3.3 Three Year Urgent Rehabilitation Plan

3.3.1 Concepts for Urgent Rehabilitation Plan

Taking into account UNTAET's policies for road and bridge sector to: 1) eliminate road sections and impassable 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 used to formulate the three years urgent rehabilitation plan of this Study as follows:

- 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 rehabilitations will facilitate efficient national security and provide humanitarian aid and ensure salvaging available 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 for future projects;
- To develop rehabilitation plans formulated in close coordination with other International Funding Agencies and bilateral donors;
- To target the completion of the plan by the end of year 2003.

3.3.2 Formulation of Urgent Rehabilitation Plan

3.3.2.1 Road Rehabilitation Level and Rehabilitation Works

It is necessary to set up road links from the present road network and to establish desired road rehabilitation levels on a basis of the road functions of each link. Considering the existing road conditions, three levels of rehabilitation criteria and corresponding rehabilitation work described in Table 3.3.1 are established as a basis for the road rehabilitation plan.

Table 3.3.1 Road Rehabilitation Level

Road Rehabilitation Level	Rehabilitation Works
Level 1 – Emergency rehabilitation to make the road passable in dry season Emergency rehabilitation of the section currently hindering the vehicle passage, and so ensuring passage of vehicles even such as trucks and four-wheel drive vehicles.	· Construction of causeways for the sections of roads and bridges washed out due to flood and debris flow; · Rehabilitation of drainage channels, protection of road surfaces and shoulders using gabions · Soil removal and installation of drainage channel for sections where debris or sedimentation are deposited due to slope failure; · Rehabilitation of drainage channels and installation of gabions for the section of slip-down of road surfaces and shoulders due to steep slope failure; · Correction of depressed pavement surface due to sinking of roads by landslides;
Level 2 : Keep the road passable even during rainy season Improvement of the road structures that tend to suffer closure due to rainfall. Rehabilitation level is to extend the passable periods through improvement of river crossing sites and prevention measures for possible drainage, slope, and slip failure.	· Provision of outside drainage; · Rehabilitation of road surface drainage; · Prevention measures against landslide; (Measures such as drainage, counter weight, caisson type piles, etc.) · Prevention of scouring; · Slope protection
Level 3: Rehabilitation upto original standard Rehabilitation to restore original road functions, including mainly rehabilitation of road shoulders, pavement, and slopes; and prevention measures against landslides, and other safety measures.	· Rehabilitation of pavements; · Rehabilitation of shoulders; · Rehabilitation of safety devices; · Providing adequate sight distance for road

3.3.2.2 Application of Rehabilitation Level to Each Link

Taking into account beneficiaries, traffic volume, the field of industry supported by road, the road function (either foreign trade and development road or Inter-city road, or both functions), the present road links are prioritized into three categories to create the road hierarchy by rating of the evaluation items described below;

Evaluation Item 1: Beneficiaries

Beneficiaries are defined to indicate the numbers of population by each road rink per length. Ratings add one point by 200 population numbers per km.

Evaluation Item 2: Traffic Volumes

The existing road will be classified to four categories by 12 hrs traffic volumes. Rating point criteria of each categorized road by Traffic volume is shown by Table 3.3.2.

Table 3.3.2 Rating Point Criteria of each road link

12 hour Traffic Volumes in Nos. of Vehicles	Rating Point
More than 500	5
500-300	4
300-100	3
Less than 100	2

Evaluation Item 3:Urgent Rehabilitation Policy

The high rehabilitation policy of an inter-regional road network is to connect production centers in order to recover the regional industry or to connect principal port, and neighbor countries for foreign trade. Rating point of road link to meet this condition is put at 5.

Evaluation Item 4: Road Function of Inter-Regional Road

The inter-regional road links are classified based on road connection of the inter-city relationship. Rating point of each categorized links by road connection criteria is shown by Table 3.3.3.

Table 3.3.3 Rating Criteria of Road Connection of Inter-Regional Road

Evaluation	Connection with	Function	Points
4-1	1. Capital city to District capital city	Main	5
	2. Capital city to District capital city	Backup	4
4-2	1. Between District capital cities	Main	4
	2. Between District capital cities	Backup	3

Table 3.3.4 shows the rating results based on criteria mentioned above:

Table 3.3.4 Evaluation and Rating Results of Each Link by Rating

No	Link No			Road Link		Length in Km	Evaluation Items *					Total Point
				Begining	End		1	2	3	4-1	4-2	
1	0	0	1	Border	Loes	41.2	2	3	5	4	3	17
2	0	0	2	Loes	Liquica	38.1	3	4	5	4	3	19
3	0	0	3	Liquica	Tibar	22.5	3	4	5	4	3	19
4	0	0	4	Tibar	Dilli	12.9	10	5	5	4	3	27
5	0	0	5	Dilli	Manatuto	63.7	2	4	5	4	3	18
6	0	0	6	Manatuto	Baucau	59.3	1	4	5	4	3	17
7	0	0	7	Baucau	Laga	18.0	4	4	5	4	3	20
8	0	0	8	Laga	Lautem	41.3	1	3	5	4	3	16
9	0	0	9	Lautem	Com	21.0	1	2	5			8
10	0	1	1	Batugade	Maliana	45.1	1	2			3	6
11	0	1	2	Maliana	Hatulia	40.8	3	2				5
12	0	1	3	Hatoria	J.El Mera	22.2	4	2				6
13	0	1	5	El Mera	J.Atosabe	5.2	1	3	5	4	3	16
14	0	1	6	J.Atosabe	Tibar	40.4	1	4	5	4	3	17
15	0	1	7	J.El Mera	Atsabe	47.5	1	2				3
16	0	1	8	Atsabe	Bobonaro	34.8	2	2				4
17	0	1	9	Bobonaro	Maliana	16.4	4	2				6
18	0	2	1	Dili	Aileu	47.4	3	5	5	4	3	20
19	0	2	2	Aileu	Aituto	38.3	5	4	5	4	3	21
20	0	2	3	Aituto	Ainaro	27.8	1	4	5	4	3	17
21	0	2	4	Ainaro	Cassa	22.3	3	3	5	4	3	18
22	0	2	5	Cassa	Zumarai	17.5	3	3	5	4	3	18
23	0	2	6	Zumarai	Suai	32.0	2	3	5	4	3	17
24	0	2	7	Suai	Border	28.2	1	2	5			8
25	0	3	1	Aituto	Same	30.0	2	2		4	3	11
26	0	3	2	Same	S.R.J	27.2	2	2		3	2	9
27	0	3	3	S.R.J	Cassa	25.0	2	2		3	2	9
28	0	4	1	Manatuto	Cribas	37.9	1	2	5		2	10
29	0	4	2	Cribas	Natarbora	46.7	1	2	5		2	10
30	0	5	1	Baucau	Ossu	44.8	3	4	5	4	3	19
31	0	5	2	Ossu	Viqueque	19.4	3	3	5	4	3	18
32	0	5	3	Laga	Baguia	37.0	3	3	5	3	2	16
33	0	5	4	Baguia	Iraboreteria	18.5	4	2	5	3	2	16
34	0	6	1	Lautem	Fuiloro	18.6	3	2	5	4	3	17
35	0	6	2	Com	Fuiloro	15.1	1	2				3
36	0	6	3	Fuiloro	Los Palos	8.8	3	3	5	4	3	18
37	0	6	4	Los Palos	Iliomar	44.3	1	2				3
38	0	6	5	Iliomar	Ira. Leteria	20.0	2	2				4
39	0	6	6	Iraboreteria	Uatolari	16.4	2	2		3	2	9
40	0	6	7	Uatolari	Viqueque	45.0	1	2		3	2	8
41	0	6	8	Viqueque	Natarbora	47.0	1	2		3	2	8
42	0	6	9	Natarbora	S.R.J	48.5	1	2		2	2	7

The priority of road link is classified into three categories, one is road link with a total point of more than16 becoming road priority 1, the second is a total point between 15 and 8 becoming road priority 2 and the last is road priority 3 having a total point of less than 7. These results show three kinds of the roads as depicted in Figure 3.3.1.

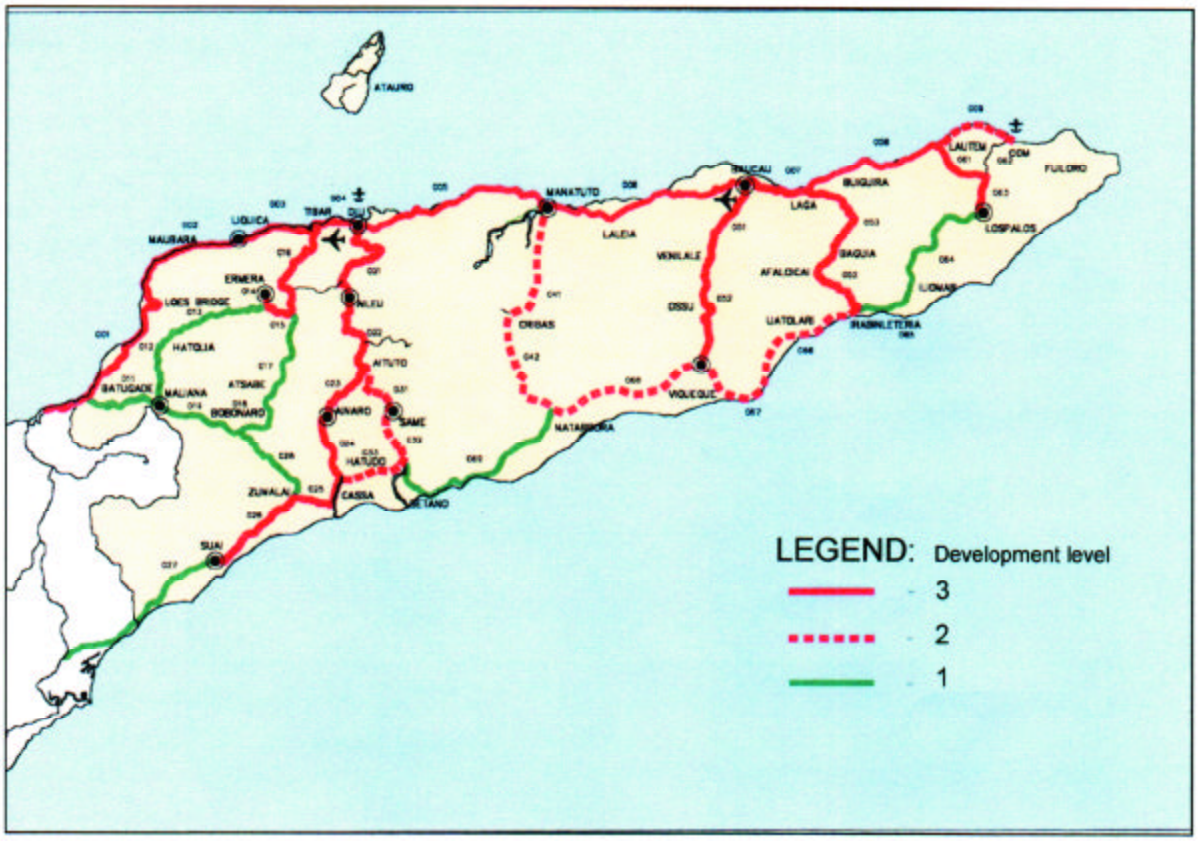


Figure 3.3.1 Development Level for Urgent Rehabilitation

It is desirable and necessary to rehabilitate all the arterial links covered in the Study up to "Rehabilitation Level 3" as mentioned above. However, due to limited resources and budget and time restriction, it is unavoidable to apply a higher rehabilitation level to prioritized links. In this Study, the following criterion is applied for each prioritized link to formulate rehabilitation planning.

Road Link	Applicable Rehabilitation level
1st Priority	Level 3
2nd Priority	Level 2
3rd Priority	Level 1

3.3.2.3 Bridge Rehabilitation Level and Rehabilitation Work

Taking into consideration the present bridge conditions derived from the bridge survey, the bridge rehabilitation plans have been selected. Thus five levels of functional rehabilitation as tabulated in Table 3.3.5 are established so as to keep the road passable through a by performing the corresponding rehabilitation work.

