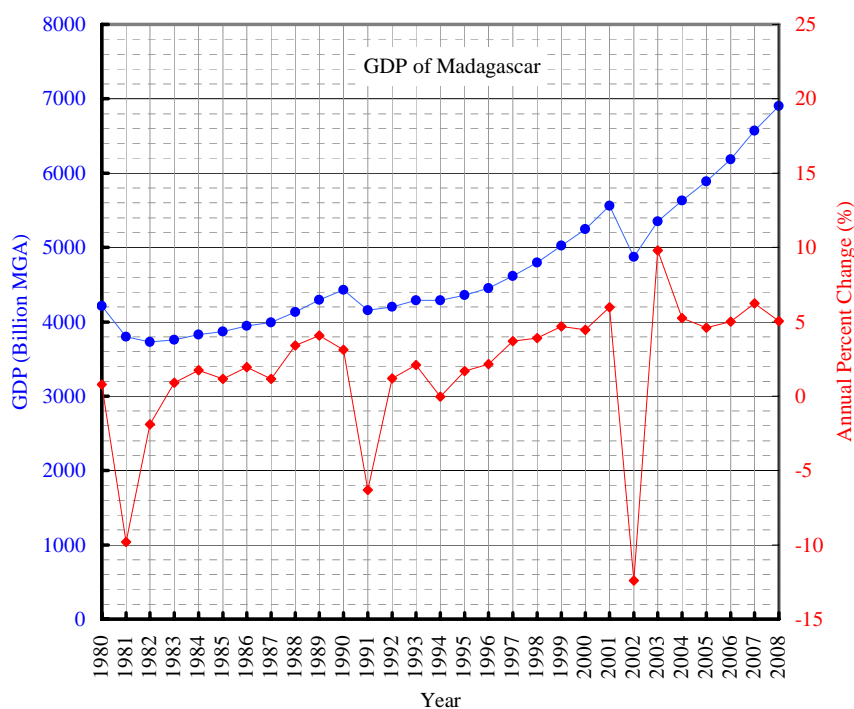
Figure 1-1-2 shows GDP and its growth rate of Madagascar. The principal industry of Madagascar is agriculture. Recently natural resources such as nickel mine or wood plantations are forced by foreign investors, and their development projects are processing. Since middle of 1990's, the government has made various efforts to push up national economy which includes privaterization of public organizations, development of foreign investment by changing national laws, and liberalization of foreign trade. These government policies reflected to the economic growth of the country and GDP has grown with higher range since late 1990's.

In 2002, Madagascar suffered economic stagnation which was caused by political confusion related to the election of the president. The growth rate of GDP dropped to -12.7% this year. However after 2003, growth of economy became steady according to the normalization of industrial activities. Recent growth rate of GDP is approximately 5 - 6 %. WB announced the growth rate of Madagascar at 6.2% for 2007.

In March 2009, the present president Andry Rajoelina overthrew the former president Marc Ravalomanana receiving the support of the military. The new government has launched but it has not received the authorization by international societies as of end of 2009. This political turmoil has caused the cancellation of textile orders and crippled tourism which are the main industry of the

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country to earn foreign currencies. The domestic industries are waiting for early solution of this political issues.



(Source : World Economic Outlook Database, April 2009, IMF)

Figure 1-1-2 GDP and Growth of Madagascar

Table 1-1-1 shows the government finance of Madagascar in 2007. In the revenue, the share of tax revenue 1,573 billion MGA shows high rate 61 %. According to the latest statistics, domestic tax revenue and import tax revenue during the period Jan. - Jun. 2008 were 521.2 billion MGA and 493.5 billion MGA respectively. These figure shows that the import tax revenue share high weight, 49 % of total tax revenue. On the other hand, Foreign revenue which is identified as financial assistance from overseas was 901 billion MGA. This value share 35 % of total revenue.

Looking at breakdown of expenditure, salary 711 billion shares 27 % of total. Accordingly otehr expenditures were, operational cost was 432 billion (17 %), investment was 1,049 billion (40 %) and others were 400 billion (15%). Payment of loan interest 155.6 billion MGA was 6 % of total government expenditure.

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Table 1-1-1 Government Finances of Madagascar 2007 (Billion MGA)

Revenue		Expenditure	
Domestic Revenue		Salary	711.2
Tax Revenue	1,573	Operational Cost	432.4
Non-Tax Revenue	35	Investment	1,049.9
Domestic Investment	83	<i>(Domestic Investment)</i>	<i>(314.9)</i>
Revenue by Private Fund	2	<i>(Foreign Investment)</i>	<i>(73.5)</i>
Others		Others	400.3
Foreign Revenue		<i>(Payment Loan Interest)</i>	<i>(155.6)</i>
Grant Aid	593		
Loan	308		
Revenue Total	2,594	Expenditure Total	2,594

(Source: Mid-Term Monitoring of MAP 2007~2012, issued on 08 Sept. 2008)

Table 1-1-2 shows the details of overseas financial assistance. Madagascar is receiving large amount of assistance from IDA (International Development Association ; an entity of World Bank Group) and EU. Japanese assistance 14.4 billion MGA was 1.7 % of total assistance in 2007.

Due to political turmoil occurred in early 2009, all international donors have suspended the assistance to Madagascar since March 2009 and are waiting for constitutional election of new president of the country. In August 2009, a meeting for solution was held at Maputo Mozambique calling political leaders of Madagascar according to the guidance made by international societies; AU, SADC, OIF and UN. The leaders made an agreement on a power-sharing deal that will cede control of the country to an interim government with elections which shall be conducted commencing within 15 months.

