

CHAPTER 3
ROADS AND BRIDGES SECTORS

CHAPTER 3 ROAD AND BRIDGE SECTORS

3.1 Present Situation of Roads and Bridges

The road network in East Timor is a ladder-shaped with the verticals being corridors running along the coastal line from east to west on both northern and southern sides of the island. These corridors are connected by five penetration south-north roads forming ladder steps (see Figure 3.1).

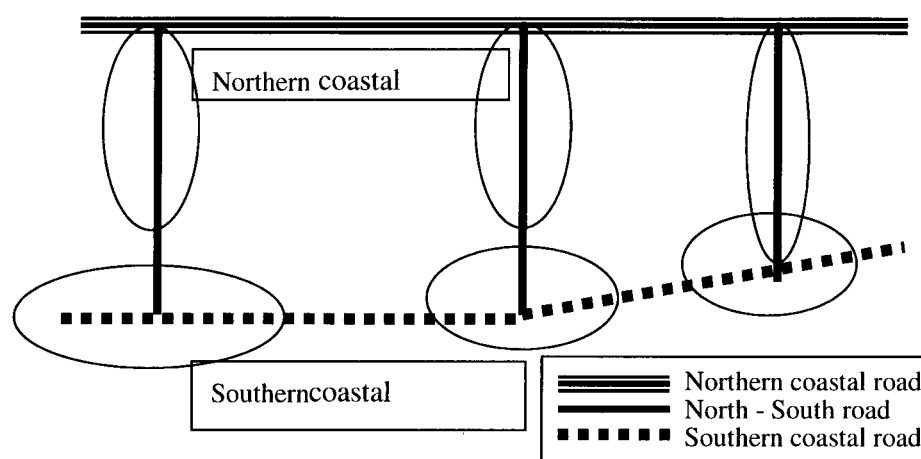


Figure 3.1 Concept of Road Network

During the Indonesian era, the roads were classified into national, provincial, and district roads. The arterial road network totals about 1,440 m of national/provincial roads and about 4,900 km of local roads with about 50 percent sealed (see Table 3.1). It has been reported about 450 bridges along arterial roads.

Table 3.1 Road Classification by Pavement Type

Classification During Indonesia Era	Definition of Terminology in this Report	Asphalt	Gravel Stone	Earth	Other	Total
National Road	Arterial Road	584				584
Provincial Road		761	100			861
District Road	Local Road	2,167	678	1,990	83	4,918
Total		3,513	777	1990	83	6,363

Unit:km

(1) Road Inventory Survey

The purpose of the Study is to formulate an urgent rehabilitation plan. Thus the road inventory survey is made along the arterial roads to determine road defects, deficiencies and damages requiring urgent restoration. In East Timor, most arterial roads run in

mountainous terrain, and the road standard applied is lower than Japanese standard one for a design speed of 20 km/h. The necessary road facilities, such as drainage, slope protection, bridges and slope protection, and safety devices are in poor conditions (see Table 3.2).

Table 3.2 Summary of Road Defect and Deficiency Per Inventory Survey

Type of Damage/Defect	Unit	Quantity
Cut Slope Slip Down		
Im-passable	l.m.	1,500
Debris occupied more than 1 m width	l.m.	7,250
Debris occupied less than 1 m width	l.m.	9,380
Buried side ditch	l.m.	62,500
Slip Down of Valley side shoulder		
Less than 1m depth	l.m.	1,110
Between 1 m to 3 m	l.m.	2,415
More than 3 m depth	l.m.	5,480
Land Slide		
Less than 1 m depth	l.m.	5,910
More than 1 m depth	l.m.	4,330
Damage or New Construction		
Bridge protection work	Each.	18
Pipe Culvert	Each	92
Inlet or outlet	Each	144
Ditch	l.m.	85,730
Pavement	l.m.	87,100
Shoulder	l.m.	61,700
Safety Device	l.m.	45,300
Overlay	l.m.	318,240

In addition to above survey, the road inventory survey within Dili City was also carried out and the survey result is summarized in Table 3.3. It is noted that all the traffic signs at 11 intersections in Dili City have been totally destroyed and need urgent replacement.

Table 3.3 Summary of Road Works Required for Rehabilitation for Dili City Roads

Items	Pavement		Drainage		Masonry	
	Asphalt Repair	Gravel Const.	Repair	New Const.	Repair	New Const.
Total	8,175	6,120	2,422	11,536	415	3,065

(2) Bridge Inventory Survey

The bridge inventory survey covers all kinds of river crossing structures along arterial roads covered by the Study. It was also carried out by means of ocular inspection, measurement and photography (see Table 3.4). The survey included bridge data gathering such as bridge identification, classification of bridge type, measurement of bridge length, span length and girder arrangement, and condition rating of all major

members. The study includes detecting type and extent of defects/damages and degree of deterioration.

Table 3.4 Bridge Classification by Condition Rating

No.	Road section	Total Number of structures inspected	No river crossing structure *1	Cause-ways	Condition Rating		
					Poor	Fair	Good
	Arterial Road	402	7	2	44	29	353
	Dili City Road	9	0	1	2	2	4
	Total	411	7	3	46	31	357

*1: Including bridges for which construction has been suspended.

3.2 Traffic Survey

The traffic survey carried out in this Study are 1) traffic counting survey at 14 locations in inter-district road sections and at 12 intersections in Dili City, and 2) Road side OD survey at 6 locations.

The 12 hours traffic volume counting survey at 14 locations indicates that the stations with volume of more than 500 vehicles/12hrs are of Dili-Liquca and Dili –Aileu. Based on the traffic count survey results the road sections are classified into four categories each with the corresponding traffic volume.

The survey result is shown in Figure 3.2.

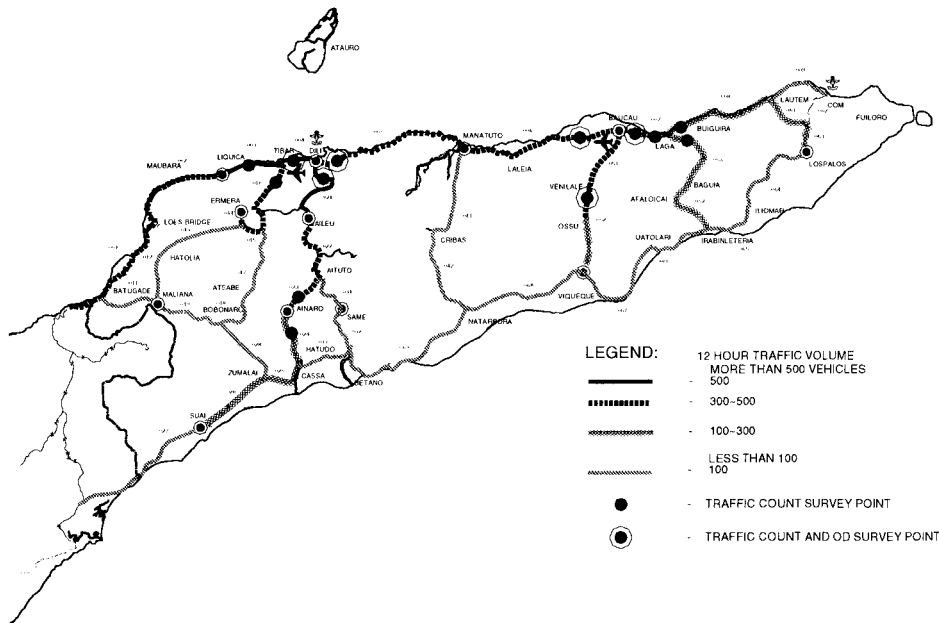


Figure 3.2 Traffic Count Survey Results

3.3 Formulation of Urgent Rehabilitation Plan

(1) Concepts for formulating Urgent Rehabilitation Plan

UNTAET's policies for the road and bridge sectors are to: 1) eliminate impassable road sections and bridges, 2) create job opportunity for Timorese and 3) provide capacity building of Timorese, and UNDP's recommendations stated in "Plan of Action for Rehabilitation, Operation and Maintenance of Key Infrastructure in East Timor in November 1999", basic concepts are formulated as listed below for the three years urgent rehabilitation plan of this Study:

- To rehabilitate the road sections and bridges, that have locally failed or have high risks of local failure, to raise them to acceptable level. These rehabilitation will facilitate efficient national security and provide humanitarian aid and ensure saving of the road and bridge assets and to induce revival of economic activity;
- To select only the plans prioritized from their favorable cost-effect aspect in order to effectively and efficiently use the limited resources;
- To incorporate labor incentive works and methods in a plan to create job opportunity for Timorese as much as possible;
- To formulate the plans incorporated for technical transfer to UNTAET's staff and local staff to result in self-reliance of future projects;
- To develop rehabilitation plans formulated in close coordination with other International Funding Agencies and bilateral donors; and
- To target the completion of the plan by June 2003.