Table 3.3.5 Bridge Rehabilitation Level

Prioritized Bridge Functional Rehabilitation	Rehabilitation Work
Level 1: Restoration of Impassable Bridge River crossing site is not passable at present due to washed out bridge or roads.	· New bridge construction to be provided when bridge is washed out. · Causeway or flood relief bridge construction is to be provided when the roads are washed out.
Level 2: Restoration of Impassable River Crossing Site River crossing site is not passable due to unfinished bridge construction.	· Continue construction as per the original plan when of the field progress is more than 50 %. · Install causeway when the field progress is less than 50 %.
Level 3: Maintaining Passable Bridge Critical bridges which will be failed due to severe deterioration /defect of major members and dangerous bridges with inadequate load carrying capacity	· Replace these bridges with a new bridge
Level 4 : Improvement of Impassable River Crossing Site River crossing site is not passable because there are no river crossing structures.	· Install causeways to make the roads passable at least during the dry season.
Level 5 : Improvement of Bridge Function Some bridges are a bottleneck of smooth traffic flow due to inadequate bridge opening or width.	· Replace bridges with a new bridge in when existing bridges have inadequate load carrying capacity, bridge opening or width. If the bridge has an inadequate bridge opening the grade is raised. When the bridge has an inadequate width, the bridge should be widened.

3.3.2.4 Rating of Bridge Rehabilitation Work

It is crucial to determine the priority of bridge rehabilitation work considering not only the priority of functional rehabilitation of bridges, but also the road hierarchy where the bridge is located. The quantitative rating for each category, i.e. the bridge functional rehabilitation priority and the road hierarchy, is introduced in the Study to determine the priority of bridge rehabilitation work. A rating point of each rank for the bridge functional rehabilitation priority and the road hierarchy is established and tabulated in Tables 3.3.6 and 3.3.7 and an overall rating point of each bridge is calculated by adding the point totals for each bridge rated in each category. Consequently, a bridge with higher rating point becomes a higher priority than the bridge with lower points.

Table 3.3.6 Rating Point of Road Hierarchy

Priority	Description	Rating Point
1st Priority Link	24 Hours passable through the year	10
2nd Priority Link	24 Hours passable through the dry Season, but Less hours through Wet Season	5
3rd Priority Link	24 Hours Passable Only through the Dry Season	1

Table 3.3.7 Rating Point of Bridge Functional Rehabilitation Level

Level of Bridge Functional Rehabilitation	Rating Point
Level 1: Restoration of Impassable Bridge	10
Level 2: Restoration of Impassable River Crossing Site	8
Level 3: Maintaining Passable Bridge	6
Level 4: Improvement of Impassable River Crossing Site	4
Level 5: Improvement of Bridge Function	2

Based on the prioritizing criteria mentioned above, Table 3.3.8 shows the bridge rehabilitation priority for a road link together with an outline of the rehabilitation works.

Table 3.3.8 Bridge Rehabilitation Priority

Priority	Total Point	Number of Bridges Covered	Road sections	Rehabilitation Work
1	16	3	01:Dili-Aileu-Ainaro-Cassa	River control work including protection around abutment
1	16	5	15:Baucau-Viqueque	Reconstruction of bridges and culverts
2	14	13	14:Laga-Baguia-J.C. of coastal road	Construction of causeways
2	14	6	03:J.C. of Dili-Liquica road – Gleno - Ermera	Reconstruction of bridges
3	13	6	12:Manatuto-Baucau	Reconstruction of Bridges and Reinforcement
4	12	5	09&11:Aitudo-Same-Betano-Cassa	Completion of suspended bridge and reconstruction of bridges and culverts
4	12	3	17:Viqueque-Natabora	Reconstruction of bridges and construction of causeways
4	12	3	16:Viqueque-Irabinleteria	Completion of suspended bridge construction and reconstruction of bridges and culverts
4	12	2	07:Dili-Manatuto	Reinforcement
4	12	1	13:Baucau-Laga-Lospalos	Reinforcement
4	12	3	02:Dili-Liquica-Tutobaba	River control work
5	9	8	08 Manatuto-Biculie-Natabora	Completion of suspended bridge construction and reconstruction of bridges and culverts
6	7	1	18 Lospalos-Irabinleteria	Construction of causeways
7	3	3	04 J.C. of Gleno- Ermera - Hatolia	Reconstruction of bridges and reinforcement
8	3	4	05 J.C. of Gleno- Ermera - Atsabe	ditto

The location of bridges with rehabilitation method on a link basis is shown in Figure 3.3.2.

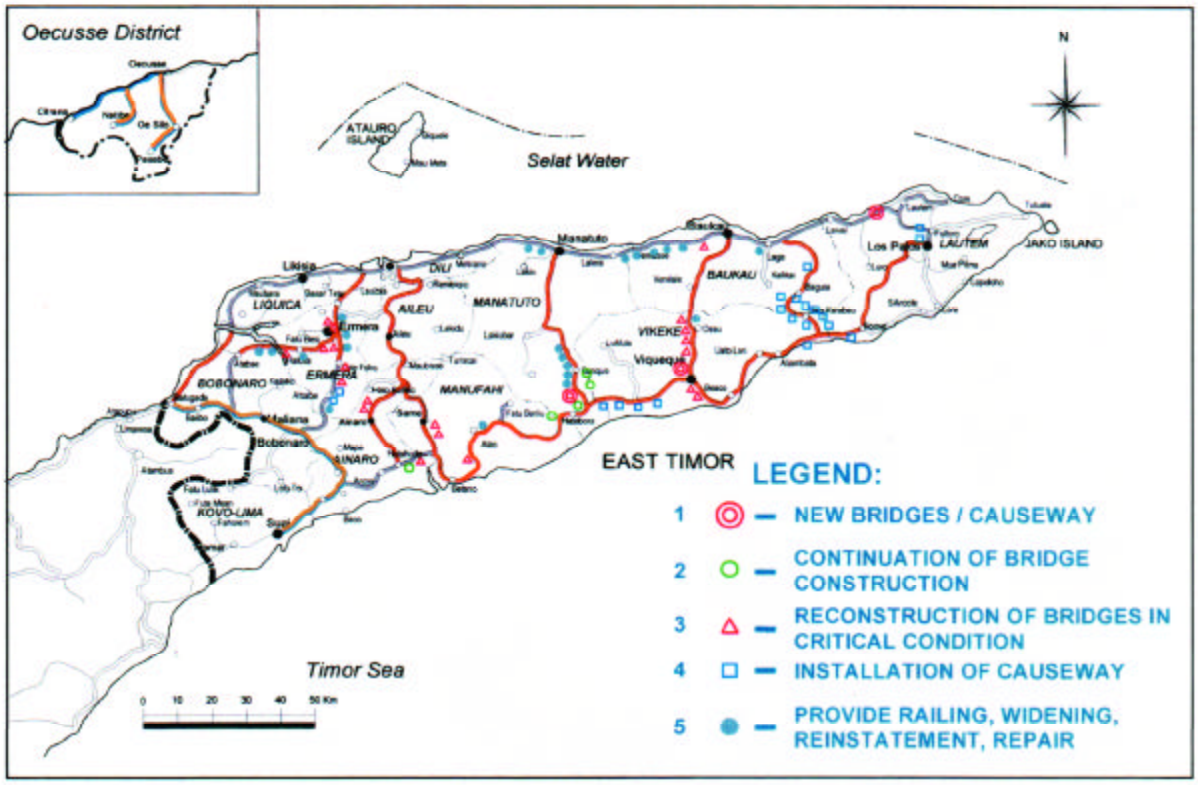


Figure 3.3.2 Locations of Bridges and Culverts for Rehabilitation

3.3.3 Preliminary Design

The preliminary design of the road and bridge restoration for roads failure sections and inadequate river crossing structures along the study road links are carried out in accordance with the design criteria established in the Study and rehabilitation design drawings and work quantities are prepared accordingly. The design drawings are attached in APP 3.3.3.

3.3.3.1 Applicable Design Standard

The existing roads and bridges, except the alignment which followed topographic contour lines, have been designed and constructed during the Indonesian era basically in accordance with Bina Marga's Design Standards such as Road Design Standard and Bridge Design Code. Hence, the preliminary designs are carried out referring to the said standards and following standards if required to supplement those.

- Slope Protection Design Manual by Japan Road Association
- Drainage Structure Design Manual by Japan Road Association
- Road Disaster Prevention Manual by Japan Road Association
- Specifications for Highway Bridges by Japan Road Association
- Standard Specifications for Highway Bridges by AASHTO

3.3.3.2 Design Concept

The roads in East Timor mostly have the following geotechnical problems:

- Large scale rotational failure underlain by thick deposits of basaltic colluvial talus,
- Rock mass failure for limestone cliff faces,
- Consolidation settlement beneath fill embankment, and
- Too steep cut and fill slopes with frequent slip (causing embankment failure).

The most contributory factor to these geotechnical instability and general road degradation is a complete lack of surface and sub-soil drainage, and inadequate drainage system. This problem should be resolved as a priority for any restoration or rehabilitation.

Adopting of high design standard does not necessarily insure against damage. 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 alignment and width of the road shall then follow the original route in the design of rehabilitation work; no geometric design standard shall be applied for the design. The rehabilitation work shall be so designed that it can be maintained by locally available materials and intensive labor within the limited financial sources. The following drainage measures will be taken in the design:

- Review all drainage system with appropriate hydraulic design,
- Improve cross culverts that are likely too small,
- Install additional culverts,
- Design adequate drop inlets and kerb,
- Construct side drains,
- Control run-off above areas of potential land slide, and
- Provide sub-surface drains.

3.3.3.3 Typical Cross Section

In principle, the roads shall be restored to the original road section. However, two types of road section have been prepared, one for two lanes roads and the other for one lane roads in the section where it is applicable. RC slab bridge and box culvert will have the same section as the road, and bridges shall have a carriageway exceeding that of the road by at least 0.25m on both sides for safety reason. Figures 3.3.3 and 3.3.4 show the typical sections of roads, culverts and bridges to be applied in rehabilitation work.

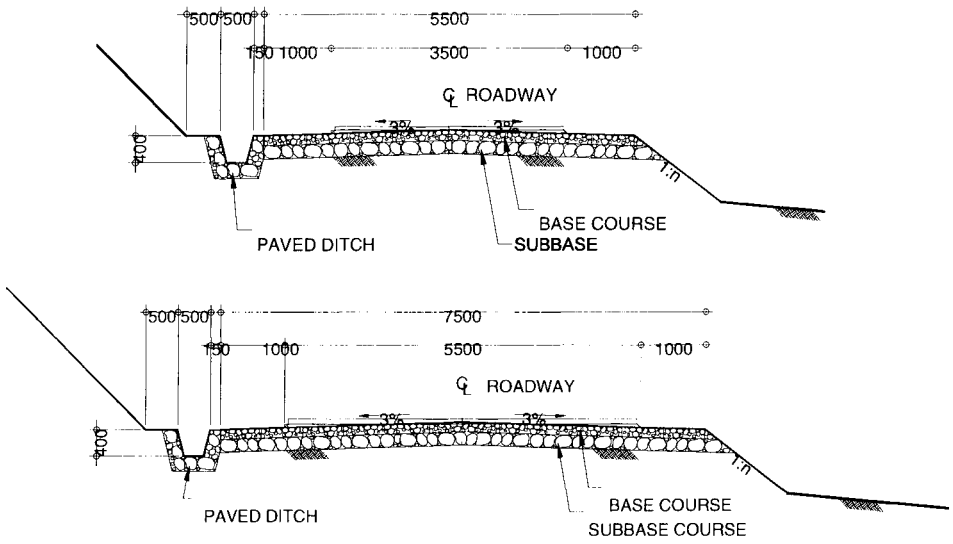
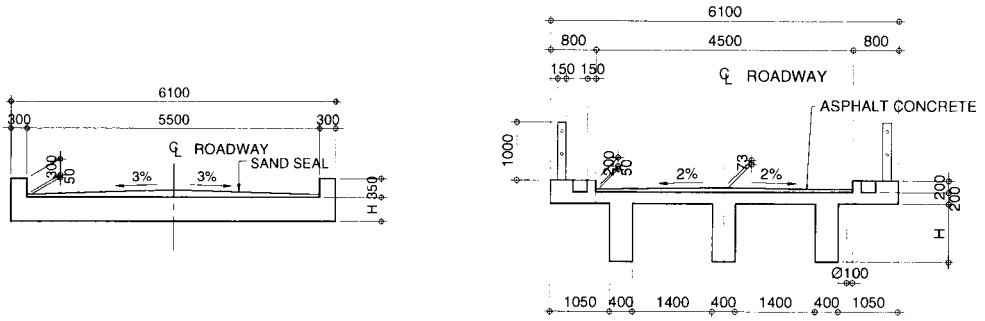
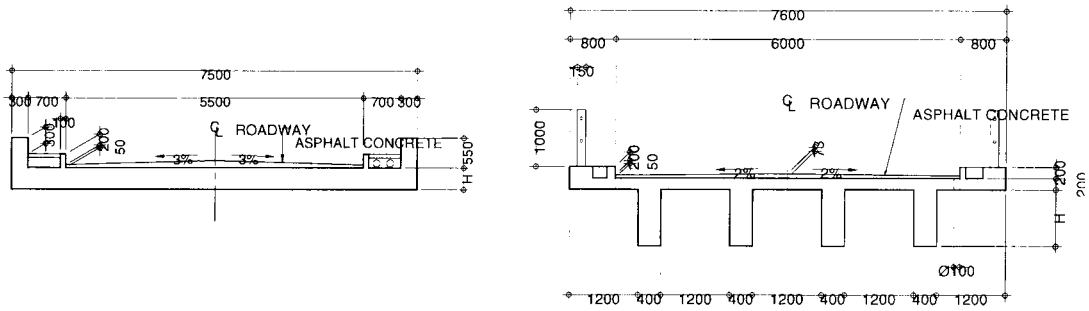