Table 1-1-2 Financial Assistance from Overseas (Billion MGA)

Donor	2007	Jan.-Jun 2008
Multi-Countries		
IDA	310.0	128.3
EU	219.6	72.7
UNICEFF	46.6	33.9
MCC	-	24.9
AfDB	39.0	18.5
Others	39.8	16.5
Bi-Country		
France AFD	33.6	16.7
Japan	14.4	16.3
Germany	17.7	9.8
USAID	-	24.8
China	-	46.5
Others	138.0	-
Total	858.7	408.9

(Source: Mid-Term Monitoring of MAP 2007~2012, issued on 08 Sept. 2008)

1-2 Overview of Transportation in Madagascar

Figure 1-2-1 shows the transportation network of Madagascar. Madagascar has 8 major airports, 16 government ports, 895 km of railway truck, and 31,612 km of roads.

1-2-1 Road Network

Roads in Madagascar are categorized as follows.

Primary National Roads.....	2,560 km
Secondary National Roads.....	4,753 km
Temporary National Roads.....	4,549 km
Provincial Roads.....	12,250 km
Communal (Local Government) Roads.....	7,500 km
Total.....	31,612 km

Of all these roads, only 5,855 km are currently in good or fair condition. Paved roads are 4,074 km in total, from which the ratio of paved to total National Roads is calculated at 34 %.

For other data, WB calculated in Africa Development Indicator 2008/09 that the total road network length is 49,827 km, in which 11.6 % is paved.

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Figure 1-2-1 Transportation Network of Madagascar

There are many seasonal roads (shown in the Figure 1-2-9 by pink colored lines) which allow traffic in dry season. In terms of access between capital regions and ports, only three ports; Toamasina, Mahajanga and Toliara have all seasons access by roads.

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1-2-2 Train Lines

The railway network of Madagascar consists of Northern and Southern Railways.

The Northern Railway has 732 km truck length in total. The truck connects Toamasina port and Antananarivo and Antsirabe. The operation of this line is handled by private operator MADARAIL under the concession contract with government made in 2003.

The southern Railway has 163 km truck length and connects Fianarantsoa and Manakara port.

1-2-3 Airports

Madagascar has 8 major airports. According to the government policy “Open Sky” 10 international carriers opened regular line or its under preparation. The name of airlines areas follows.

Air France, Corsair, Air Italy, Blue Panorama, NEOS, Air Austral, Air Mauritius, AirlinK Regional, Comores Aviation, and Royal Aviation

For domestic air routes, only Air Madagascar has regular routes.

1-2-4 Ports

Madagascar has 16 government controlled ports. International ports are Toamasina Port, Antsiranana Port, Mahajanga Port, and Toriara Port. Other ports are handling domestic cargoes or feeder cargoes passing through these international ports. In these ports Toamasina Port is main port of the country which handles most of the international cargoes.

1-3 Present Status of Port Sector in Madagascar

Table 1-3 shows port statistics of 2007, and Table 1-4 shows the container throughput of each port in Madagascar. From tables, Toamasina port handled 2.4 million tones of cargo in 2007 which equivalent to 71 % of total cargo of the country. Particularly for international cargo of Toamasina; 2.3 million tons was 91 % of the total.

For container cargo, Toamasina port handled 112,425 TEU in 2007 which was 83 % of total cargo of the country.

Table 1-3-1 Port Statistics of Madagascar 2007 (Unit : Ton)

Name of Port	International					Domestic (Cabotage)					Coastal (Borinage)					Grand Total
	Loaded		Unloaded		Total	Loaded		Unloaded		Total	Loaded		Unloaded		Total	
	Solid Cargo	Liquid Cargo	Solid Cargo	Liquid Cargo		Solid Cargo	Liquid Cargo	Solid Cargo	Liquid Cargo		Solid Cargo	Liquid Cargo	Solid Cargo	Liquid Cargo		
ANTALAHA	0	0	0	0	0	9 428	0	6 049	0	15 477	7 432	0	4 295	0	11 727	27 204
ANTSIRANANA	35 459	0	17 023	0	52 482	76 022	33 790	73 875	16	183 703	0	0	0	0	0	236 185
ANTSOHIHY	0	0	0	0	0	9 068	9 140	1 045	0	19 253	0	0	5	0	5	19 258
MAHAJANGA	40 321	0	15 839	0	56 159	75 598	66 971	77 496	3 061	223 126	5 593	0	30 515	0	36 108	315 393
MAINTIRANO	0	0	0	0	0	2 510	0	1 671	0	4 181	291	0	0	0	291	4 472
MANAKARA	0	0	0	0	0	2 613	0	70	0	2 683	0	0	0	0	0	2 683
MANANJARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAROANTSETRA	0	0	0	0	0	0	0	0	0	0	5 763	0	3 984	0	9 747	9 747
MOROMBE	0	0	0	0	0	0	0	0	0	0	154	0	2 898	0	3 052	3 052
MORONDAVA	0	0	0	0	0	3 646	5 025	1 017	0	9 688	1 845	0	1 525	0	3 370	13 058
NOSY BE	18 721	2 141	8 008	0	28 870	19 086	20 333	6 091	0	45 510	154	0	16	0	170	74 550
PORT ST LOUIS	0	0	0	0	0	586	0	481	0	1 067	0	0	0	0	0	1 067
TOAMASINA	1 105 396	451 444	558 163	170 479	2 285 482	23 566	0	37 726	0	61 292	19 341	0	67 544	0	86 885	2 433 659
TOLAGNARO	1 374	0	0	0	1 374	44 233	16 835	13 851	0	74 919	0	0	0	0	0	76 293
TOLIARA	81 281	0	8 788	0	90 069	7 364	19 506	15 715	0	42 585	1 387	0	597	0	1 984	134 638
VOHEMAR	1 084	0	6 206	0	7 290	33 794	15 633	8 276	0	57 703	0	0	180	0	180	65 173
Total	1 283 636	453 585	614 027	170 479	2 521 726	307 514	187 233	243 363	3 077	741 187	41 960	0	111 559	0	153 519	3 416 432