(2) Formulation of Urgent Rehabilitation Plan

Road Rehabilitation Level:

The road rehabilitation level was firstly established in order to rehabilitate a road section to be suited to the road function and importance. For this purpose, the three levels of rehabilitation criteria consisting of **Level 1: Emergency rehabilitation to make the road passable in dry season**, **Level 2: Keep the road passable even during rainy season**, and **Level 3: Rehabilitation up to original standard** are established as a basis for the road rehabilitation plan considering the existing road conditions.

The application criteria of rehabilitation level to each section was secondly established. Taking into account beneficiaries, traffic volume, the field of industry supported by road, the road function, the present road sections are prioritized into three categories to create the road development level for Urgent Rehabilitation.



Figure 3.3 Development Level for Urgent Rehabilitation

Due to limited resources and budget and time restriction, it is unavoidable to apply a higher rehabilitation level to prioritized sections. In this Study, the following criterion is applied for each prioritized section to formulate rehabilitation planning.

Table 3.5 Applicable Rehabilitation Level

Road Section	Applicable Rehabilitation Level
1st Priority	Level 3
2nd Priority	Level 2
3rd Priority	Level 1

Bridge Rehabilitation Level:

Taking into consideration the present bridge conditions derived from the bridge survey as well as the road hierarchy, five levels of functional rehabilitation consisting of **Level 1: Restoration of Bridge Impassable, Level 2: Restoration of River Crossing Site Impassable, Level 3: Maintaining Bridge Passable, Level 4 : Improvement of River Crossing Site Impassable and Level 5 : Improvement of Bridge Function** are established so as to keep the road passable as long as possible.

The bridge rehabilitation work is prioritized considering not only the level of functional rehabilitation of bridges, but also the road hierarchy where the bridge is located. From

this exercise, the bridge rehabilitation priority for a road by section was made together with an outline of the rehabilitation works.

(3) Preliminary Design

The preliminary design of the road and bridge restoration for roads failure sections and inadequate river crossing structures along the study road sections are carried out in accordance with the design criteria established in the Study and rehabilitation design drawings and work quantities are prepared accordingly.

Design Concept:

Application of a high design standard inevitably disturbs the physical environment to a greater extent rather than a lower standard. Such disturbance can actually increase the risk of failure; consequently the cost of maintenance will be greater. The existing alignment and width of the road shall then follow the original in the rehabilitation design. The rehabilitation work shall be so designed that they can be maintained by locally available materials and intensive labor within the limited financial sources.

Road Rehabilitation Design:

Taking into account road failures detected along the existing roads and the importance of drainage facilities to be improved, the road rehabilitation measures are classified into seven types and each type is designed at preliminary level. These types include protection of debris flow, restoration of shoulder failure, restoration of embankment faultier, restoration of land slipped area, pavement overlay, provision of side ditch and subsoil drain, and provision of culvert.

Bridge Rehabilitation Design:

Based on the previous practice, availability of local materials, topographic and geological conditions in East Timor, the type of bridges and culverts by span length are recommended and designed for a new bridge construction in the Study.

(4) Construction Cost Estimate

The total construction cost of the three year urgent rehabilitation plan for the study roads and bridges is estimated at US\$ 73.04 million at June 2000, and these costs are derived from the estimated work quantities multiplied by corresponding unit prices. This cost includes direct and indirect cost, and general items for mobilization and demobilization of staff, transportation cost, installation, maintenance and dismantling of field office and laboratory and local communication cost.

(5) Construction Planning

Taking into account the project features, topographic and geological conditions, present infrastructure situation and socio-economic conditions in East Timor, the construction plan are formulated with special attention to 1) responsibility for right of way (ROW) to

UNTAET, 2) priority of local procurement, 3) maximum usage of local labors and contractors, 4) limited size of construction equipment and 5) application of mitigation measures for adverse environmental effects.

3.4 Quick Projects

(1) Implementation of Quick Projects

Taking into account that keeping the roads and bridges open as the highest priority in UNTAET's program, the Quick Project listed below was formulated in the early stage of the Study and implemented during the month of April, May, June, July and August using the labor intensive method with the main purpose of creating job opportunity for the Timorese. The outline of the QPs is as follows:

Table 3.6 Road Links for QPs

Road Section	Length in km	Scope of Work	Working Period	Implementation Method
Dili- Manatuot-Baucau	123 km	Maintenance for glass cutting and side ditch cleaning along shoulders.	40 days	Force Account Basis
Dili – Aileu - Ainaro	110 km	Rehabilitation of failure/defects by gabion works for slipped fill section and filling gravel to potholes.	105 days	Contract Basis
Baucau – Laga – Baguia	42 km	Rehabilitation of failure/defects by installation of gabion works for slipped fill section, filling gravel to potholes and construction of causeway for a river.	105 days	Contract Basis

3.5 Implementation Plan

(1) Concepts for Formulating Implementation Plan

The basic concepts for formulating the Project Implementation Plan in the Study are; 1) the scope comprising a total of 1,500km in length and about 450 bridges along arterial roads in the whole East Timor including Ocuci District, 2) the implementation period of three Timorese financial years starting from July 2000 to June 2003, 3) the budgetary limitation spread over three year period, which is approximately 73 million US\$ in total and 4) collaboration with other funding agencies and donors to represent a realistic plan without overlapping and repeating.

(2) Annual Budget Allocation

The total capital cost required for rehabilitation and maintenance of the existing roads and bridges in East Timor is estimated to be US\$ 72 million for the June 2000 price. An annual investment of each route and routine maintenance cost are tabulated in Table 3.8.

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Note: (JICA STUDY) does not mean a commitment of funding for D/D and construction works of the above projects

Figure 3.4 Implementation Plan

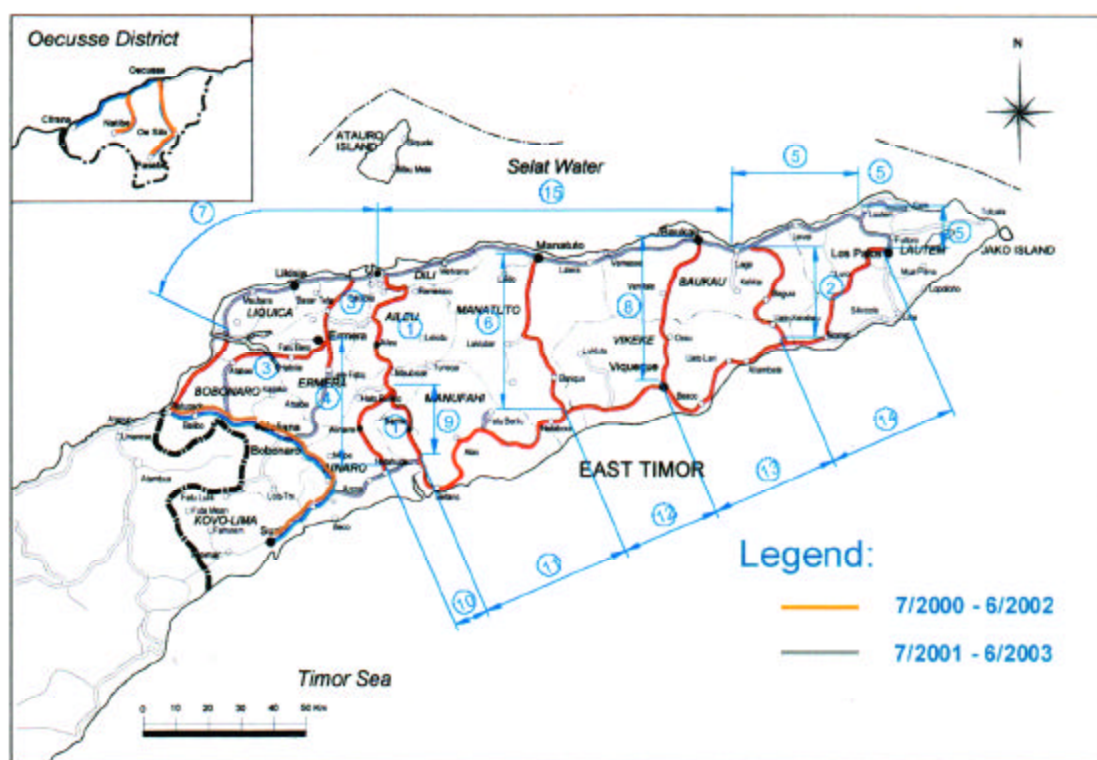


Figure 3.5 **Location Map of Project Route**

Table 3.7 Annual Budget Allocation

Unit: Million US\$

Category	Length (km)	FY00	FY01	FY02	Total
Urgent Rehabilitation of Arterial Roads	1,445	16.5	22.4	14.5	53.4(13.6)
Routine Maintenance and Restoration of Rural Roads	4,918	8.0	6.0	5.0	19.0(3.0)
Total	6,363	24.5	28.4	19.5	72.4(16.6)