Figure 3.3.3 Typical Cross Sections of Roads



(1) For one lane road



(2) For two lane road

Figure 3.3.4 Typical Cross Sections of Bridges

3.3.3.4 Road Rehabilitation Design

Taking into account road failures detected along the existing roads and the importance of drainage facilities to be improved, road rehabilitation measures are classified into seven types. These types including debris flow protection, shoulder failure restoration, land slide restoration, etc and suitable drainage structures such as side ditch, sub soil drainage, cross drainage are to be designed in accordance with the design policy and design manuals. The design results are depicted in Figure 3.3.5.

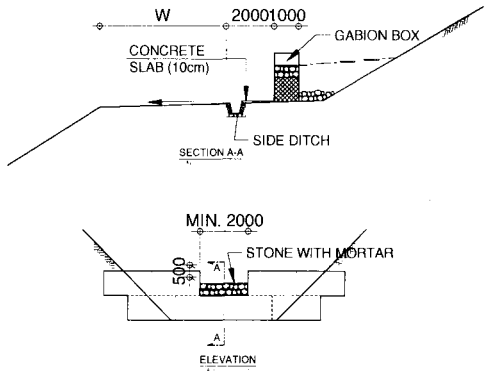
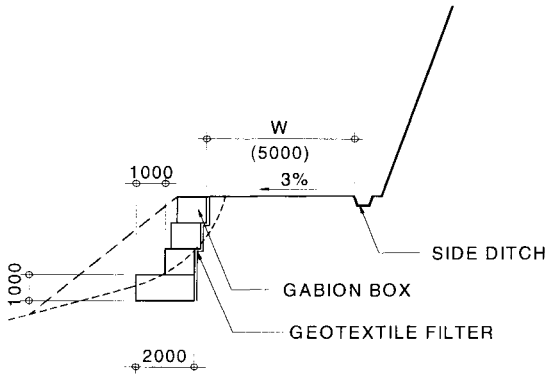
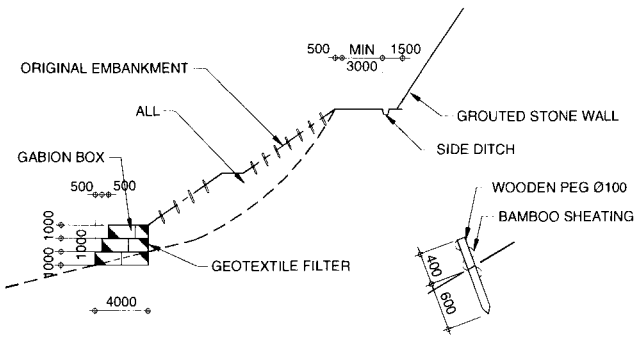
(1) Protection of Debris Flow	
(2) Restoration of Shoulder Failure	
(3) Restoration of Embankment Failure	

Figure 3.3.5 Typical Restoration Design

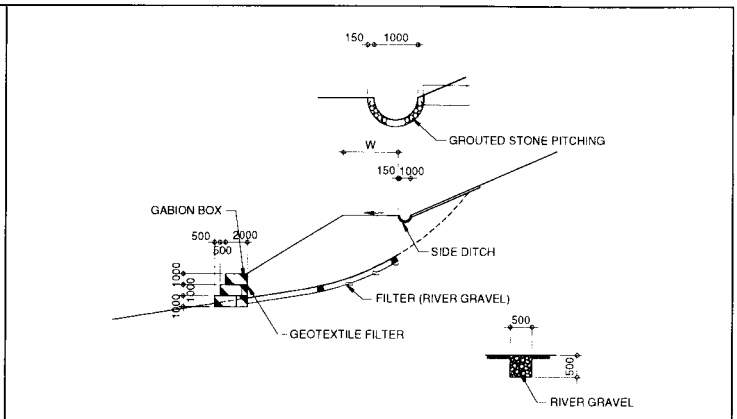
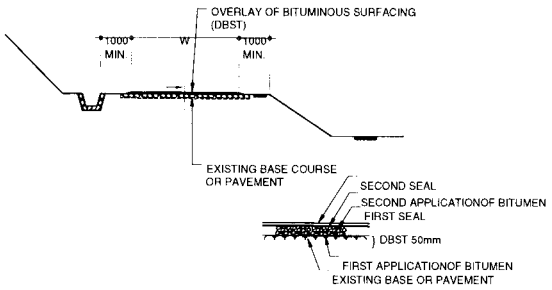
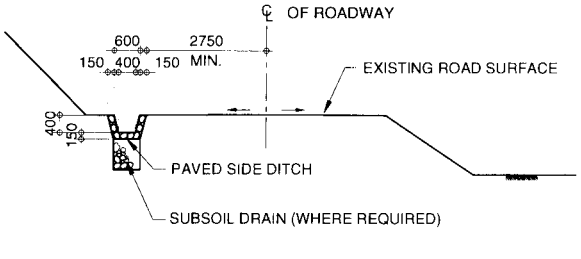
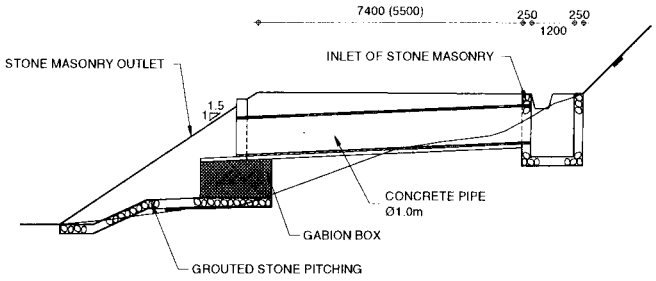
(4) Restoration of Land Slipped Area	
(5) Overlay of Pavement	
(6) Providing side ditch with subsoil drain	
(7) Provision of Culvert	

Figure 3.3.5 Typical Restoration Design

3.3.3.5 Bridge Rehabilitation Design

(1) Bridge Design Criteria

- Applicable Live Load: HS 20-44*1.25

Most of the existing bridges in East Timor have been designed for Indonesian D-loading in accordance with Bina Marga Spec. 1970-1974 which is about 25 % greater than Australian Standard Loading (L 44 Load in NAASRA) and 60 % greater than AASHTO loading (HS-20-44). Application of D-loading as East Timor new loading is likely to be overdesigned and unfeasible taking into account the present and future traffic volumes and vehicle types in East Timor. An applicable bridge design code including loading standard in East Timor should be at an international level considering future development and be consistent with standards applied in neighboring South East Asian countries.

From the aspects mentioned above, it is recommended to use the AASHTO code with design live load of HS 20 - 44 increased by 25% , which is widely applied in most of South East Asian countries. Thus it is recommended to be applied as East Timor's Bridge Design Code.

- Seismic Load: Lateral Seismic Coefficient of 0.15

The earthquake records since 1973 with a magnitude more than 6 and within a radius of 300 km from Dili, Lospalos and Suai were collected from the National Earthquake Information Center (NEIC) of the United States Geological Survey. Based on these records, acceleration at each city center for each earthquake were calculated. The maximum acceleration derived from these calculation is 136 gal due to the earthquake on May 14, 1995 with a magnitude of 6.9 and an epicenter of 8.38 S and 125.13 E (46 km from Dili). Based on these records over 27 years, the design acceleration with a 50 year return period was calculated using the Weibull Distribution Model and the result is 140 gal which is equivalent to 0.143, say 0.15 of lateral seismic coefficient.

- Material Strength

Reinforced concrete slabs and box culverts will be constructed with a concrete of compressive strength of 21 N/mm^2 (cylinder strength). For reinforced concrete girder bridges, the beams and deck slab shall have concrete strength of 24 N/mm^2. Substructures such as abutments and piers shall be of 21 N/mm^2 concrete strength. Round bars are generally used for bridge construction in East Timor at present but it is desirable to use deformed bars, especially in beam construction. Reinforcing bars conforming to Grade 60, ASTM A615, or equivalent are recommended.

(2) Applicable Bridge Type

Based on the past practice, availability of local materials, topographic and geological conditions in East Timor, the following type of bridges and culverts by span length are recommended in the Study.

- Box Culverts/RC slab

For small bridges ranging 5 to 10m span, RC slab bridge with stone masonry abutments is economical. However many examples of abutment scouring and poor workmanship are observed. It is required to provide enough embedded depth of footing and river bed protection. Box culverts are recommended for small gullies or creeks with no run off during dry season.

- Reinforced concrete bridges

Reinforced concrete T-beam bridges are most practical in span ranging 10-20 meters, and I-beam bridges are used for spans up to about 25meters where reinforced concrete girders become inefficient. This type of bridge can be largely constructed of locally available materials and have many are common in East Timor. Caisson foundations are labor intensive and are also recommended based on the past experience. Substructure should be of reinforced concrete structures instead of stone masonry.

- Steel truss bridges

For spans required for more than 30 meters, standard steel trusses are recommended because of following reasons:

- easy quality control at job site
- simple construction (no false work or intermediate supports)
- to ease transportation of steel members over long distances on poor roads
- to permit participation by local contractors due to relatively low site technology, and
- uniform and standard design and field work.

- Causeway

For a site where no river crossing structure exists along Priority 2& 3 links, a causeway is recommended as a viable river crossing structure. In case no river flow occurs during a dry season or a flash type flow during rainy season, a river bed type causeway is recommended. A vented type causeway is suitable if a river has stagnant or steady flow through a year.

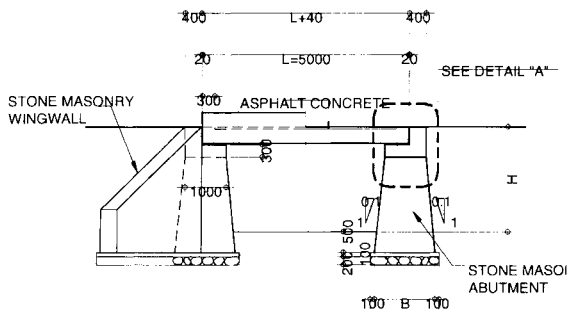
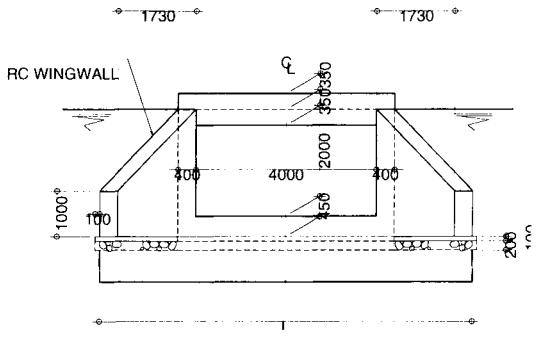
Table 3.3.9 shows a summary of recommended bridge types in the Study.