(Source APMF)

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Table 1-3-2 Port Container Throughput Statistics of Madagascar (Unit : TEU)

Name of Port	2003	2004	2005	2006	2007
ANTSIRANANA	6 602	7 510	7 264	5 753	4 719
MAHAJANGA	12 416	10 669	9 232	10 472	10 720
MORONDAVA	-	-	320	262	249
NOSY BE	1 472	2 444	2 209	2 289	2 320
TOAMASINA	94 847	102 306	116 615	92 529	112 425
TOLAGNARO	1 259	1 737	678	39	227
TOLIARA	4 833	6 804	4 251	2 102	2 711
VOHEMAR	-	-	-	599	1 354
TOTAL	121 429	131 470	140 569	114 045	134 725

(Source : APMF)

Chapter 2. Natural Conditions and Field Survey

2-1 Natural & Maritime Conditions

2-1-1 Meteorological Conditions

(1) Overview of Climate

The climate in Madagascar is dominated by the southern trade winds and Toamasina in the east coast is categorized into the east tropical wet forest climate, that is created by the trade winds.

(2) Temperature and Rainfall

Average temperature in Toamasina is 24°C annually, 26 °C in rainy season and 22°C in dry season. Annual rainfall in Toamasina averages more than 4000mm.

(3) Winds in Toamasina

The predominant wind directions are ESE and SE quadrants that occupy about 50% of the total occurrence.

(4) Cyclones

Almost cyclones generated in eastern Indian Ocean moved to Madagascar. The maximum wind speed of the 100-year return period is estimated to be about 89m/sec.

2-1-2 Marine Conditions

(1) Tides

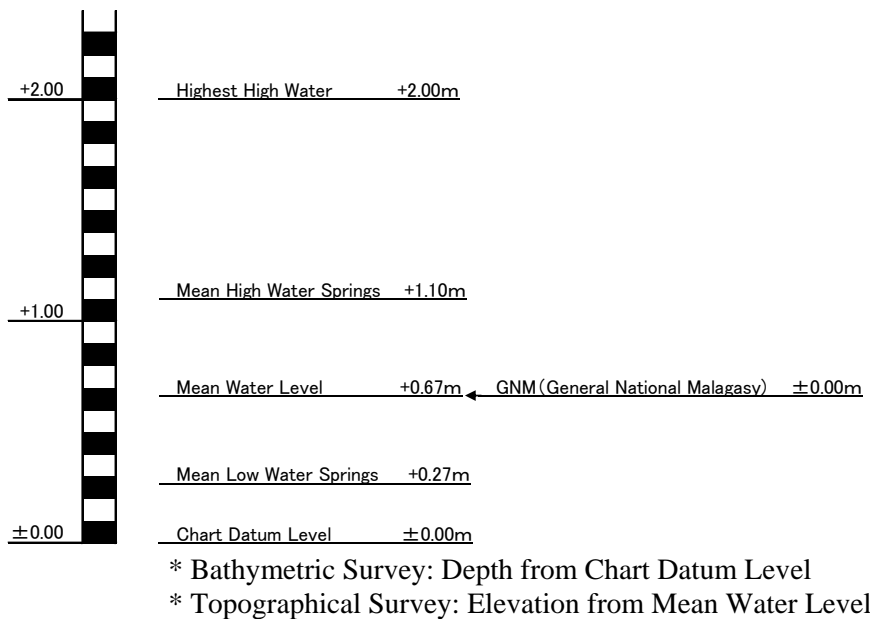


Figure 2-1-1 Tide Condition at Toamasina Port

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(2) Currents

The currents observation in the present study indicates hourly variation currents, currents toward Southern directions are predominant with the speed of about 10 cm/s to 30 cm/s. The currents in the port area shows similarity to the surveys conducted in 1981.