Note: The figure in () means component of capital cost for bridge rehabilitation.

(3) Urgent Rehabilitation Funded by the Government of Japan

Among the 18 projects formulated in the Study, the Government of Japan (GOJ) has committed to provide grant aid for urgent rehabilitation for Dili – Aileu – Ainaro – Cassa using UNDP as a project implementing agency. In addition to above, it is strongly recommended that one of the important North-South penetration roads, Laga- Baguia – JC of South Coastal Road would be selected as a candidate for urgent rehabilitation projects by the Government of Japan.

3.6 Maintenance and Operation Plan

(1) Present Organization and Staffing

The Road Sector under the Transportation Department of UNTAET is responsible for formulating and developing institutional policies, land transport regulation activities, planning, design and operation activities for roads and bridges in East Timor. The organization of the Road Sector as of the end of June 2000 is depicted in Figure 3.6 below.

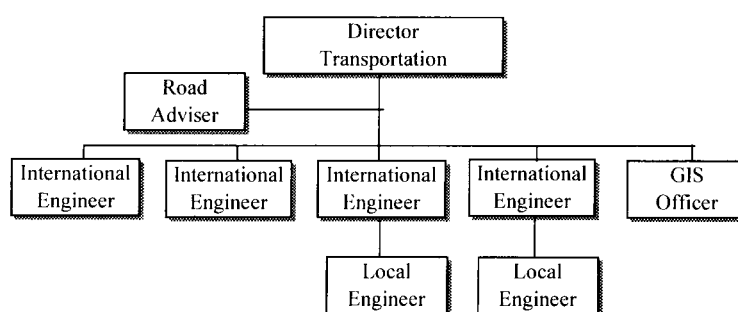


Figure 3.6 Organization Chart of Road Sector

At present, all the rehabilitation works including sorts of maintenance works are being carried out on a contract basis with private contractors, except emergency restoration work being implemented by Peace Keeping Force (PKF), in coordination with the Road Sector, UNTAET.

(2) Capacity Building

The Department of Transport and Works (DTW), with headquarters in Dili is scheduled to be established to manage the transport system covering sub-sectors of land transport including road and bridge, maritime and port sector and aviation sector. The proposed administrative structure aims to ensure development of a road management and maintenance system that establishes local capacity to manage and improve the road assets to facilitate transport and economic development and growth. The organization structure of the DTW headed by Secretary is to include four major division as outlined in Figure 3.7.

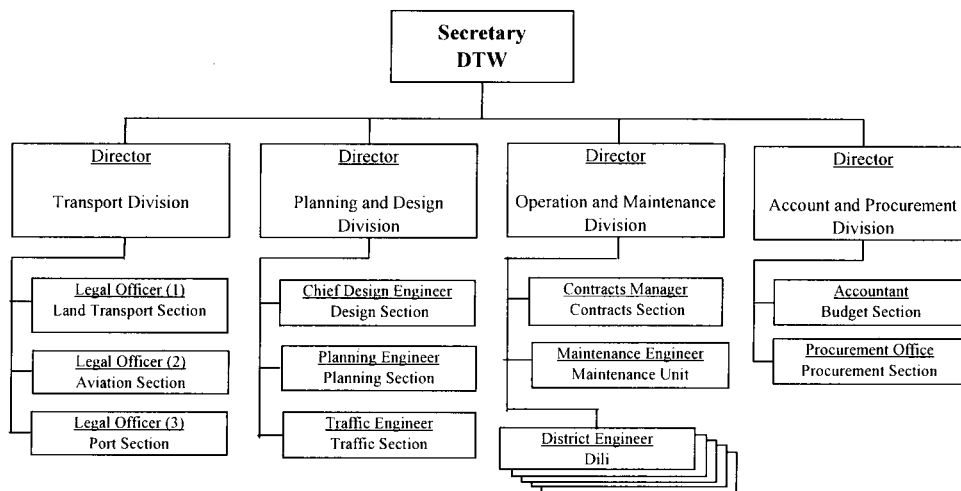


Figure 3.7 Proposed Organization Chart of DTW

(3) Maintenance Works

It is recommended from the capacity building aspect that the routine types of maintenance works shall be carried out on a force account basis by the Department of Transport and Works (DTW)'s District Office. The district office which shall be established in every district and equipped with a set of maintenance equipment and tools, while the sophisticated work (incidental maintenance) requiring heavy construction equipment or periodical maintenance work in bulk shall be carried out on a contract basis.

The inspection and maintenance crew to be organized in each District office that is responsible for actual maintenance works consists of one superintendent and two foremen (one each for roads and structures), who should have some knowledge of the road and bridge engineering and multi-discipline of the maintenance works, supported by labors required. The organization of maintenance crew is depicted in Figure 3.8.

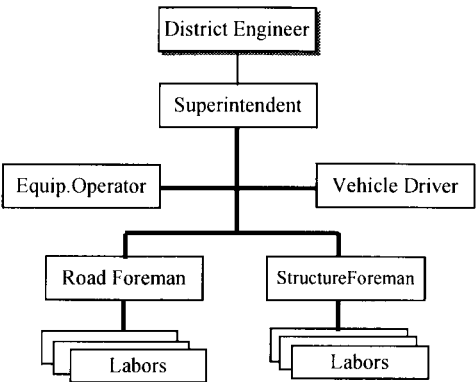


Figure 3.8 Proposed Organization of Maintenance Crew

CHAPTER 4
PORTS SECTOR

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4.1 Present Situation of Ports

East Timor has three commercial ports of Dili, Carabela and Com including smaller wharves in Oecussi and Liquica, and slip landing structures in Oecussi, Batugade and Suai. The locations of these ports are shown in Figure 4.1.

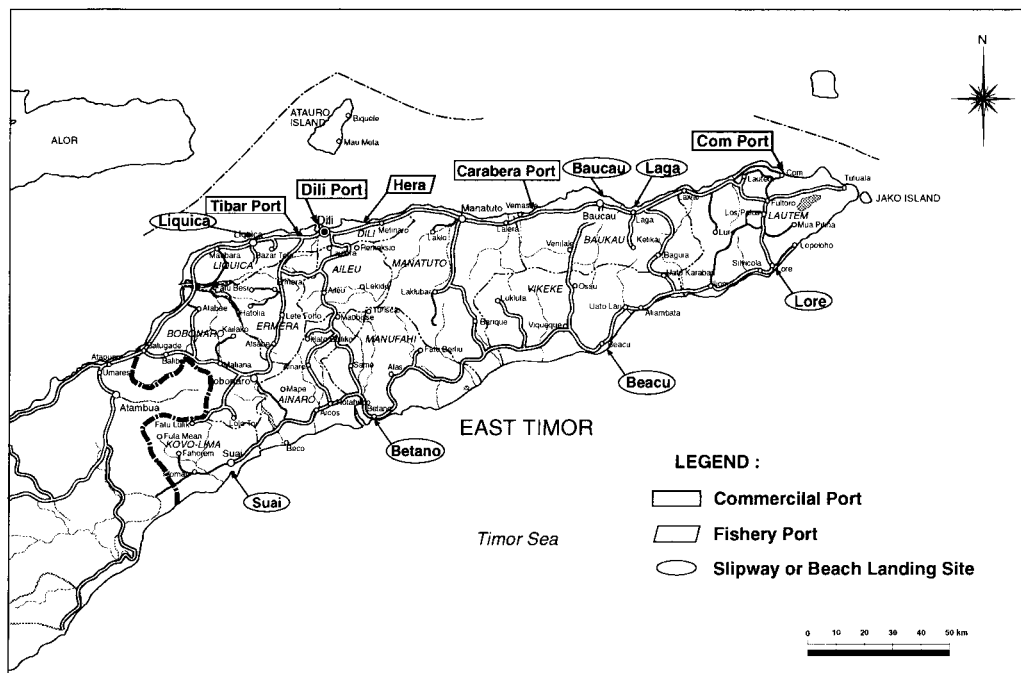


Figure 4.1 Location of Ports in East Timor

4.1.1 Dili Port

(1) Location

Dili port is the Lifeline port in East Timor is located in the center of Dili city. The existing layout plan of the Port shown in Figure 4.2.