Table 3.3.9 Recommended Bridge Type

Span Range (m)	Type of bridge	Application Criteria
Up to 5m	Box culvert or RC slab (with stone masonry abutment)	Depend on flow condition, availability of material and/or ground condition at the site.
5-10m	Two cell box culvert or one span RC slab	Ditto
10- 25m	RC T- or I-beam bridge with RC substructure	With spread foundation or caisson foundation
More than 30m	Steel truss	Standard steel truss and RC substructures
Various	River Bed Type Causeway	No river flow during dry season or flash type flow during rainy season
	Vented Type Causeway	stagnant or steady flow through a year

In parallel to the bridge work, river control work around the bridge site shall be provided to protect river banks and substructures. These works include river bank protection, river bed protection, river alignment protection and aggradation protection work.

Typical plan of recommended bridge type, causeway and river control works are shown in Figure 3.3.6.

(1) RC slab with stone masonry abutment and wingwall	
(2) Box culvert with RC wingwall and aprons	

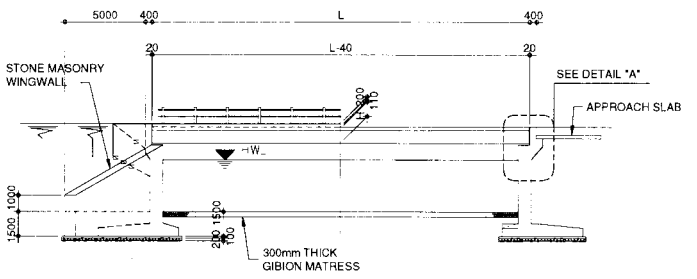
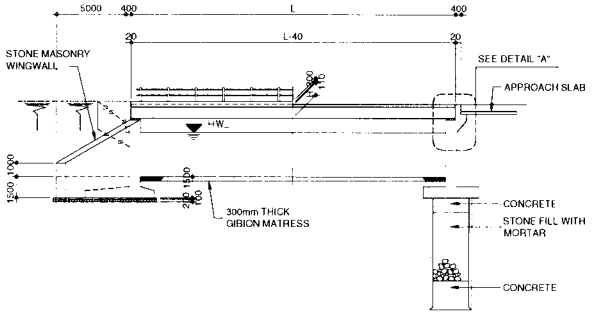
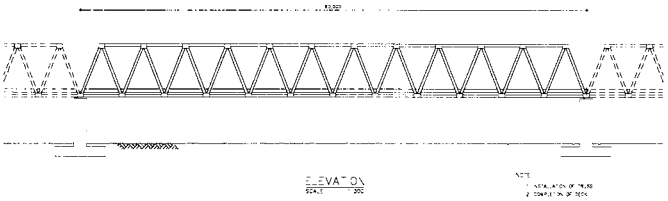
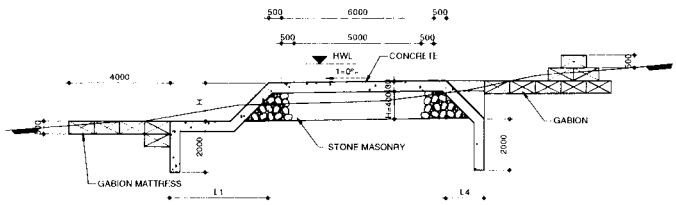
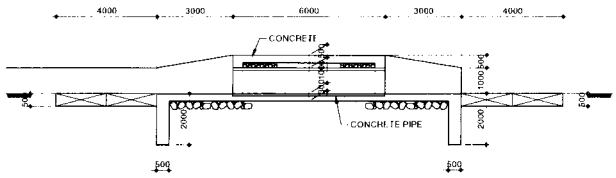
(3) RC T girder bridge with spread foundation	
(4) RC T Girder bridge with caisson foundation	
(5) Steel truss bridge: - erection of truss	
(6) Causeway (bed level causeway)	
(7) Causeway (vented causeway)	

Figure 3.3.6 Typical Plan of Recommended Bridge Types, Causeways

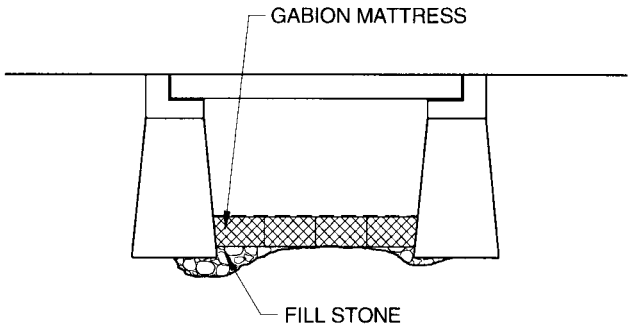
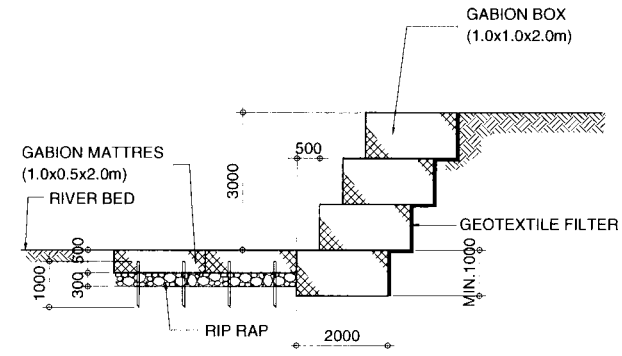
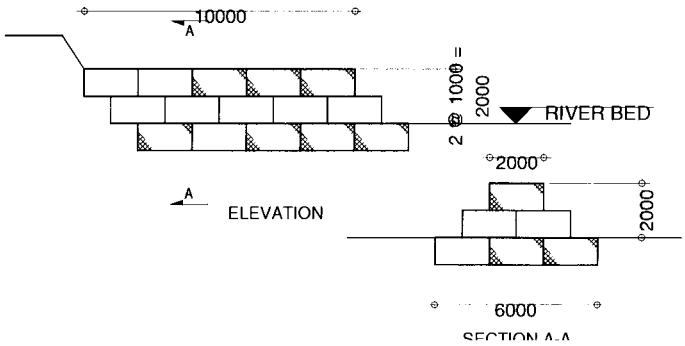
(1) Scouring under abutment: by wire mesh gabion	
(2) River control work Bank protection : - gabion wall	
(3) Super dike /Groin: by wire mesh gabion	

Figure 3.3.7 Typical Plan of River Control Works

3.3.3.6 Estimated Work Quantities

Based on the preliminary design results mentioned above, the work quantities are estimated accordingly. Following are a summary of the work quantities covering the three years urgent rehabilitation plan.

(1) Road Work

Table 3.3.10 Summary of Road Work Quantity

	Item	Unit	Quantity
1	**Missing of road by scouring**		
	Construction of road embankment	m	1,970
2	**Slope failure restoration**		
	Cut slope slip	m	14,190
	Shoulder slip down	m	7,790
	Land slide	m	9,300
3	**Drainage**		
	Installation of pipe culvert	No.	110
	Inlet & outlet	No.	170
	Paved side ditch	m	83,900
4	**Pavement work**		
	New pavement	m^2	180,000
	Overlay	m^2	760,000
	Shoulder repair	m	24,100
5	**Safety facilities**		
	Safety devices	m	36,000

(2) Bridge and River Training Works

Table 3.3.11 Summary of Bridge Work Quantity

1	**New Construction**		
	RC slab bridge	No	32
	Two span RC slab bridge	No	1
	RC T girder bridge with spread foundation	No	14
	RC T girder bridge with caisson foundation		1
	Two span RC T girder bridge with caisson foundation	No	2
	RC hollow slab bridge	No	1
	Box culvert	No	2
	Causeway (L= 40m)	No	8
	Causeway (L=250m)	No	1
	Pipe culvert (1- ϕ 0.9m)	No	9
	Pipe culvert (2- ϕ 0.9m)	No	2
2	**Continuation of bridge construction**		
	RC T girder bridge (superstructure only)	No	1
	RC T girder bridge (one abutment + superstructure)	No	1
	Steel truss (W=6.0m, L=60m)	Span	1
	Placing deck slab concrete for steel truss including bituminoussurfacing	L.S.	1
3	**Repairing/strengthing**	Bridge	39
4	**Protection work**		
	River training work	Place	8
	Sabo dam	No	1

3.3.4 Construction Cost Estimate

The total construction cost of the three year urgent rehabilitation plan for the study roads and bridges is estimated at US$ 73.0 million at June, 2000 derived from the estimated work quantities multiplied by corresponding unit prices tabulated in Chapter 8. This cost includes direct and indirect cost, and general items for mobilization and demobilization of staff, transportation cost of equipment and material, installation, maintenance and dismantling of field office and laboratory and local communication cost.

The total construction cost of US$ 73.0 million comprises of US$ 56.3 million, for the road works equivalent to 77.2 % of the total, and US$ 16.7 million, for the bridge work to 22.8 %. The percentage of each work category for road routes No. ① ~⑮ is shown in Figure 3.3.8.and a summary of total construction cost with each breakdown is tabulated in Table 3.3.12.

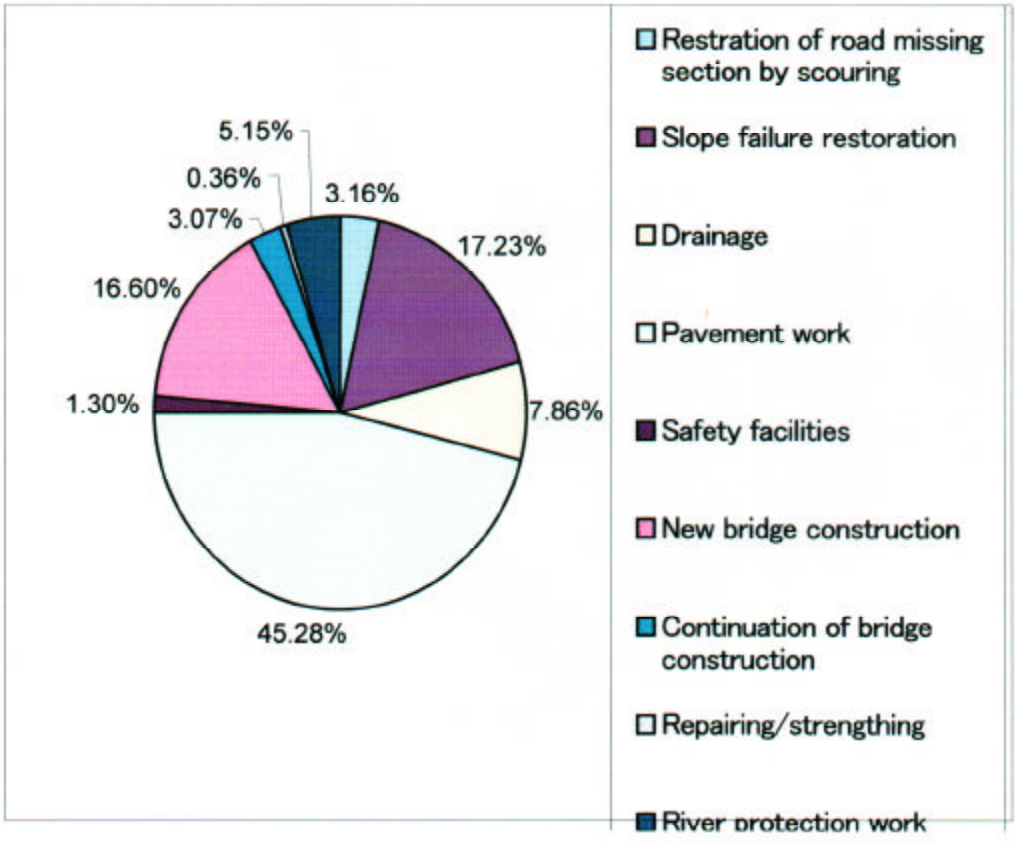


Figure 3.3.8 Percentage of Each Work Category (Routes ①~⑮)