(3) Wave

1) Observed Waves

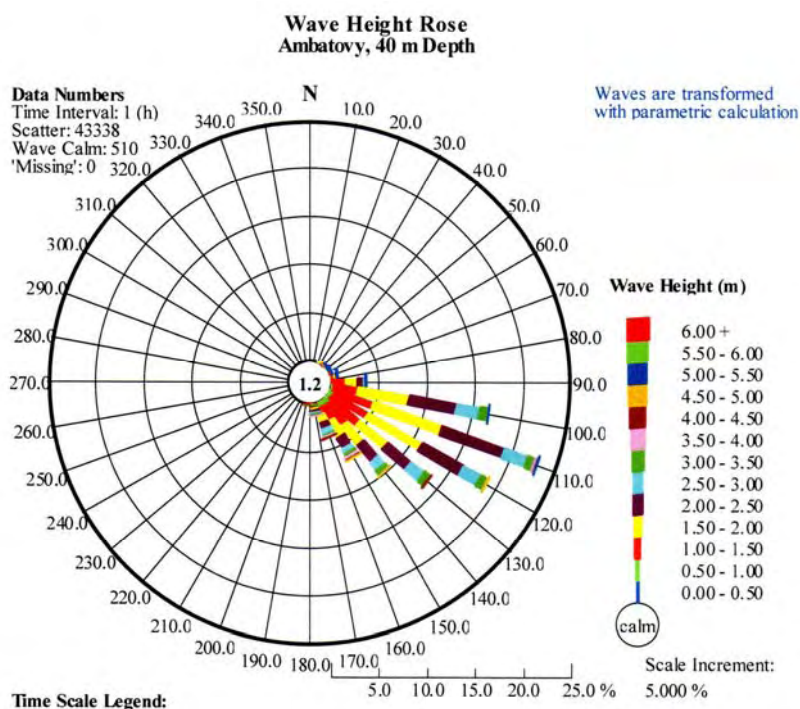
The average significant wave height in the observation period is about 0.5m behind the Grand Recif and 1.0m in the open sea. Mean wave periods corresponding to each wave at two different locations are 7 or 8 seconds and 8 or 9 seconds respectively.

The average wave height and period at the two locations are summarized in the following table.

Tide	Wave Height at No.2 (m)	Wave Height at No.1 (m)	Wave Period at No.2 (sec.)	Wave Period at No.1 (sec.)
Low Tide	1.78	0.44	7.54	4.82
Mean Tide	2.04	0.49	7.97	5.32
High Tide	2.28	0.61	8.21	5.28

2) Offshore Waves (- 40m depth)

A wave height rose, distribution of wave height by direction and distribution of wave height by period are shown as follows:



(Source: W. F. BAIRD & ASSOCIATES)

Figure 2-1-2 Wave Height Rose offshore Toamasina Port at 40m Depth

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3) Design Offshore Wave

As a result of reviewing the JETRO report, the design offshore wave of the return period for 50 years is justified as the followings.

Dimensions of wave	
Height (H _o)	12 m
Period(T)	15 s
Directions	NNE-SSE

2-1-3 Soil Conditions

Profiles of subsoil in the project sites are illustrated as the following figures.