(2) Approaches

The port is a small open natural port with available vessel draft varying dramatically due to the presence of numerous reefs on a sandy seabed. The approach channel is characterized by a narrow passage either side of the detached reefs, which are visible at low water.

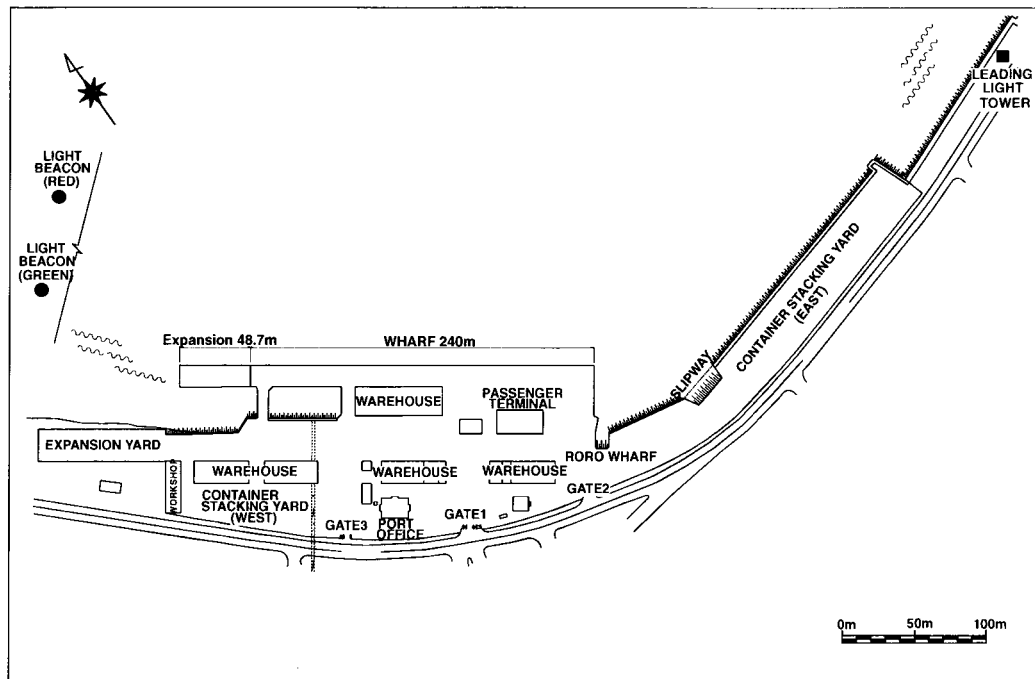


Figure 4.2 Existing Layout Plan of Dili Port

(3) Tugboat

Presently the port is unable to offer any tugboat service so that the calling vessels are rather difficult to berth and unberth. On the other hand, this inconvenience situation is one of the reasons for damage of the fenders.

(4) Wharf

The size of wharf is 240m long and 20m wide and it is reinforced concrete structure. The condition of the wharf is generally fair enough on the surface but it is poor at the bottom of deck. The wharf allows berthing for vessels with a maximum length of 140m and 6.2m draught. The Western end of the wharf has been extended 48m, the construction has not been completed. The wharf is very busy since the vessel occupied ratio in April and May of 2000 is more than 95%. The handling volume was 227, 474 ton and called vessels were 556 at Dili port in 1997 (East Timor in Figures of 1997 edition). Presently two (2) vessels are berthing per day on average since February 2000. However, the gross weight tonnage (GWT) or dead weight tonnage (DWT) of those vessels are unknown. It is therefore, estimated that the cargo handling volume of the port might increase drastically this year compared to 1997.

(5) Facilities

The port has buildings, storage facilities, marshalling areas, water system, cargo handling equipment, lighting system, and fender system.

Originally thirty- (30) rubber fenders existed at the front face (seaside) of the wharf in order to prevent damage to the berthing vessels and wharf. Presently the most of rubber fenders are unsatisfied condition. They are split, miss a portion and hanging as pieces.

(6) Harbour Beach-Landing Site (East Container Stacking Yard)

The port includes a beach-landing site with a reinforced concrete ramp located at the South East End of the wharf.

(7) Navigation Aids

The navigation aids are classified into three (3) groups in this Dili Port, which are; 1) Entrance Light Beacon, 2) Lighthouse and 3) Leading Light.

The stages and foundation piles are extremely poor and dangerous.

The typical photographs of the structure are shown in Figure 4.3.



Figure 4.3 **Typical photographs of pile structure**

The lighthouse is located in the western end of Dili Port, and uses an outside power supply and functions.

A leading light exists in the green belt on North side of the Coast road (JL. ASADE BANDAIRA) in front of UNTAET Head Quarter. One (1) existing leading light was built in 1983. The steel erected tower is in extremely poor condition, most of members are corroded. Members are dropping to the ground, due to the heavy corrosion.

(8) East Container Stacking Yard

The revetment protects the seaside of container stacking yard with gravel pavement. The revetment consists of two portions, the West portion of 56m and East portion of 172m. The condition of the revetment is very poor since many portions have collapsed.

(9) West Container Stacking Yard

The West Container Stacking Yard is gravel surface as well as the East so that the stable materials such as asphalt or concrete must pave the ground. On the other hand, a situation of the revetment is extremely poor even compared with a poor revetment of the East Container Stacking Yard. According to the collapsed condition, it is conjectured that the revetment was damaged by earthquake.

(10) Others

The city of Dili had a 6 ~ 7 on the Richter scale of earthquake at 11:33 AM of May 15, 1995. The location of hypocenter was latitude 08° 36' South and longitude 126° 16' East, depth of 47 km, which is 78 km West of the port.

The earthquake hurt many lives and damaged Dili port badly. The said earthquake caused the damages or collapsed revetments of the East and West container-stacking yards.

4.1.2 Com Port

(1) Location

Com port is situated on the North East coast of East Timor, which is latitude 08°

Com port is situated on the North East coast of East Timor, at latitude 08° 22' South and longitude 127° 04' East. The highway distance is approximately 203 km East of Dili. It is the most east commercial port in East Timor. An opening in the coastal reef forms this small natural harbor. The port was constructed for sugar export of the East district of the East Timor.

The existing layout plan of the Port is shown in Figure 4.4.