Table 3.3.12 Summary of Total Construction Cost

Unit: US Dollar

	Item	Unit	Quantity	Unit Price	Amount
Ⅰ. Route ①~⑮					
1	**Road Missing Section by Scouring**				
	Construction of road embankment	m	1,970	682.0	1,344,000
2	**Slope Failure Restoration**				
	Cut slope slip	m	14,190	20.3	288,000
	Shoulder slip down	m	7,790	734.0	5,718,000
	Landslide	m	9,300	142.0	1,321,000
3	**Drainage**				
	Installation of pipe culvert	No.	110	1,120.0	123,000
	Inlet & Outlet	No.	170	1,960.0	333,000
	Paved side ditch	m	83,900	34.4	2,886,000
4	**Pavement Work**				
	New pavement	m^2	180,000	38.4	6,912,000
	Overlay	m^2	760,000	15.7	11,932,000
	Shoulder repair	m	24,100	17.0	410,000
5	**Safety Devices**				
	Safety devices	m	36,000	15.3	551,000
	Subtotal of Road				31,818,000
6	**Bridges**				
6-1	**Construction**				
	RC slab bridge	No.	32	25,000	800,000
	Two span RC slab bridge	No.	1	36,500	37,000
	RC T-girder bridge with spread foundation	No.	14	207,300	2,902,000
	RC T-girder bridge with caisson foundation	No.	1	283,400	283,000
	Two span RC T-girder bridge with caisson foundation	No.	2	486,100	972,000
	RC hollow slab bridge	No.	1	302,500	303,000
	Three span RC bridge	No.	1	651,300	651,000
	Box culvert	No.	2	89,000	178,000
	Causeway (40m)	No.	8	48,700	390,000
	Causeway (250m)	No.	1	487,200	487,000
	Pipe culvert (1- ϕ 0.9m)	No.	9	4,200	38,000
	Pipe culvert (2- ϕ 0.9m)	No.	2	7,800	16,000
6-2	**Continuation of Bridge Construction**				
	RC T-girder bridge (superstructure only)	No.	1	148,400	148,000
	RC T-girder bridge (one abutment + superstructure)	No.	1	173,600	174,000
	Steel truss (W=6.0m, L=60m)	Span	1	900,400	900,000
	Placing deck slab concrete for steel truss including bituminous	L.S.	1	83,000	83,000
6-3	**Repairing/Strengthing**	Bridge	39	3,900	152,000
6-4	**Protection Work**				
	River training work	11	11	124,200	1,366,000
	Sabo dam	1	1	826,300	826,000
	Subtotal of Bridge				10,706,000
7	**Total of Route ①~⑮**				42,524,000
Ⅱ. Others					
	Dili City				
	Roads	L.S.	1	2,100,000	2,100,000
	Bridges	L.S.	1	1,265,000	1,265,000
	Subtotal of Dili City				3,365,000
	Bobonaro, Suai, Ocuci Ditrict				
	Roads	L.S.	1	7,429,000	7,429,000
	Bridges	L.S.	1	1,697,000	1,697,000
	Subtotal of Bobonaro, Suai, Occuci District				9,126,000
	Routine Maintenance and rural road				
	Roads	L.S.	1	15,000,000	15,000,000
	Bridges	L.S.	1	3,000,000	3,000,000
	Subtotal of Routine Mainteance and rural road				18,000,000
	Total of Others				30,491,000
Grand Total					73,015,000

Note: Including general works, construction cost, engineering cost, and contingency (10%)

3.3.5 Construction Planning

3.3.5.1 Basic Concepts of Project Construction

Taking into account the project features, topographic and geological conditions, present infrastructure situation and socio-economic conditions in East Timor, the construction concepts are established as follows:

- Maximize the procurement of local labors, materials and equipment in East Timor so as to increase employment opportunities, to facilitate technology transfer and Timorese capacity building and to provide positive impact to the local economy.

- Establish good communication between UNTAET, consultant, contractor and the other agencies concerned for the project implementation as smooth as possible.

- Prepare a practical construction plan taking into account the local rainfall pattern, period required for materials and equipment procurement, and application of appropriate construction methods.

- Establish and apply mitigation measures for adverse environmental effects to preserve fragile environmental conditions in East Timor.

- Formulate field work programs preventing any inconvenience and temporary road closure to the present vehicular and pedestrian traffic.

3.3.5.2 Special Attention in Construction

(1) Responsibility for Right of Way (ROW)

UNTAET shall be responsible for land acquisition if required and any compensation to local residents with regard to ROW and quarry site, borrow pit and spoil bank related to the road and bridge construction.

(2) Unloading Port of Imported Materials and Equipment

Dili Port, which is the main international port available in East Timor, has limited port facilities of 240 m berthing length with 6.2m water depth and is relatively congested. Furthermore, no loading and unloading equipment are available at present. Under such conditions, procurement of imported materials and equipment for construction use should be scheduled well in advance.

(3) Priority of Local Procurement

The materials, equipment and manpower locally available in East Timor shall be procured on a priority basis to facilitate local economy and capacity building.

The construction materials available in East Timor are limited and these include sand, concrete aggregates, asphalt, emulsion, lubricant, gasoline, timber and plywood. Among these, asphalt, emulsion, lubricant, gasoline, timber and plywood are available but imported from neighboring countries.

(4) Availability of Local Contractors

About 14 contractors have been registered in UNTAET and are available in East Timor. Among these, only 3 are local contractors and the remaining are either JVs with foreign contractors or foreign contractors. These companies own commonly used equipment such as small dump trucks, dozer/shovel, small compactor, cargo trucks and they are willing to lease these equipment to a contractor of the project.

(5) Environmental Constraints during Construction

Natural conditions in East Timor are fragile and UNTAET is spending every effort to formulate several regulations and guidelines for environmental protection. Under such conditions, special attention shall be paid for the environmental protection measures in order to eliminate any adverse effects derived from the project implementation.

(6) Relevant Laws of Procurement from the Third Countries

All the regulations issued by UNTAET are applicable law in East Timor for construction business and procurement from outside country. It is expected that Gross Revenue Tax, Import Tax and other Taxes imposed in East Timor are exempted in the projects funded by bilateral donors.

3.3.5.3 Procurement Schedule

(1) Construction Materials

Lubricant/oil, imported gasoline, and sand and gravel are available locally for the project. Gabion wire, cement, reinforcing bar, corrugated pipe, plywood, timber are not available locally and are procured from the neighboring countries. The sources of construction materials to be procured are shown in Table3.3.13:

Table 3.3.13 Procurement of Major Construction Materials

Item	Procured in East Timor	Procured in neighboring countries
Cement		O
Aggregate and sand	O	
Gabion Wire		O
Reinforcing bar		O
Straight asphalt	O	
Emulsion		O
Concrete admixture		O
Gasoline	O	
Gravel & Bolder	O	
Timber		O
Plywood		O
Laboratory Equipment		O

(2) Construction Equipment

There are minor and commonly used small construction equipment owned by local contractors available in East Timor. The equipment will be lent to contractors. However, these equipment are scheduled to be used only for a short term periods in the project and construction equipment required for use during long term periods will be procured in neighboring countries to cut costs.

Table 3.3.14 Procurement for Major Construction Equipment

Item	Capacity	Procured in East Timor	Procured in neighboring countries
Bulldozer	10 t		O
Pay Loader	1.2 m3		O
Excavator	0.4 m3		O
Dump Truck	3 t	O	
Compaction Roller	1-2 t		O
Trailer	20 t	O	
Cargo Truck	3 t		O
Generator	30 kVA		O
Air Compressor	3 m3/min	O	
Tamper	60 - 100 kg		O
Water Pump	4" dia., 30 m		O
Vibrator	45 mm		O

(3) Labors

Because of the field work given through QIPs and urgent rehabilitation implemented by UNTAET or several donors, certain labor skills are available in East Timor. However, engineers such as supervisors and specialists for specific fields are very limited, and so involvement of some foreign engineers and experienced technicians from neighboring countries for the project implementation is unavoidable in order to facilitate capacity building through the on the job training and to complete the project on schedule. In this regard, involvement of 25 local labor per one foreign technician and 10 local engineers

per one foreign engineer shall be stipulated in condition of the contract for the Project.

3.3.5.4 Construction Schedule

Construction period of each project link generally depends on a magnitude of works involved or the length of the road. The project period including detailed design, tendering and construction period is 2 years in an average. The two years consist of five months for detailed design, three months for tendering and sixteen months for construction as shown in Figure 3.3.9.

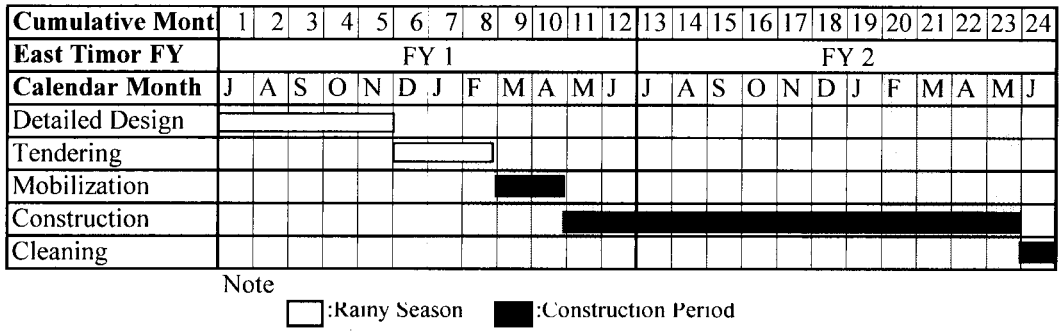


Figure 3.3.9 Typical Construction Schedule

3.4 Quick Projects (QP)

Taking into account that keeping the roads and bridges open is the highest priority in UNTAET's program, the Quick Project, which is called Quick Impact Project (QIP) in UNTAET, was formulated for road and bridge sectors in the early stage of the Study and implemented during the month of April, May, June and July by labor intensive methods. The main purpose was to create job opportunity for the Timorese.

3.4.1 Selection of Road Links for QPs

Prior to selecting appropriate the road links for QPs, the existing corridors consisting of northern coastal corridor, southern coastal corridor and five penetration roads are subdivided into 13 road links in term of road function and condition aspects. Each link was evaluated from the following viewpoints. The evaluations are to be as quantitative as possible in order to select candidate links for QPs. :

- The decline of road function compared to when it was originally designed and expected;
- Possible tackling restoration works by means of labor intensive methods in order to create job opportunity for Timorese;
- No conflict with other Donors' QPs; and
- Road hierarchy and number of beneficial population, land use pattern and beneficial industry along a link.

Based on the evaluation and rating of each road link from above mentioned characteristics, the following links shown in Table 3.4.1 are selected with specific scope of the works.

Table 3.4.1 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 filing 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, filing gravel to potholes and construction of causeway for a river.	105 days	Contract Basis

3.4.2 Implementation of QPs

(1) Emergency Rehabilitation of Road Links, Dili – Aileu – Ainaro and Baucau – Laga – Baguia – Southern Road JC

- Original Contract

Both links, Dili – Aileu – Ainaro and Baucau – Laga – Baguia – Southern Road JC are north – south penetration corridors among the five links in East Timor running through steep mountainous terrain with fragile geological condition. These two links mainly support agriculture sector. The first link has been provisionally rehabilitated on a spot basis under UNDP Program as funded by the Government of Norway, UNTAET as funded by Department of International Development (DFID) in UK and by NGO(Timor Aid). However, the road failures resulting in lowering the road function still are occurring every after heavy rainfall and are observed at several places. The second link latter has suffered from a long term lack of maintenance. It is in very poor condition and is no longer passable by any vehicles at four locations. For this link no rehabilitation was made by any donors after the destruction. The tender

rehabilitation was made by any donors after the destruction. The tender document including the drawings for this Project was prepared by the Study Team during the period from mid. March to mid. April. The Project has been implemented on a contract basis by the Japanese Contractor procured through competitive biding. The outline of the original contract is :

- Funding Agency	: Japan International Cooperation Agency (JICA)
- Contract Amount	: US$ 900,000.00
- Name of Contractor	: Tobishima Corporation
- Mode of Contract	: Unit price contract
- Contract Period	: 2 May – 15 July 2000 (75 days)

- Modification of Contract

The scope of the work has been changed on June 21,2000. That is to cancel the works from Baguia to JC of Southern Coastal Road due to 1) a large scale landslide occurred at the end of June at 3.6 km southward from Baguia and 2) no access roads available from the southern side to JC of Southern Coastal Road.