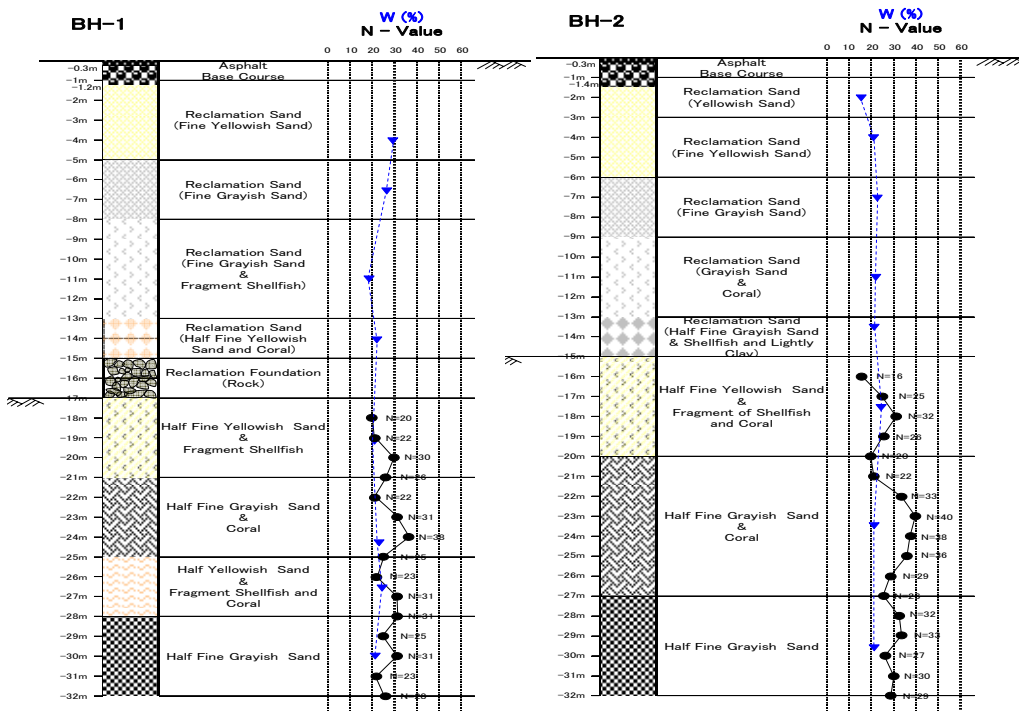


Figure 2-1-3 Soil Boring Log around Mole C

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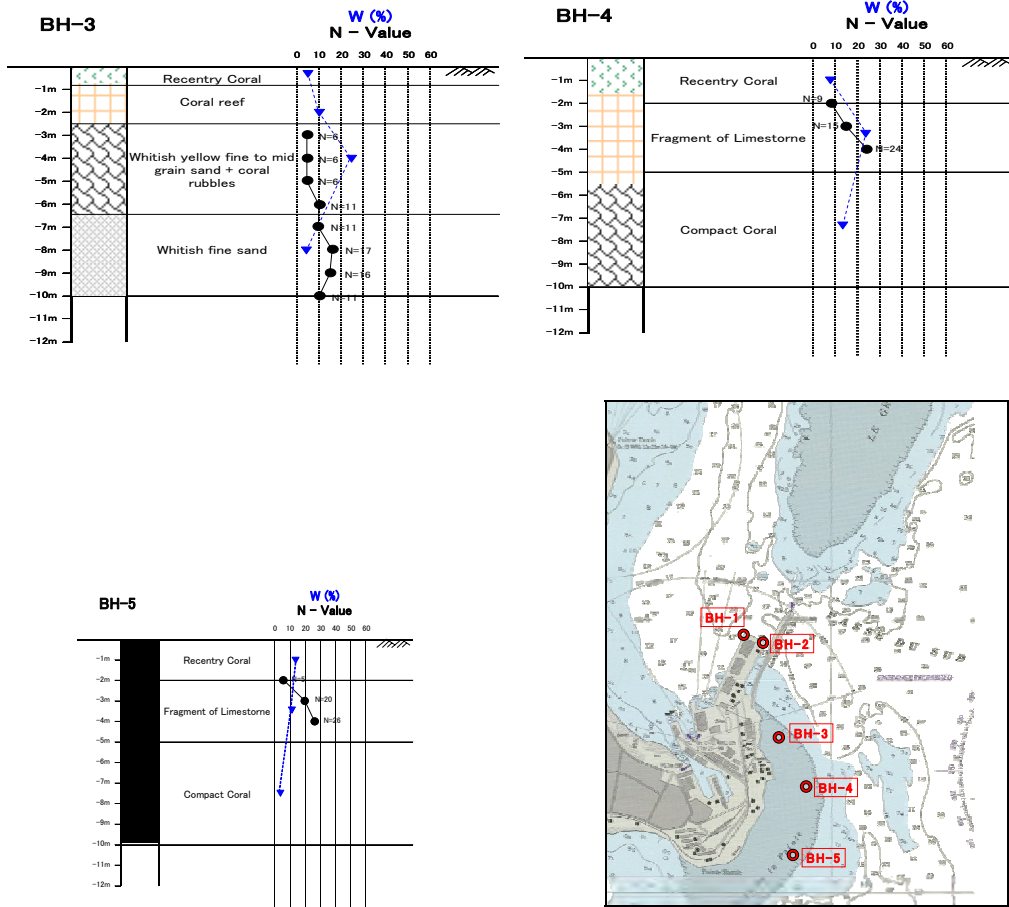


Figure 2-1-4 Soil Boring Log around Point Reef

Chapter 3. Cargo Demand Forecast

3-1 Socio-Economic Conditions of Madagascar

3-1-1 Population

The population of Madagascar in 2008 is 20 Million. Taking into account the IMF data (1990-2008), growth rate of population shows 2.9%. Figure 3-1-1 shows the population data and its growth curve.

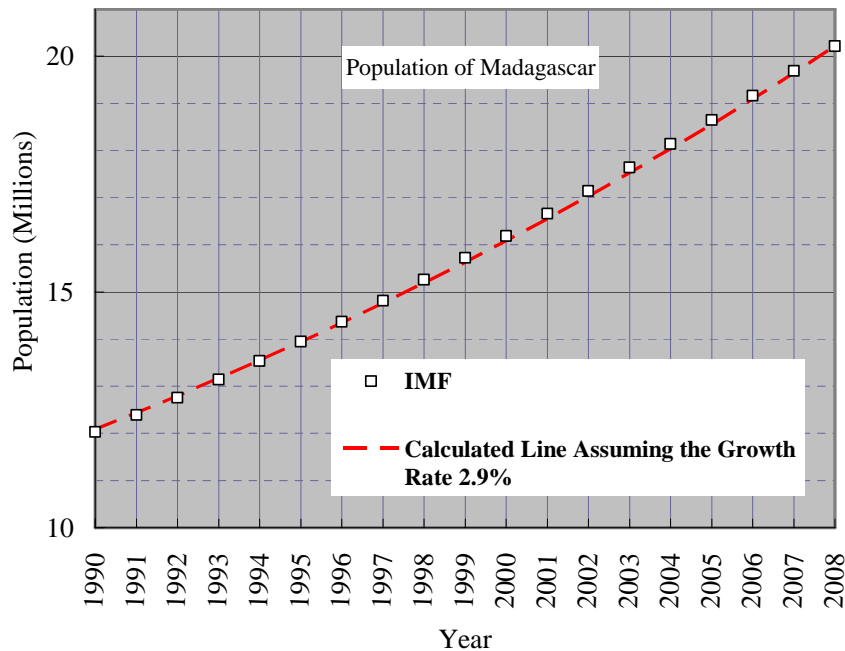
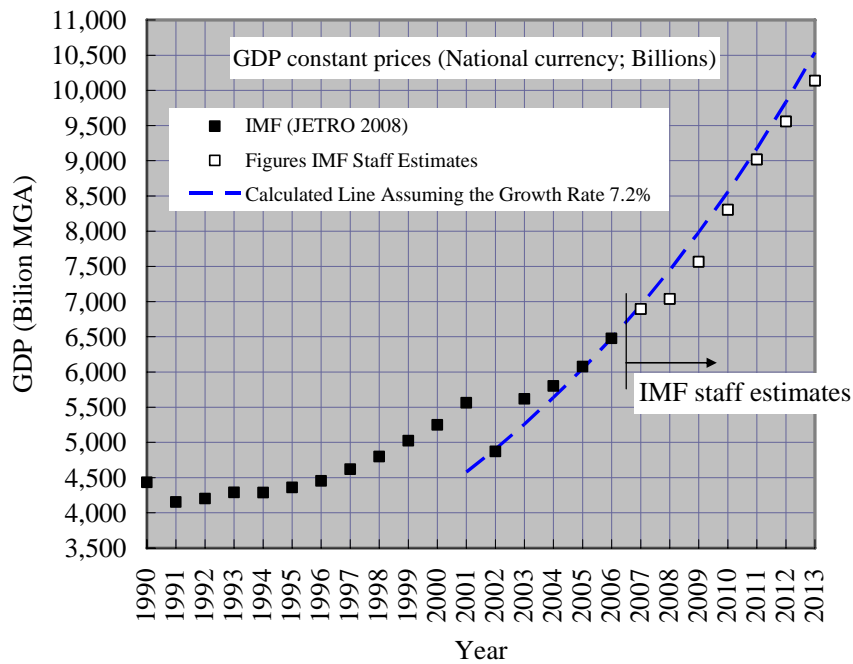