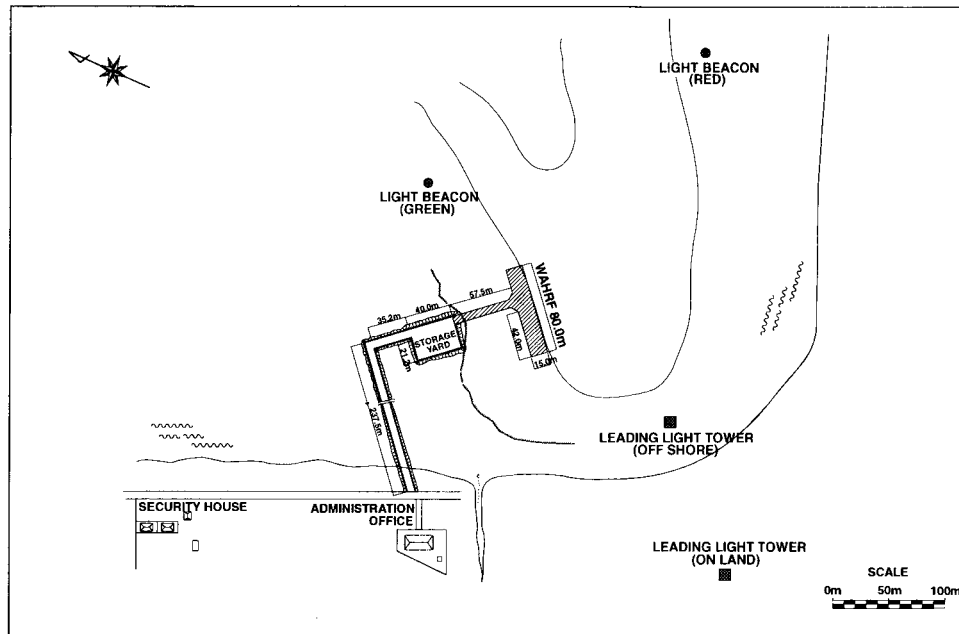


Figure 4.4 Existing Layout Plan of Com Port

(2) Approaches

The approach to the harbor is marked by two (2) navigation aids, and two- (2) leading lights exists on the splash zone and inland. The condition of those navigation aids is structurally good, however all of the power supply system had been destroyed during the post-consultation destruction. Therefore, the port is unable to offer to the night calling vessels.

(3) Wharf

The wharf is a T-shaped quay with a pier of 80m of length and 15m of width with a depth alongside of 8.6m. The condition of the wharf is generally good, only a few spots are needs to be rehabilitated.

(4) Open Storage Area

An approximately 850m² of paved open storage area is located a middle of the access.

(5) Facilities

Originally a number of buildings existed such as a Port Administration office building, a Generator building, a Security house and some others. However, the most of buildings have incurred damage during the post-consultation destruction so that none of those are usable.

More than enough water comes from the mountain area. People of the neighborhood are utilizing this water as their daily use water.

(6) Problems

The navigation aids are classified into two (2) groups in Com Port, which are 1) a set of Entrance Light Beacon, 2) a set of Leading light. All of those are not functioning after the post-consultation destruction in 1999. Therefore, batteries and battery chargers should be replaced to offer to the night calling vessels as a safe navigable port.

Most fenders are damaged seriously due to inadequate of the vessel size, quality of the fenders and installation. Therefore, the fender size and quality shall be reconsidered prior to replacement, also the installation method should be properly instructed.

The capacity of concrete bit is unknown and all of those base plates (metal portion) are badly corroded.

The port does not have any cargo handling equipment, so that calling vessels should be equipped their own suitable gears.

Lighting system for the wharf, open storage area and access road originally existed, however lamps had been stolen. Also, the power transmission and service wires had been completely destroyed, so that the public power supply must be considered prior to rehabilitation of the port lighting system.

4.2 3 Years Plan for Urgent Rehabilitation

4.2.1 Basic Concept for Urgent Rehabilitation Plan

The basic concept of the plan is a full-scale rehabilitation. In accordance with the concept that the planning should include;

- 1) Safe navigable port;
- 2) Safe berthing port;
- 3) Safety, and rise of the cargo-handling efficiency;
- 4) Port security; and
- 5) Erosion protection for the inland port facilities.

On the other hand, the major two (2) ports (Dili and Com) are prioritized in accordance with number of called vessels, location and future development etc. It is confirmed that Dili is a higher priority than Com.

4.2.2 Formulation of Urgent Rehabilitation Plan

The project has been formulated in accordance with the basic concept and the present situation of the short listed sites. The present situation of such sites will be carefully examined to suitable for the project. In general, the examinations were made during both high and low tides hours as well as several weather conditions. In addition, the target of the urgent rehabilitation should be completed by June of 2003.

The short listed rehabilitation projects are selected as follows in accordance with the above-described basic concept.

- 1) Restoration of Navigation Aids and Fenders at Dili Port;
- 2) Rehabilitation of West Container Stacking Yard at Dili Port (Fire fighting system, lighting system and lighthouse are included);
- 3) Restoration of East Container Stacking Yard at Dili Port (lighting system is included); and
- 4) Restoration of Navigation Aids and Fenders at Com port.

When the structure of port management system is concreted, the following project will be selected;

- 5) Installation of rubber wheel loader at Dili port.

4.2.3 Inventory Summary and Priority of Urgent Rehabilitation

As a result of the site survey, and in accordance with the basic concept and formulation of Urgent Rehabilitation, the priority of Urgent Rehabilitation has been placed as shown in Table 4.1.

4.2.4 Preliminary Design

The structural requirement has been determined, considering the Timorese practice and construction materials as practical as to carry available except for the special materials such as Steel Pipe Piles, Rubber Fenders, Navigation Aids, etc. Basically the design shall be to restore the original function of the existing facilities.

Table 4.1 Inventory Summary and Priority of Urgent Rehabilitation

Port	Contents of Facilities		Summary of Inventory Survey			Priority of Urgent Rehabilitation	
			Unaffected	Medium	Serious		
Dili	Wharf	Wharf Structure	○			D	
		Wharf Expansion Fender			○ ○	(ADB Quick Project) Three Years Plan : A	
	Navigation Aids	Entrance Light Beacon Leading Light	○		○	Three Years Plan : A D	
	East Container Yard	Pavement Revetment Slipway		○ ○		(ADB Quick Project) Plan after 2003 (ADB Quick Project)	
		West Container Yard	Pavement Inner Road		○	○	Three Years Plan : B Three Years Plan : C
	Building		Passenger Terminal Port Office Warehouse	○ ○			D D Three Years Plan : C
		Utilities	Water Supply Drainage System Electric Supply Lighting Fire Fighting System		○ ○ ○ ○		Three Years Plan : B Three Years Plan : B Three Years Plan : B Three Years Plan : C Three Years Plan : B
	Equipment		Cargo Handling Equipment Tug Boat		○		D Plan after 2003
			Carabera	Wharf	Wharf Structure Fender	○ ○	
	Com				Wharf	Wharf Structure Fender	○
Navigation Aids		Entrance Light Beacon Leading Light		○ ○			Plan after 2003 Plan after 2003

4.2.5 Project Cost

Summary of the quantities and the costs of major items in US dollars are tabulated as follows.

(1) Restoration of Navigation Aids and Fender System at Dili Port

Description	Unit	Q'ty	Cost in US\$	
			Unit Rate	Amount
Pile Driving	Nos.	8	7,450	59,604
Erection of the Stages	Nos.	2	82,837	165,674
Installation of Navigation Aids	Nos.	2	8,164	16,329
Installation of New Fenders	Nos.	30	27,403	822,084

(2) Rehabilitation of West Container Stacking Yard at Dili Port

Description	Unit	Q'ty	Cost in US\$	
			Unit Rate	Amount
ICB Pavement	m2	5,500	76.3	734,006
Asphalt Pavement	m2	5,370	70.1	394,663
Drainage	m	1,074	234	263,484
Water Supply (6" Pipe)	m	1,110	130	144,300
Fire Fighting (6" Pipe)	Nos.	12	32,500	260,000
Street Light (Single H=9m)	Nos.	34	2,340	28,080
Improvement of Ware Houses	Nos.	4	104,000	416,000

(3) Restoration of Revetment of East Container Stacking Yard at Dili Port

Description	Unit	Q'ty	Cost in US\$	
			Unit Rate	Amount
Foundation Rubble Rock	m3	2,580	40.1	103,369
Concrete Wall	m	180	1,348.0	242,634
Backfilling & Compaction	m3	2,800	35.9	100,517
Armor Rock	m3	720	44.7	32,159
Concrete Pavement	m2	880	101.3	89,156

(4) Restoration of Navigation Aids and Fenders at Com port

Description	Unit	Q'ty	Cost in US\$	
			Unit Rate	Amount
Entrance Light Beacon (Off shore)	Nos.	2	34,756	69,511
Leading Light (Off shore)	Nos.	1	8,771	8,771
Leading Light (On land)	Nos.	1	5,091	5,091
Installation of Fenders	Nos.	20	22,378	447,561

4.2.6 Construction Planning

The construction method will consider procurement of locally available materials and local conditions of the construction industry in East Timor as much as possible. Certain construction materials such as steel products are not available in the local market which are imported from Australia, Indonesia, Singapore, etc., but the procurement source will be determined based on the market price.