Thus, work quantities derived from deletion of Baguia – JC of Southern Coastal Road section was re-allocated to newly damaged spots/locations due to recent heavy rain in Dili-Aileu-Ainaro and Baucau-Laga-Bagia sections.

- Quality Control

The field tests such as slump test of fresh concrete, field density test of backfill material and as built measurement survey were conducted during the contract period as quality control activities. In addition, certificates of the materials such as gabion wire, corrugate pipe, cement submitted by the Contractor were reviewed and accepted by the Consultant.

- Progress Control

Based on the construction schedule submitted by the Contractor, a progress control chart, so called as "S curve chart", was prepared accordingly. On a weekly basis, actual progress accomplishment by percentage was plotted on the chart to compare scheduled progress and actual one.

The actual progress was always behind the schedule, but the whole works was completed with a 30 days time extension.

- Payment Control

The schedule payment was applied in the contract.

After signing the contract on 2nd May 2000, advance payment amounting Japanese Yen 28,650,000, which corresponds to 20 % of the Contract price, was paid to the Contractor on 8 May 2000.

Final payment, which is the remainder of J. Yen 66,850,000, is paid on 28 August 2000 upon the completion of the Work i.e., after final inspection and issuance of the final certificate by the Consultant.

- Safety Control

The following safety control measures took place during the implementation.

- Installation of traffic sign boards and flagmen before and after each job site,
- Provision of safety helmet for each labor and field foreman, and
- Safety control issue were discussed in every weekly coordination meeting.

(2) Routine Maintenance of Dili- Manatuto- Baucau Link

This link supporting socio-economic activities is the most important in East Timor and connect Dili, capital city in East Timor to Baucau, the second largest city. After the destruction, INTERFET first repaired critical spots that hindered smooth transport of humanitarian aid and security cargo on a force account basis. It was however observed that critical road deficiencies aggravate the road function. One of them is heavy and tall vegetation on the shoulders and full sediment in the side ditches resulting from lack of maintenance. Taking into account these conditions, the Project was formulated in coordination with UNTAET and has been implemented by the Study Team on a force account basis with the implementation period of forty-days from the end of March to mid. May. The Project organization is depicted in Figure 3.4.1.

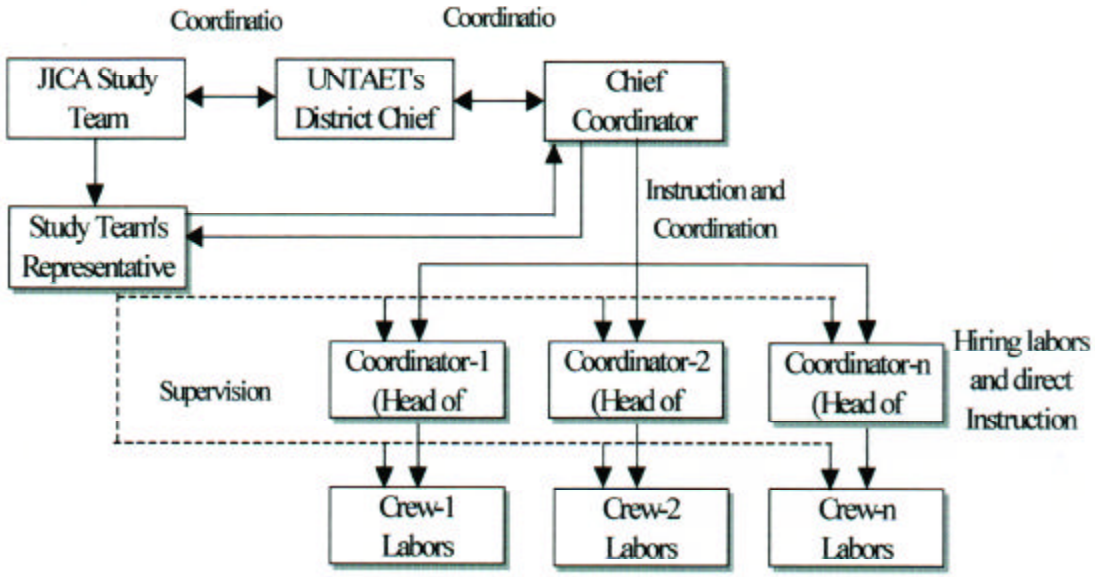


Figure 3.4.1 Organization of Force Account Project

Photo 3.4.1 Comparison Before and After the Work

3.5 Implementation Plan

3.5.1 Basic Concepts for Formulating Implementation Plan

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

- The scope covered in the Implementation Plan comprises a total of 1,449km in length of the arterial roads and 450 bridges along these roads in East Timor including Oecusse District.
- 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 open the impassable sections due to road failure or missing structures,
  2) to rehabilitate the roads and bridges up to their original function, and
  3) to provide routine and periodical maintenance
- The concept of the road and bridge urgent rehabilitation is to sustain a road net work by extensive routine maintenance work.
- The budgetary limitation over three year period, which is approximately 71 million US$ in total consisting of 38.0 million US$ from the Trust Fund for East Timor(TFET) under a trusteeship of the International Development Agency(IDA), 30.0 million US$ from bilateral and non-trust fund multilateral contribution, and 3.0 million US$ from UNTAET recurrent fund. This limitation shall be taken into account in formulating the implementation plan.
- Collaboration with other funding agencies and donors such as UNDP, ADB and IBRD should be considered to formulate a realistic plan without overlapping and repeating.
- Capacity building of the Timorese engineers and local contractors should take into account possible institutional change i.e., assuming that Department of Transport and Works and District Maintenance Offices have been established as per ADB's recommendation.

3.5.2 Implementation Plan on a Priority Basis

The implementation plan of each project section rehabilitation and routine maintenance has been scheduled on a priority basis taking into account the basic concepts mentioned above and is depicted in Figure 3.5.1. Figure 3.5.2 showing locations of each link.

Route No	Road Section	Capital Cost US$ Mill	2000 Q3 Q4	2001 Q1 Q2 Q3 Q4	2002 Q1 Q2 Q3 Q4	2003 Q1 Q2	Commited Agency
(1)	Dili-Aileu-Aituto-Ainaro-Cassa	4.82					JAPAN
(2)	Laga-Baguia-Afaloicai	6.54					QP by Japan
(3)	Tibar-Ermera	3.12					(JICA STUDY)*
(3)-1	Ermera-Hatolia	1.65					(JICA STUDY)*
(4)	Ermera-Letefoho-Atsabe	2.41					(JICA STUDY)*
(5)	Laga-Lautem-Los Palos	2.72					(JICA STUDY)*
(6)	Manatuto-Cribas-Natabora	1.88					ADB-TFET
(7)	Dili-Tibar-Liquica-Maubara-Loes	3.04					(JICA STUDY)*
(8)	Baucau-Venilale-Viqueque	4.97					ADB-TFET
(9)	Aituto-Same-Betano	2.16					ADB-TFET
(10)	Cassa-Betano	0.74					(JICA STUDY)*
(11)	Betano-Natabora	0.41					(JICA STUDY)*
(12)	Natabora-Viqueque	0.63					(JICA STUDY)*
(13)	Viqueque-Beacu-Uatolari-Irabinleteria	1.09					(JICA STUDY)*
(14)	Irabinleteria-Illiomar-Los Palos	2.08					(JICA STUDY)*
(15)	Dili-Manatuto-Baucau-Laga	4.28					(JICA STUDY)*
	Dili city	3.37					(JICA STUDY)*
	Bobonaro, Suai, Oecusse Districts	9.13					ADB-TFET
	road	18.00					ADB/OTHERS
	Total	**73.04**		**24.65**	**31.69**	**16.67**	

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

Figure 3.5.1 Implementation Plan

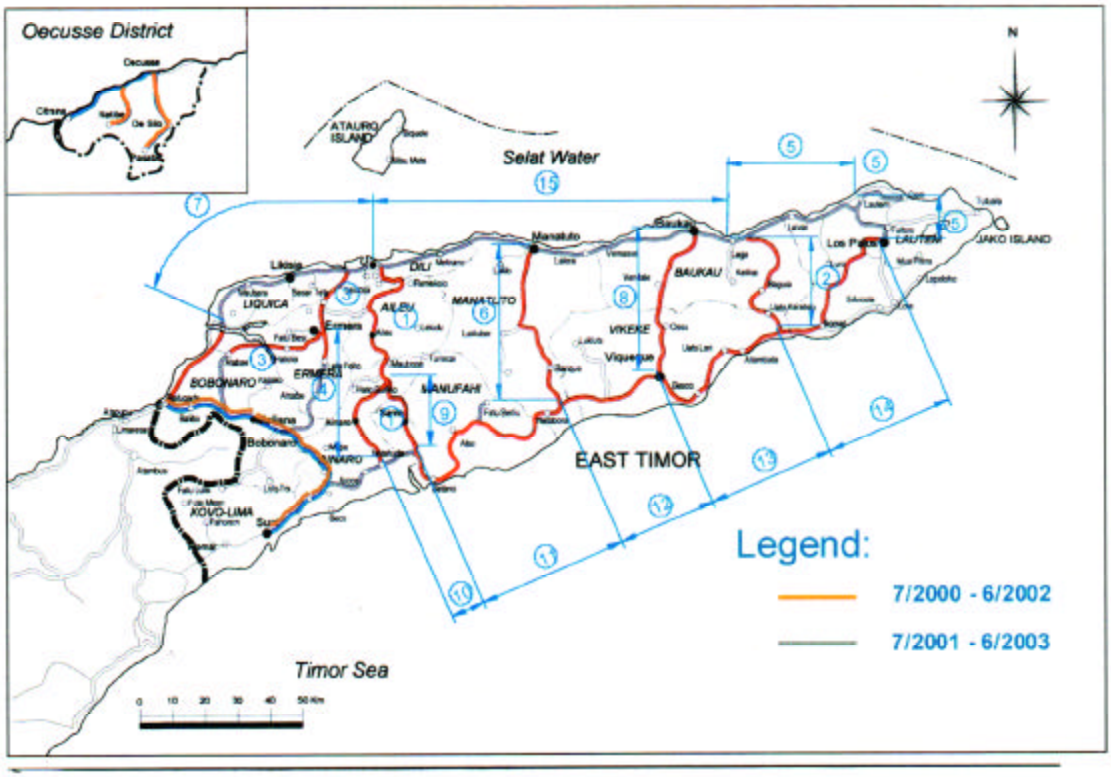


Figure 3.5.2 Location Map of Project Route

The implementation plan has been formulated considering the following matters;

- It is assumed that the project implementing agency will be Department of Transport and Works (DTW) to be newly established in UNTAET or UNOPS in UNDP with consulting services from international engineering firms undertaking detailed design and construction supervision.

- It is envisaged that the rehabilitation works will be implemented by contractor(s) selected through local competitive bidding (LCB) or international competitive bidding (ICB), depending on the magnitude of the project.

- It is expected that routine maintenance will be conducted on a force account basis by newly established area maintenance offices equipped with key construction equipment under ADB's program.

- The implementation period covering detailed design, tendering activities and construction of each section takes minimum one year to a maximum of two years, depending on the project road length and magnitude of works involved.