Figure 3-1-1 Population and Growth Curve

3-1-2 GDP

GDP of Madagascar in 2006 was 7 Billion MDA. In the past, the figure of GDP dropped in 2002, which is due to political troubles related to the election of the President. However this stagnation was broken through by new government, since then the growth of GDP keeps high rate recently.

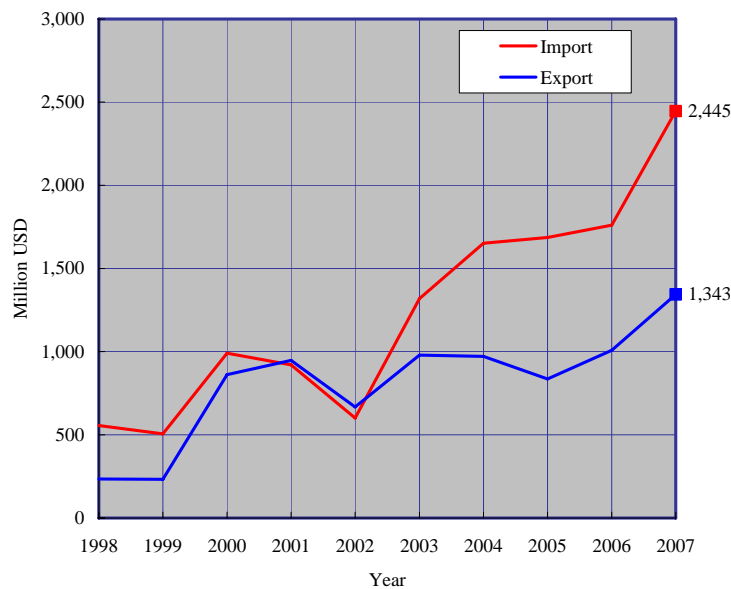
Madagascar Action Plan (MAP) issued in 2006 mentions that the target growth rate for 2007-2012 will be 8~10%. Similarly, IMF estimate the growth rate to be higher than 7.0 % as shown in Figure 3-1-2. Government issued the middle term monitoring report for MAP in 2008, where the growth rate in 2008 was estimated at 7.2%.



(National Currency; Billion MDA, Source : IMF)
Figure 3-1-2 GDP Constant Prices

3-1-3 Import and Export

Following Figure shows the data of import and export values. A trade imbalance is observed with import value predominating in Madagascar. Such trend seems to have begun in 2002 and the imbalance gap is still widening as long as these data is considered. Import value in 2007 was 2,445 million USD which was 80% higher than export value.



(Source : GTR, JETRO)
Figure 3-1-3 Import and Export Values of Madagascar

Major export commodities are apparel, seafood and spices in value base. Mineral and fuel are the major export commodities in quantity base. Major import commodities are oil, machinery and vehicles in value base. Oil, cement and rice are the major import commodities in quantity base.

3-2 Cargo Demand Forecast

3-2-1 Container Cargo

For container cargo forecast, the growth curve fitting was applied and the result was verified by several methods which were introduced in the past researches and forecast literatures. The result of forecast shows 10% growth rate. Figure 3-2-1 shows the predicted growth curve until 2020. The demand for 2020 is estimated at 426,000 TEU.