4.3 Implementation of Urgent Rehabilitation Funded by Japan

“Restoration of Navigation Aids and Fender System at Dili Port” has committed by the Government of Japan and will be implemented this year. The contents of this project are summarized as follows;

(1) Implementation Period

The total project implementation period including Detailed Design, Tendering and Construction is estimated at seven (7) months to complete the Project, after procurement of a project consultant

(2) Project Cost

The project cost is estimated at US\$ 2,500,000.00 in total.

Items	Amount in US\$
Construction Cost	2,050,000.00
Consulting Services	450,000.00
Total	2,500,000.00

4.4 Operation and Maintenance Plan

Formerly port operation and port maintenance of Dili are executed by the Ministry of Communications, Directorate General of Sea Communications Indonesia. However, the most of personnel returned to Indonesia, so that at the present, the port is undertaken by UNTAET. Asian Development Bank (ADB) is preparing capacity building including operation and maintenance for the port.

4.5 Implementation Plan

The basic concepts for the Project Implementation Plan in the study are as follows:

- The implementation period to materialize the plan is over three Timorese financial years starting from July 2000 to June 2003.
- The implementation priority is 1) to secure safety navigation and berthing of Vessel, 2) to secure safety and efficiency of Cargo Handling.

The implementation plans are summarized in Figures 4.5 together with 4.6 and 4.7 including ADB and Portugal Projects.

Implementation Schedule of Port Sector

	Task Name	Capital Cost US\$ Mill	2000				2001				2002				2003				Committed Agency	
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
			PY1				PY2				PY3									
Dili Port	Completion of Wharf Extension	0.40																ADB-TFET		
	Restoration of Landing Craft Slipway	0.04																ADB-TFET		
	Rehabilitation of East Container Yard	0.20																ADB-TFET		
	Emergency Repairs and Equipment	1.33																ADB-TFET		
	Equipment (Assessed budget)	0.40																UNTAET		
	Restoration of Navigation Aids & Fenders	2.50																Gov. of JAPAN		
	Rehabilitation of West Container Yard	4.55																—		
	Restoration of East Container Yard Revetment	1.89																—		
	Interim Port Management Services	N/A																Portugal		
	Port/Maritime Institutional Development	0.15																ADB		
	Institutional "Operationalization" and Training	inc																ADB-TFET		
	Port/Maritime Sector Development Plan	0.15																ADB		
Com Port	Rehabilitation of Navigation Aids & Fenders	1.37																—		
Others	Beach Matting : Suai, Betano, Beacu	0.09																ADB-TFET		
Total of Capital Cost		13.07	0.30	4.96				2.54				2.20				3.26				
			Total of Three Years																9.70	