3.5.3 Budgetary Allocation

The total capital cost required for rehabilitation and maintenance of the existing roads and bridges in East Timor is estimated at US$ 73 million at the June 2000 price. An annual investment of each section and routine maintenance cost covering the all types of roads, is further broken down into road and bridge categories, and tabulated in Table 3.5.1. A summary of the budgetary allocation is shown by Table 3.5.2.

Table 3.5.1 Summary of Budgetary 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.

Table 3.5.2 Summary of Total Project Cost

Route No.	Route	Road Length (km)	Jul-00 Jun-01	Jul-01 Jun-01	Jul-02 Jun-03	Capital Cost (US$)		
						Road	Bridge	Total
①	Dili-Aileu-Aituto-Ainaro-Cassa	136.0	4,825,000		0	4,635,000	190,000	4,825,000
②	Laga-Baguia-Afaloicai	42.0	800,000	5,737,000	0	4,560,000	1,977,000	6,537,000
③	Tibar-Ermera	46.0	1,400,000	1,717,000	0	1,666,000	1,451,000	3,117,000
③-1	Ermera-Hatolia	20.0	1,300,000	347,000	0	369,000	1,278,000	1,647,000
④	Ermela-Letefoho-Atsabe	48.0		1,000,000	1,409,000	1,991,000	418,000	2,409,000
⑤	Laga-Lautem-Los Palos	90.0		2,000,000	718,000	2,690,000	28,000	2,718,000
⑥	Manatuto-Cribas-Natarbora	85.0	1,000,000	881,000	0	653,000	1,228,000	1,881,000
⑦	Dili-Tibar-Liquica-Maubara-Loes Bri	74.0		1,200,000	1,836,000	2,654,000	382,000	3,036,000
⑧	Baucau-Venilale-Viqueque	64.0	1,000,000	3,972,000	0	4,629,000	343,000	4,972,000
⑨	Aituto-Same-Betano	57.0	1,000,000	1,164,000	0	972,000	1,192,000	2,164,000
⑩	Cassa-Betano	25.0		703,000	32,000	32,000	703,000	735,000
⑪	Betano-Natarbora	48.5	116,000	289,000	0	222,000	183,000	405,000
⑫	Natarbora-Viqueque	47.0	114,000	512,000	0	512,000	114,000	626,000
⑬	Viqueque-Beacu-Uatolari-Irabinleteri	61.4	618,000	470,000	0	618,000	470,000	1,088,000
⑭	Irabinleteria-Illiomar-Los Palos	64.3	1,386,000	697,000	0	1,387,000	696,000	2,083,000
⑮	Dili-Manatuto-Baucau-Laga	141.0		1,000,000	3,281,000	4,228,000	53,000	4,281,000
	Dili City		1,100,000	1,000,000	1,265,000	2,100,000	1,265,000	3,365,000
	Bobonaro,Suai,Ocuci District	400.0	3,000,000	3,000,000	3,126,000	7,429,000	1,697,000	9,126,000
					0			
	Routine Maintenance and rural road		7,000,000	6,000,000	5,000,000	15,000,000	3,000,000	18,000,000
	Total	1,449.2	24,659,000	31,689,000	16,667,000	56,347,000	16,668,000	73,015,000

3.5.4 Urgent Rehabilitation Program 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 of Dili – Aileu – Ainaro – Cassa through UNDP as a project implementing agency.

In addition to above, it is strongly recommended by the Study Team that one of the important North-South penetration roads, Laga- Baguia Road which was implemented under QPs during the Study period but are still being not passable due to a large scale land slide should be selected as a candidate for urgent rehabilitation projects by the Government of Japan. In this regard, it should be noted that an alternative route study shall be conducted to select an appropriate route from the technical and economical viewpoints prior to conduct of the detailed design.

The Project profiles of above two projects are tabulated in Figures 3.5.3 and 3.5.4.

Project No.	R-1	Project Name	Urgent Rehabilitation of Dili - Aileu - Ainaro - Cassa
Development Body	UNTAET		
Operation Body	UNDP		

Development Method

- [x] B/Q bidding
- [ ] BOT/BT
- [ ] Other

Financial Assistance

- [x] Required
- [ ] Not required

Project cost (Tousant US$)

Exchange rate: 1US$=110Yen (June, 2000)

Total	**4,820**
Civil works	3,708
Contingency (10% of Civil works)	370
Engineering	742

Location Map

Major Development Components

The Project concepts of the urgent rehabilitation for Dili - Aileu – Ainaro – Cassa road are 1) to repair a section where will probably be failed or damaged due to backlog maintenance and 2) to rehabilitate the road to meet the original function.

Major rehabilitation works anticipated along the road are as follows:

- To rehabilitate slip area of shoulder and travel-way in valley side,
- To rehabilitate cut slope failures by an effective low cost measure,
- To improve depressed area due to land slide,
- To restore damaged shoulders,
- To repair deteriorated and damaged pavement,
- To restore and install side-ditch at a section where is required,
- To rehabilitate cross drains including outlet and inlet,
- To repair culverts and bridges damaged,and
- To install road safety facilities such as guard rail, warning sign boards.

Project Description

The Project is broadly divided into three components, the first component is rehabilitation civil work by a selected civil contractor, the second is engineering services by a qualified consulting firm(s) and the third is project administration by UNDP that is an implementing agency of the Project.

Implementation Schedule

Year	2000/2001	2001/2002	2002/2003
D/D and tendering	■		
Construction		■	

Site Picture

Figure 3.5.3 Project Profile for Urgent Rehabilitation Plan of Dili-Aileu - Ainaro- Cassa

Project No.	R-2	Project Name	Urgent Rehabilitation Plan of Laga- Bagia - J.C.of Southern Coastal Road
Development Body	UNTAET		
Operation Body	UNDP		

Development Method	
[x]	B/Q bidding
[ ]	BOT/BT
[ ]	Other

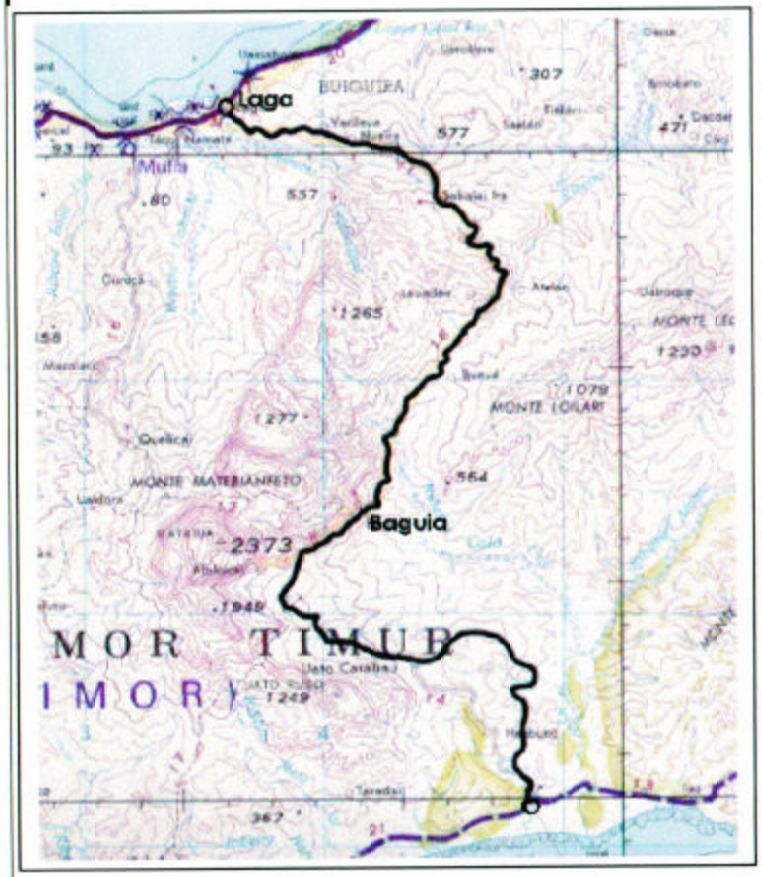
Financial Assistance	
[x]	Required
[ ]	Not required

Project cost (Tousant US$)

Exchange rate: 1US$=110Yen (June, 2000)

Total	**6,540**
Civil works	5,031
Contingency (10% of Civil works)	503
Engineering	1,006

Location Map



Major Development Components

The Project concepts of the urgent rehabilitation for Laga-Baguia - JC of Southern Coastal road are 1) to repair a section where is not passable due to land slide and where will probably be failed or damaged due to backlog maintenance and 2) to rehabilitate the road to meet the original function.

Major rehabilitation works anticipated along the road are as follows:

- To rehabilitate slip area of shoulder and travel-way in valley side,
- To rehabilitate cut slope failures by an effective low cost measure,
- To improve depressed area due to land slide,
- To construct causeways ,or appropriate river crossing structures
- To repair deteriorated and damaged pavement,
- To restore and install side-ditch at a section where is required,
- To rehabilitate cross drains including outlet and inlet,
- To repair culverts and bridges damaged, and
- To install road safety facilities such as guard rail, warning sign boards.

Implementation Schedule

Year	2000/2001	2001/2002	2002/2003
D/D and tendering		[redacted]	
Construction			[redacted]

Project Description

The Project is broadly divided into three components, the first component is rehabilitation civil work by a selected civil contractor, the second is engineering services by a qualified consulting firm(s) and the third is project administration by UNDP that is an implementing agency of the Project.

Site Picture

Figure 3.5.4 Project Profile for Urgent Rehabilitation Plan of Laga- Bagia - J.C.of Southern Coastal Road

3.6 Maintenance and Operation Plan

3.6.1 Organization and Staffing in Charge of Road Sector

(1) Present Organization

The Road Sector under the Transportation Department in 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 by Figure 3.6.1.

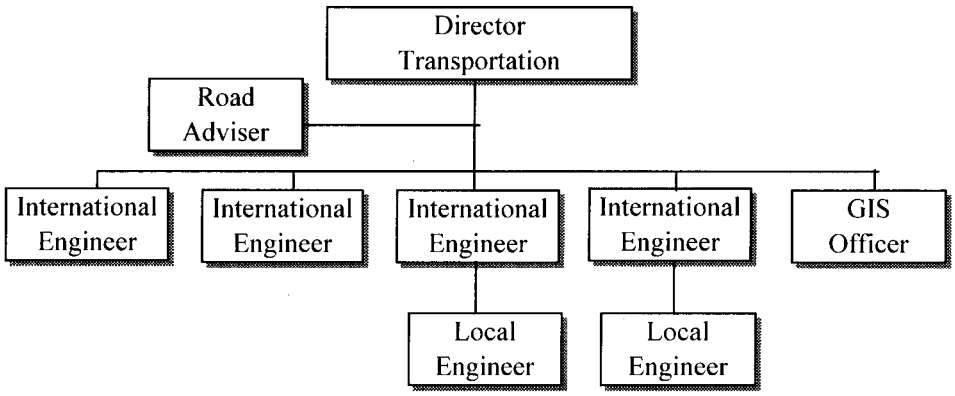


Figure 3.6.1 Organization Chart of Road Sector

At present, all the rehabilitation works including maintenance works are being carried out on a contract basis with private contractors or by donors' and NGO's force account basis, except emergency restoration work being implemented by Peace Keeping Force (PKF), in coordination with the Road Sector.

CNRT (National Council of Timorese Resistance) has also an Infrastructure Department in its organization. The infrastructure division in CNRT is however not functioning as a real counterpart agency of UNTAET due to the shortage of a number of experienced staff.

(2) Staffing, Technical Capability and Budget

As of the end of June, the Road Sector consists of one Road Advisor seconded from Northern Territory and four engineers, who are all international staff from different countries such as Australia, Nepal and Philippines, and two local engineers who belonged to the former Public Works Department in Dili District (DPUK Dili). These staff are well experienced and capable enough to perform their duties and responsibilities in their positions, but it is quite obvious too few staff to primarily function for the Road Sector in East Timor.

The annual capital investment for road and bridge sector form the Trust Fund for East Timor (TFET) and from bilateral and non-trust fund multilateral contribution, and recurrent budget for said sector is about 22.8 million US$ and 2.4 million US$ respectively on an average over a coming three years period.