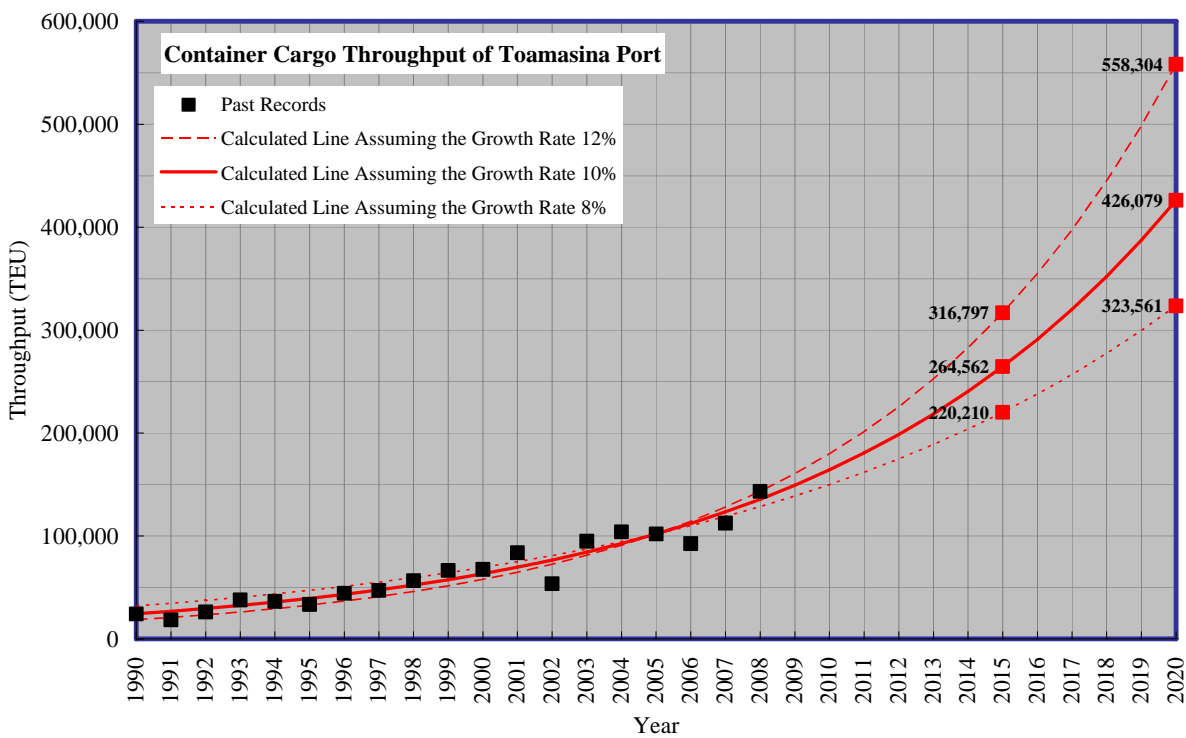


Figure 3-2-1 Demand Forecast of Container Cargo Throughput

3-2-2 Bulk & General Cargo

For bulk & general cargo forecast, appropriate curve fitting was applied to the past data. The result shows 3% growth is assumed. In addition, demand of new projects was added, which are for Ambatovy project and Woodchip export project by Oji Paper Co. Figure 3-2-2 shows the predicted growth curve until 2020. The demand for 2020 is estimated at 983,000 ton of conventional cargo, and 4.3 million ton including new projects demand.

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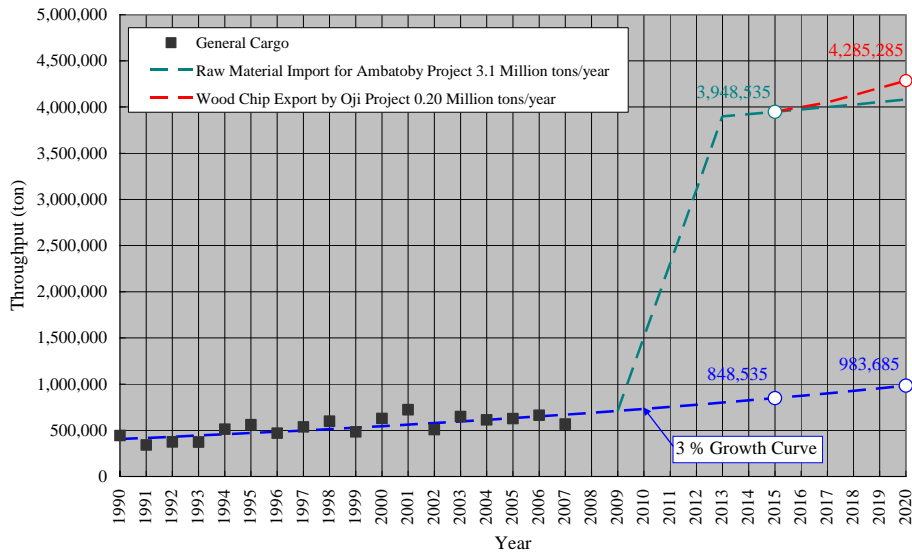


Figure 3-2-2 Bulk & General Cargo Forecast

3-2-3 Liquid Cargo

In Madagascar, Galana Oil had an oil refinery in Toamasina until 2003. Before then, Madagascar had imported crude oil, and produced petroleum product was consumed in the country as well as exported to surrounding country's market. Since 2004, upon closing of the refinery, crude oil import has been stopped, processed oils import has increased in exchange. As export of oils has been also stopped, handling volume of liquid cargo has been decreased in 2004.

The Figure 3-2-3 shows the future forecast of liquid cargo. Blue dotted line shows the future forecast assuming 2% growth. This growth rate is the prediction made by International Energy Agency (IEA) for oil demand in African region. When 2% growth rate is applied, the liquid cargo throughput in Toamasina port will mark 805,000 ton in 2020.