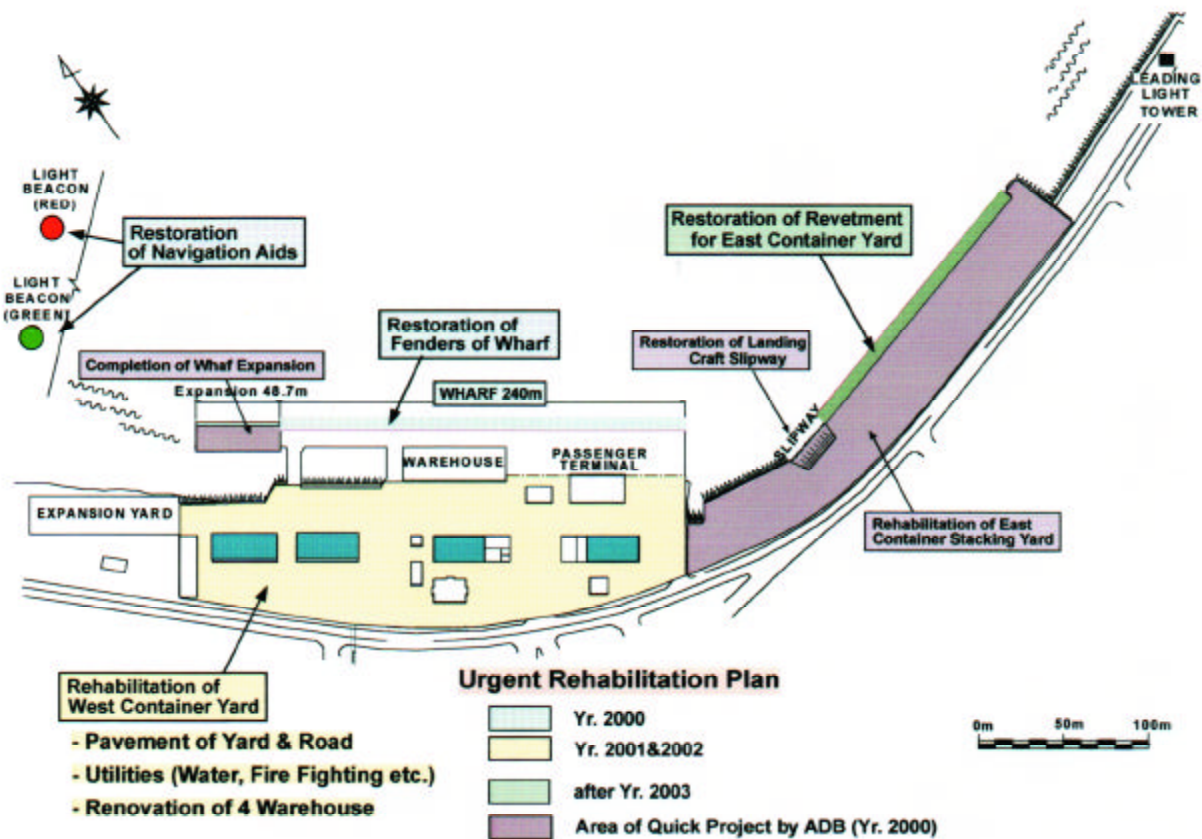


Figure 4.6 Implementation Plan of Dili Port

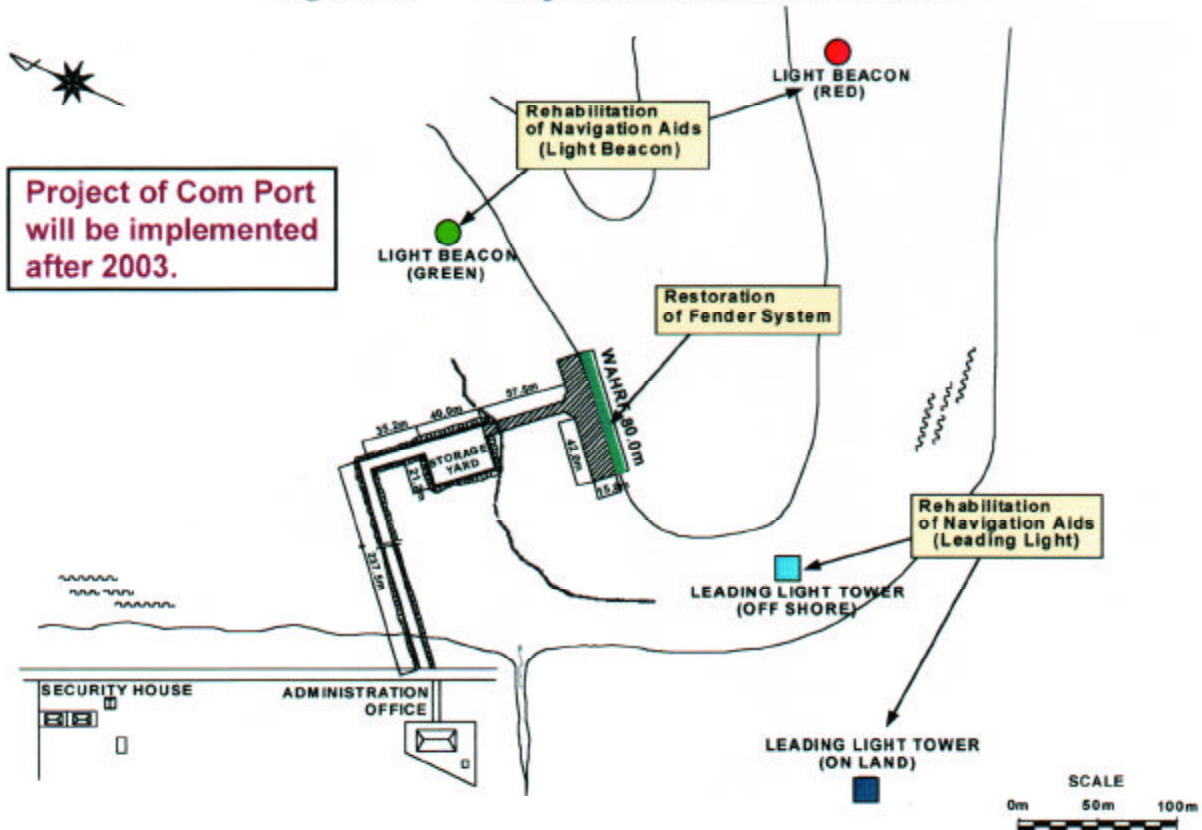


Figure 4.7 Implementation Plan of Com Port

CHAPTER 5
POWER SECTOR

CHAPTER 5 POWER SECTOR

5.1 Present Situations of Power Supply Facilities

There are 60 power stations throughout East Timor and these all use diesel engine generators. However, output from individual units varies greatly from 25 kW to 3.0 MW. The table 5.1 shows all power stations in each district, present output as of the end of May 2000, and operating conditions as of the end of June 2000. 32 power stations have been suspended its operation as of the end of June 2000 (31 small power stations located at rural areas and Ainaro power station).

Table 5.1 Outline of Power Generation Facilities in East Timor

No.	District Name	Power Station	Present Output (kW)	Current Conditions		Remarks
				Operating	Not Operating	
1	Dili	Caicoli	1,200	x		
2		Komoro	11,000	x		
3		Atauro	48	x		
4	Baucau	Baucau	640	x		Restored by UNTAET
5		Venilale	64	x		
6		Baguia	40	x		
7		Quelicaí	80	x		Restored by Portugal
8	Lospalos	Lospalos	580	x		
9		Tutuala	32	x		
10		Iliomar	0		X(J-1)	To be restored by Japan
11		Luro	0		X(P-1)	To be restored by Portugal
12		Lautem	25	x		
13	Manatuto	Manatuto	550	x		Under restoring
14		Laclubar	25	x		Restored by Portugal
15		Soibada	80	x		
16		Natarbora	0		X(P-2)	To be restored by Portugal
17		Manelima	0		X(A-1)	To be restored by ADB
18	Aileu	Aileu	170	x		
19		Maubisse	20	x		
20		Remexio	0		X(J-2)	To be restored by Japan
21		Lequidoe	0		X(A-2)	Restored by UNTAET
22	Viqueque	Viqueque	580	x		
23		Ossu	40	x		
24		Uatu Lari	80	x		
25		Uatu Carbau	0		X(N-1)	To be restored by UNTAET
26		Lacluta	0		X(J-3)	To be restored by Japan
27	Same	Same	400	x		
28		Fatuberliu	24	x		
29		Alas	40	x		

No.	District Name	Power Station	Present Output (kW)	Current Conditions		Remarks
				Operating	Not Operating	
30		Turiscail	40	X		Restored by UNTAET
31		Betano	0		X(A-3)	To be restored by ADB
32	Ainaro	Ainaro	0		X(A-4)	To be restored by ADB
33		Hato udo	0		X(J-4)	To be restored by Japan
34		Hato bilico	0		X(J-5)	To be restored by Japan
35		Fatululic	0		X(J-6)	To be restored by Japan
36	Ermera	Gleno	180, 0	X		Restored by UNTAET
37		Letefoho	0		X(A-5)	To be restored by ADB
38		Hatolia	30	X		Restored by UNTAET
39		Atsabe	0		X(J-7)	To be restored by Japan
40		Railako	0		X(N-2)	Under restoration by UNTAET
41		Ermera	30			Temporary
42	Maliana	Maliana	1, 358	X		
43		Bobonaro	0		X(A-6)	To be restored by ADB
44		Batugade	0		X(A-7)	To be restored by ADB
45		Atabae	0		X(J-8)	To be restored by Japan
46		Balibo	0		X(A-8)	To be restored by ADB
47		Lolotoe	0		X(A-9)	To be restored by ADB
48	Suai	Suai	285	X		
49		Zumalai	0		X(J-9)	To be restored by Japan
50		Fohorem	0		X(A-10)	To be restored by ADB
51		Tilomar	0		X(A-11)	To be restored by ADB
52		Beco	0		X(J-10)	To be restored by Japan
53		Raimean	0		X(J-11)	To be restored by Japan
54		Fatumean	0		X(A-12)	To be restored by ADB
55	Oecusse	Oecusse	150	X		Restored by UNTAET
56		Passabe	0		X(A-13)	To be restored by ADB
57		Nitibe	0		X(A-14)	To be restored by ADB
58		Oesilo	0		X(A-15)	To be restored by ADB
59	Liquica	Loes	0		X(J-12)	To be restored by Japan
60		Bazartete	0		X(J-13)	To be restored by Japan

Source: UNTAET/PAET (including partial corrections made by the Study Team in the site surveys)

Note: X(J-1) to X(J-13) : Target power stations for urgent grant aid by Japan

X(N-1) to X(N-2) : Target power stations for restoration by UNTAET

X(A-1) to X(A-15) : Target power stations for restoration by ADB

X(P-1) to X(P-2) : Target power stations for restoration by Portugal

Even for operating power stations, maintenance of facilities is well behind, and this leads to major reductions in generator output and higher fuel consumption, etc. Moreover, adequate fuel procurement cannot be carried out and power stations are only operated from 17.30 to 23.30 at night in almost all districts except Dili, Baucau and its environs. And not only is this preventing the supply of energy to local residents, it is also hindering the operation of social welfare facilities and development of the local economy.

5.2 Formulation of the Three Year Plan for Urgent Rehabilitation

5.2.1 Basic Concept of the Three(3) Year Urgent Rehabilitation Plan

Three (3) year urgent rehabilitation plans were formulated based on the results of analysis of the power station's inventory and the following basic concepts.

- (1) Urgent rehabilitation of facilities destroyed in conflict(Resumption of power supply)
- (2) Ensuring of present power supply conditions in Dili (Maintaining of performance for facilities in operation)
- (3) Reinforcement of facilities for the demand increase of anticipated development for upcoming three years.

5.2.2 Formulation of Three Year Urgent Rehabilitation Plan

(1) Plan for Restoration of Rural Power Stations (Plan No.1)

1) Outline of Plan

This rehabilitation plan aims to rebuild 32 small scale rural power stations including Ainalo Power Station which were destroyed or burned in the conflict following the referendum on independence and are not currently operating, in order to resume the stable supply of power to citizens living in regional villages and surrounding areas.

2) Basic Specifications & Quantity for Equipment and Materials at Each Power Station

- | | |
|--------------------------------|---|
| ① Diesel engine generators: | 2 units (ordinary use and backup) |
| ② Generator output: | Approximately 50 kW (Short term), 40 kW or more (Prime output). |
| ③ Electrical system | 415/240 V, 50 Hz |
| ④ Cooling system: | Air cooling |
| ⑤ Synchronized operation: | Manual synchronization |
| ⑥ Fuel oil: | Diesel oil |
| ⑦ Fuel tank: | Main tank and Daily tank |
| ⑧ Distribution panel: | Self-standing or wall-mounted type |
| ⑨ Civil & architectural works: | Foundations and roof for facilities, etc. |
| ⑩ Piping & wiring: | 1 lot |
| ⑪ Spare parts: | 2-year supply |

(2) Plan for Maintaining of Performance at Komoro Power Station (Plan No. 2)

1) Outline of Plan and Objective Equipment

This plan is to maintain the present output capacity of Komoro Power Station which provides stable power supply to Dili and its environs. The plan which entails implementation of an overhaul, supply of spare parts and restoration of auxiliary equipment.