(3) Organization Recommended by ADB

The ADB- funded TA 3401, Transport Sector Restoration Project includes establishment of institutions and regulatory frameworks in the road, port and airport sectors, and by reviewing the long-term development requirements to enable these sectors to contribute to poverty reduction and economic growth. However, as of the end of June, a concrete organization and staffing of the road sector has not been accomplished. Hence, an organization and staffing presented herein are derived from the review results by the Study Team of "Proposed Structure of the Planned Department of Transport and Works" stated in Appendix 5 of Report on a Project Grant from the Trust fund for East Timor to the UNTAET for Emergency Infrastructure Rehabilitation Project.

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 the Secretary is to include four major division as outlined below:

- Transport Division includes the following activities:
  - Land transport section's activities covering i) reclassifying roads, ii) reviewing, revising and adjusting the road sector legal framework, including a road safety program, to directly cater to the needs of East Timor road users, iii) establishing and implementing road transport regulations in collaboration with the police and iv) supporting the central UNTAET in preparing procurement guidelines for works and supplies contracts; these are proposed to adhere to the principles of economic efficiency using competition and an establishment of a local contracting industry.
  - Maritime and Port section's activities covering i) implementing international conventions, and ii) managing contracts.
  - Aviation section's activities cover i) implementing international conventions, and ii) managing contracts.

- Planning and Design Division includes the following activities:
  - i) management of feasibility studies for capital investment projects and preparation of general and technical specifications, and ii) development of a road asset management system.
- Operation and Maintenance Division includes following activities:
  - i) technical evaluation of international tenders and contract management , ii) program and implement routine and periodic maintenance and manage works through – minor labor based contracts and – specific maintenance and periodic maintenance contract to organized labor though 13 district offices (Note; ADB proposed five regional centers (Baucau, Dili Maliana, Oecusse and Same) for maintenance, but 13, one office for each district is proposed in this Report)
- Finance Division including following activities:
  - Preparation of budget requests, budget allocation and procurement of equipment and materials and asset control.

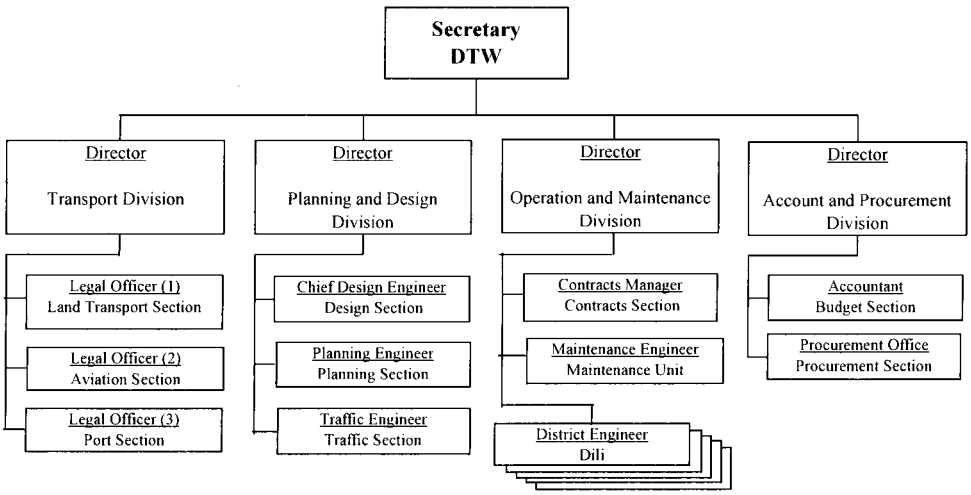


Figure 3.6.2 Proposed Organization Chart of DTW

(4) The DTW's Staffing

A total of about 60 staff members as shown in Table 3.6.1 will be required in the DTW HQ in Dili. In the first year, a few foreign staff will be required, but reduced gradually to minimum extent in the third year as a result of technology transfer to Timorese engineers through the on the job training.

Table 3.6.1 Proposed Staffing of DTW Headquarter in Dili

Category	No's of Staff
Secretary	1
Director	4
Sr. Engineer	10
Sr. Administrator	6
Assistant Engineer	14
Clerical	10
Driver	8
Others	6
Total	60

It is proposed that the DTW's District Office is staffed by a District Engineer, Supervisor, Administrator, Mechanic and a few supporting staff as shown in Table 3.6.2. To the extent possible, the position will be filled with East Timorese who have the adequate skills. The DTW structure includes no labor contingent. Small labor groups are expected to be provided through local contractors.

Table 3.6.2 Staffing of District Office in Road Sector

Category	No's of Staff
District Engineer	1
Supervisor	1
Administrator	1
Mechanic	1
Foreman	2
Operator	2
Driver	2
Total	10
Grand Total	130=10*13 District

3.6.2 Road Maintenance Works

As mentioned earlier, the road network and structures in East Timor are "fragile". It has been constructed for low traffic volumes and light axle loading. It traverses steep and unstable mountain slopes, experiences intense tropical rainfall, and crosses many wide rivers with ill-defined riverbeds. Even after QIPs and the urgent rehabilitation works have been completed as scheduled, the road and bridge failures will be definitely occur every after heavy rain. Hence, the road maintenance is requisite especially in East Timor to keep the roads open, which in turn facilitate efficient national security and transport of humanitarian aid and ensure salvage of the road and bridge assets and to induce revival of economic activity.

The maintenance works are broadly divided into three categories consisting of routine, periodic and incidental maintenance. Scope of the work of each categorized maintenance is as follows:

Routine Maintenance

- Visual inspection by vehicle to defect deviencies and damages,
- Cleaning of surface, side ditch, canal, and culverts,
- Vegetation control as grass cutting of slope and shoulder, care of roadside trees, and
- Repair and repainting of traffic safety facilities such as centerline, pedestrian crossing.

Periodic Maintenance

- Pavement maintenance and repair,
- Overlay, and
- Repair of slope protection and drainage structures.

Incidental Maintenance

- Restoration work for road failure such as slope failures, slip down and small scale landslide.

3.6.3 Bridge Maintenance Works

Bridges in the road network are designed to ensure efficient movement of people and goods because of their strategic location and the serious consequences occurring their capacity is impaired or, even worse, when they fail. Particular attention must be given to the systematic inspection and maintenance of bridges as an essential part of the surveillance and management of the road network.

The maintenance works for bridges are also broadly divided into three categories consisting of routine, periodic and incidental maintenance. Scope of the work of each categorized maintenance type as follows:

Routine Maintenance

- Visual inspection by vehicle to detect deficiencies and damages,
- Cleaning operation; removal of foreign materials such as trash, dirt or vegetation and floating debris by hand,
- Small scale removal and replacement operations; substitution of deteriorated elements such as deformed steel railing, damaged river bank protection, etc, and
- Localized repairing operation; repairing to potholes on bridge surface and to concrete defects such as scaling, flaking, spalling, etc. by patching.

Periodic Maintenance

- Small scale restoration operation; re-pointing of stone masonry, brick work, wire meshed gabion, reinstallation of traffic sign and river bed protection work,
- Localized repainting operation; repainting of rusted steel members, and providing protective coating to concrete members, and

- Lubrication and greasing operations.

Incidental Maintenance

- Restoration work for bridge failure and bank collapse.

3.6.4 Implementation and Operation System

In the road and bridge maintenance, it is essential to effectively manage the maintenance activity and to correctly carry out the works at the job site. A successful management and implementation of the maintenance rely on the organization and method applied as well as staffing and their capacity. Therefore, the overall organization linking the proposed Department of Transport and Works HQ and District Offices who are directly responsible for actual maintenance works. The proposed maintenance team's organization and staffing is presented hereafter.

(1) Mode of Maintenance Work

It is recommended from capacity building aspect that the routine type of maintenance works shall be carried out on a force account basis by the DTW's District Office, based on an annual maintenance program formulated by the DTW HQ, while the sophisticated work requiring heavy construction equipment or periodical maintenance work in bulk shall be conducted on a contract basis. The flow of maintenance works highlighting the relationship between DTW's HQ and each District Office is depicted in Figure 3.6.3.

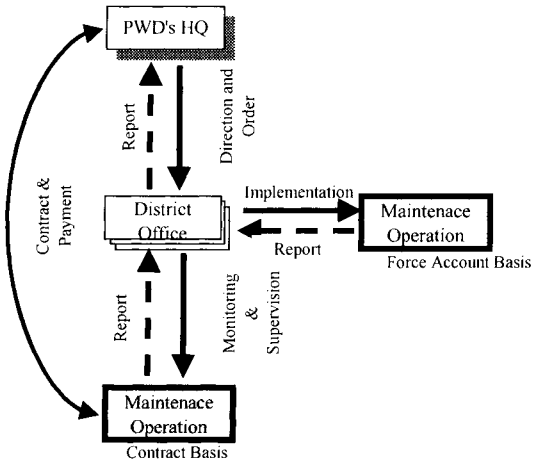


Figure 3.6.3 Chain of Command for Maintenance Activities

The responsibilities and duties at each level are as follows:

DTW's HQ is responsible for formulation of annual maintenance program, budget arrangement and control, monitoring field maintenance progress and quality and procurement of material / equipment for a force account basis and contractors for a contract basis, while the District Offices' responsibilities are to implement maintenance works by both modes of force account and contract basis, to report maintenance progress and activities to HQ and to maintain maintenance equipment and tools.

(2) Maintenance Operation

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 the labor force required. The organization of maintenance crew is depicted in Figure 3.6.4.

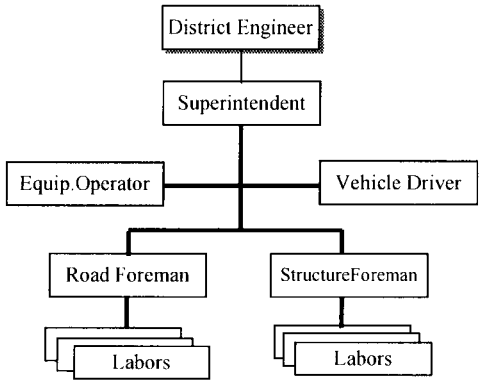


Figure 3.6.4 Proposed Organization of Maintenance Crew

(3) Maintenance Equipment, Tools and Materials

It is recommended that each District Office shall be equipped with a set of conventional maintenance equipment and tools to carry out proper maintenance works on a timely manner taking into account expected work items listed in subsection 3.6.3 on a force account basis. A set of equipment and tools and materials recommended are shown in Tables 3.6.3 and 3.6.4.

Table 3.6.3 List of Proposed Maintenance Equipment

Item	Capacity	Unit
Dozer shovel w/ excavator	0.2 m3	1
Dump Truck	3~4 ton	3
Compaction Roller	1 ton	1
Concrete Mixer	0.1 m3	1
Pick-Up		2

Table 3.6.4 List of Proposed Tools

Item	Unit
Shovel	10
Wheel Barrow	5
Safety Jacket	10
Orange Hut	5

3.6.5 Capacity Building of Timorese Engineers

It has been reported by the former Bina Marga Staff that a number of technical Timorese staff listed below, who had belonged to the former Provincial and District Public Works Department covering Road & Bridge, Housing, Irrigation and Water Supply are available to staff of Department of Transport and Works.

Table 3.6.5 Approx. Number of Technical Staff Available in East Timor

Education Level	Field		Total
	Civil Engineering	Architectural Engineering	
Doctor and Professor (S3)	0	0	0(010)
Master Degree + 2 Years(S2)	0	0	0(020)
Master Degree (S1)	15	10	25(040)
Bachelor Degree (D3)	47	40	87(050)
College Graduate (D2)	50	60	110(060)
Technical High School Graduate (STM)	2,000	2,000	4,000(100)

Note: Figure in ( ) means approximate number of Indonesian technical staff left East Timor after the destruction.

It is obvious from Table 3.6.5 that top management in the former Public Work's Department both Provincial and District was occupied by Indonesian staff before the September destruction, which means no experienced managerial Timorese staff are available at present. It is therefore vital to facilitate the capacity building of East Timorese, which in turn results in enabling them to plan, implement and manage their sector in the long term.