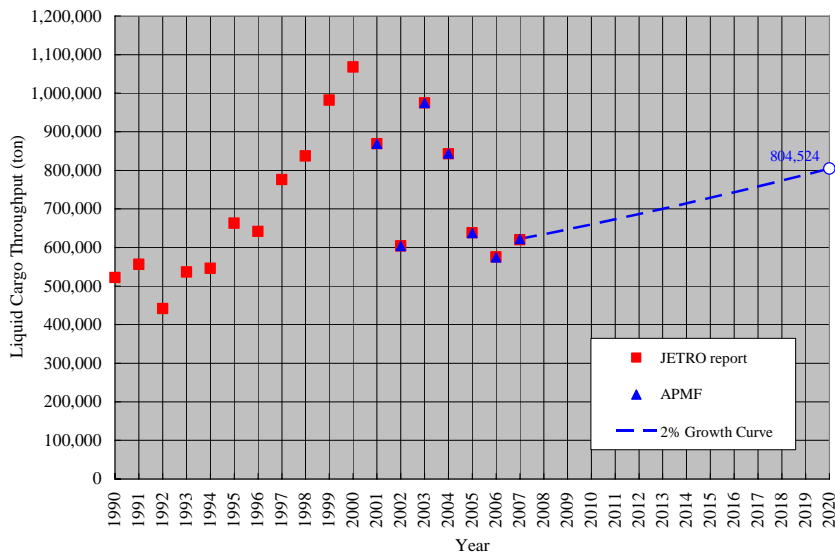


Figure 3-2-3 Liquid Cargo Throughput Data and Demand Forecast

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3-2-4 Summary

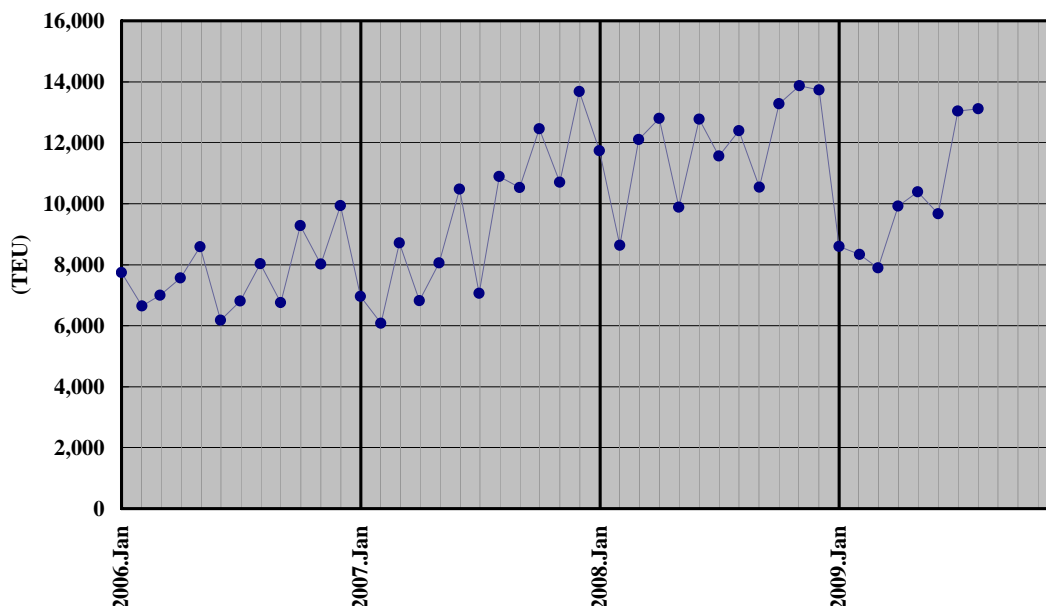
Table 3-2-4 shows the summary of cargo demand forecast.

Table 3-2-1 Summary of Cargo Demand Forecast

Item		Unit	Present Figure		Growth Rate (%)	Base Year for Forecast	Forecast		
			Throughput	(Year)			2015	2020	
Congtainer Cargo		TEU	143,307	(2008)	10%	2005	264,562	426,079	
Bulk & General Cargo	Conventional Cargo		TON	566,148	(2007)	3%	2004	848,535	983,685
	New Project	Ambatovy Pro.	TON	—	—	—	—	3,100,000	3,100,000
		Oji Paper Pro.	TON	—	—	—	—	—	201,600
	(Subtotal)		TON	(566,148)	(2007)	—	—	(3,948,535)	(4,285,285)
Liquid Cargo		TON	621,923	(2007)	2%	2007	728,682	804,524	

3-3 Influence due to Political Turmoil 2009

Due to political turmoil occurred in early 2009, cargo volume is foreseen to drop. Figure 3-3-1 shows the monthly throughput data of container throughput from 2006 to August 2009. The throughputs had firmly increased until the end of 2008, in which the peak value 13,900 TEU was recorded in November 2008. But since January 2009, throughput had recorded lower level, in which the volume of March was only 8,000 TEU. However, the figures of July and August have risen to 13,000 TEU which are the same level of 2008. If we assume the cargo volume in last quarter of 2009 remains 13,000 TEU, the annual throughput of 2009 will reach 133,000 TEU, which is 7% decrease to the 2008. Comparing to the large drop in 2002 due to the past political crisis was 36%, it seems the situation of 2009 is better.



(Source : MICTSL)

Figure 3-3-1 Monthly Throughput of Container Cargo

Referred Documents of Chapter 3

- 1) Madagascar Action Plan and Monitoring Report
- 2) Plan National de Transport (2004-2020) (*National Plan of Transport, in French*)
- 3) IMF, World Economic Outlook (*for GDP and Population*)
- 4) JETRO, Global Trade Atlas Database (*for Import & Export Statistics*)
- 5) APMF, Rapport d' Activite Portuaire 2007 (*Port Activity Report of All Ports in Madagascar*)
- 6) Containerisation International, ci-online information service (*for Container Statistics*)
- 7) OCDE, Changing World Port and Future Subject, 2006 (*for Verification of Forecast, in Japanese*)
- 8) MDS Database (*for Container Ship Regular Routes*)
- 9) Lloyd's Register Database (*for Ship Names & Dimensions*)
- 10) SMMC, Rapport d' Active 1995 – 2008 (*Activity Report, in French*)
- 11) JETRO, The Study on the Urgent Necessity of Expansion Project for Toamasina Port in the Republic of Madagascar, March 2008