Table 5.2 Objective Power Generation Equipment

No.	Engine	Generator	Country of Origin	Rated Capacity	Present Output	Year of Manufacture
1	MAK	Siemens	Germany	2.5 MW	1.8 MW	1984
2	MAK	Siemens	Germany	2.5 MW	1.8 MW	1984
3	Niigata Tekko	Meidensha	Japan	3.0 MW	2.6 MW	1988
4	PAL-MAK	PINDAD	Indonesia	2.8 MW	2.4 MW	1990 ?
5	PAL-MAK	PINDAD	Indonesia	2.8 MW	2.4 MW	1990 ?
Total output				13.6 MW	11.0 MW	

Source: PAET

2) Contents of Work and Basic Specifications

- ① The 16,000 hour inspection (overhaul), and supply of spare parts & consumable materials sufficient to last until the next 16,000 hour inspection
- ② Supply of special tools and general tools required for daily & periodic inspections and repair works.
- ③ Supply of equipment and materials necessary for repair of existing fuel oil purifiers and lubricating oil purifiers
- ④ Supply of chemicals for the existing cooling water softeners for one year
- ⑤ Supply of an 11-ton tank lorry for transporting fuel oil
- ⑥ Analysis instruments for daily inspections of cooling water and fuel oil
- ⑦ Supply of auxiliary equipment and materials necessary for the implementation of items ① through ⑥ above
- ⑧ Dispatch of technical advisors:
 - a. For implementation of item ① and ② above, dispatch at least three engineers for a minimum of two months.
 - b. Dispatch at least two engineers for a minimum of one month in order to provide technical guidance for the tools to be supplied in item ⑥ above

(3) Plan for Strengthening of Komoro Power Station (Plan No. 3)

1) Outline of Plan

This plan has been compiled with the objective of securing enough firm capacity at Komoro Power Station and achieving a stable supply of power to consumers in line with the increase in demand for power over the next three years in Dili.

2) Contents of Work and Basic Specifications

- ① Procurement and installation of the diesel engine generator (output capacity 3.6 MW 1 unit)
- ② Procurement and installation of the auxiliaries required for the above ①
- ③ Procurement and installation of electrical equipment required for the above ①

- ④ Procurement and installation of the electrical equipment required for distribution facilities, etc.:
- ⑤ Procurement of spare parts and tools for maintenance and inspection of the generating equipment and auxiliary equipment.
- ⑥ Procurement of operation, maintenance inspection and overhaul manuals, and implementation of OJT, for the power plant equipment, auxiliary equipment and electrical equipment
- ⑦ The following civil engineering and building works required for construction of the power plant
 - a. Extension of a generator room and operation control room
 - b. Construction of foundations for the generator, auxiliaries and transformer, etc.

(4) Plan for Resumption of Operation in Major Cities (Restoration Plan No. 4)

1) Outline of Plan and targeted Power Stations

This is a plan for restoration of three power stations in the cities of Baucau, Gleno and Manatuto. It is to produce construction of local government facilities, social welfare facilities and commercial facilities, etc. Therefore, a new diesel generator for each city shall be constructed as temporary substitute units for those generators as shown below, which were completely destroyed in the conflict.

- ① Baucau Power Station: substitute facilities for three units, i.e. Unit No. 3 (output 528 kW), Unit No. 4 (output 240 kW), and Unit No. 5 (output 260 kW)
- ② Gleno Power Station: substitute facilities for three units, i.e. Unit No. 3 (output 240 kW), Unit No. 4 (output unknown), and Unit No. 5 (output unknown)
- ③ Manatuto Power Station: substitute facilities for three units, i.e. Unit No. 3 (output unknown), Unit No. 4 (output 260 kW), and Unit No. 5 (output unknown)

2) Contents of Work and Basic Specifications (Common to Each Power Station)

- ① Procurement and installation of the diesel engine generator (output capacity 1.0 MW 1 unit)
- ② Procurement and installation of the auxiliaries required for the above ①
- ③ Procurement and installation of electrical equipment required for the above ①
- ④ Procurement and installation of the electrical equipment required for distribution facilities, etc.:
- ⑤ Procurement of spare parts and tools for maintenance and inspection of the generating equipment and auxiliary equipment.
- ⑥ Procurement of operation, maintenance inspection and overhaul manuals, and implementation of OJT, for the power plant equipment, auxiliary equipment and electrical equipment

- ⑦ The following civil engineering and building works are required for construction of the power plant
 - a. Extension of a generator room and operation control room
 - b. Construction of foundations for the generator, auxiliaries and transformer, etc.

(5) Plan for Restoration and Strengthening of Medium Voltage Distribution Lines (Plan No. 5)

1) Outline of Plan

Out of approximately 700 km of 20 kV distribution lines in all East Timor, since it is assumed that new construction or repair is necessary for at least 10% (roughly 70 km) over the next three years. A plan to restore and strengthen medium voltage distribution lines shall be compiled in the Project.

2) Preliminary Design of Equipment

- ① Pole-mounted distribution transformers (22 kV/415/240 V, 100 and 50 kVA)
- ② Conductor for 22 kV overhead distribution lines (steel-cored aluminum cable)
- ③ 22 kV lightning arresters (for single phase)
- ④ Cutout switches with fuses (for distribution transformers and lines)
- ⑤ 22 kV insulators and findings (suspension insulators and pin insulators)
- ⑥ Steel poles (h = 12 m and 15 m)
- ⑦ Assembling materials (cross arms, arm ties, step bolts, spikes, earth wires, rods)
- ⑧ Automatic voltage regulators (20kV $\pm$ 10%/20kV, 2MVA, Pole mounted type)
- ⑨ Procurement of power tools for 22 kV distribution line works and maintenance and inspection
- ⑩ Procurement of a street lighting wagon.
- ⑪ Procurement of a truck with cranes (crane capacity: 5 tons)
- ⑫ Procurement of operation, maintenance, inspection and overhaul manuals and implementation of OJT

5.2.3 Project Cost

The Project cost for five (5) restoration plans formulated for the Power Sector Three (3) Year Urgent Rehabilitation Plan is estimated as shown in Table 5.3 below.

Table 5.3 Total Project Cost

No.	Name of Project	Q'ty	Project Cost (US\$-Million)	Remarks
1	Restoration of Rural Power Stations	32 sites	5.18	13 sites were already approved by the Government of Japan
2	Maintaining of Performance at Komoro Power Station	1 lot	2.91	Japanese Government approved to implement the Project
3	Strengthening of Komoro Power Station	1 lot	7.20	
4	Resumption of Operation in Major Cities	3 sites	7.63	
5	Restoration and Strengthening of Medium Voltage Distribution Lines	70 km	5.50	-
Total Cost			28.42	

5.2.4 Implementation Schedule

Figure 5.1 indicates the implementation plan for 5 projects formulated under this study as “Power Sector Three Years Plan for Urgent Rehabilitation” together with aid projects planned by ADB and Portugal for the power sector.

No.	Project Name	Capital Cost (Million US\$)	2000		2001		2002		2003		Committed Agencies
			1-6	7-12	1-6	7-12	1-6	7-12	1-6	7-12	
1	Restoration of rural power stations	5.18									Rehabilitation Plan-1
	(1) Two (2) P/S funded by UNTAET	0.30		0.30							UNTAET
	(2) Fifteen (15) P/S funded by ADB	2.33		1.33	1.00						ADB
	(3) Two (2) P/S funded by Portugal	0.30		0.30							PORTUGAL
	(4) Thirteen (13) P/S funded by Japan	2.25		1.25	1.00						JAPAN
2	Maintaining of present output capacity of Komoro power station	2.91		1.50	1.41						Rehabilitation Plan-2 JAPAN
3	Institutional study for PAET by Portugal Consultant	1.00	0.50	0.50							PORTUGAL
4	Rehabilitation of Switchgears of Komoro P/S, etc	0.43			0.43						ADB
5	Upgrading of Komoro power station	7.20			2.40	2.40	2.40				Rehabilitation Plan-3 (JICA STUDY) *
6	Upgrading of three(3) major power stations	7.63				2.63	2.50	2.50			Rehabilitation Plan-4 (JICA STUDY) *
7	Reinforcement of 20kV distribution networks	5.50					2.00	2.00	1.50		Rehabilitation Plan-5 (JICA STUDY) *
	Total of Capital Cost	29.85	0.50	5.18	6.24	5.03	6.90	4.50	1.50		
(JICA STUDY) * does not mean a commitment of funding for D/D and construction works of the above projects.			5.68		11.27		11.40		1.50		

Figure 5.1 Implementation Plan of Power Sector