

# Roads

## Sector Status

Timor-Leste has an extensive paved network of rural main and district roads and secondary gravel and earth roads. The road network is a crucial asset for Timor-Leste that could be irreparably damaged if regular maintenance was not reestablished as a matter of urgency. Road access is an essential requirement of economic growth and delivery of social services with agriculture, forestry, fisheries, commerce, tourism, healthcare and education all requiring road transport services.

The road network of 5,000 kilometers (km) of main and secondary roads, of which half have bitumen surface, is lightly constructed and somewhat narrow. The roads have had little to no maintenance since 1997, and the combined effects of this, the passage of military vehicles, and one bad year (2000) of flooding caused damage. The Emergency Infrastructure Rehabilitation Project (EIRP), together with bilateral assistance from Japan and the efforts of the United Nations Peacekeeping Force (UNPKF), went a long way to stabilizing the condition of the roads, such that it is timely to consider a longer term plan. The focus of this work has been mainly at restoring road drainage structures together with short lengths of resurfacing at washouts and areas of land instability. A regional maintenance capability was also developed through four regional depots and, centrally, a road asset management system is being progressively implemented.

Of the 5,000 km, some 1,200 km form a core network of main roads, 2,000 km are district roads and 1,800 km are feeder roads connecting to the network. The road network was established to meet the needs of military control and to provide access for transmigration projects and to coffee growing areas. The changed needs of independent Timor-Leste can be substantially met by the 1,200 km of core main roads. Particularly in the context of constrained resources, the roads budget affords only a concentration on maintaining the core network and leaving much of the rest to be maintained by local communities as farm and village tracks.

There is a well-developed urban street and traffic system in Dili and smaller urban road networks in district capitals. Commercial road freight and passenger transport services are predominantly owner/operator and are unregulated. Public passenger transport consists mainly of minibuses and, in Dili, taxi services. Both are mainly owner-driver operation, the buses being mainly small van-body vehicles, with 9–15 seats and, out of town, light trucks with passenger seating. Buses operate within the urban area and are the main form of passenger transport in the rural areas. So far, there are no bus cooperatives or bus operators association. Bus routes and fares are unregulated. There is an informal bus terminal by the market at Taibese, Dili.

Traffic volumes outside of Dili, excluding motorcycles, which form up to 50% of the traffic flow on some routes, vary from 1,000 vehicles/day on the Dili to Tibar section down to 20 vehicles/day on the lower volume main roads. Heavy vehicles form about 5% of this traffic volume on the coastal routes east of Dili to Baucau, and up to 20% on the Batugade to Dili route. The roads across the island carry few heavy vehicles. Commercial road freight outside of Dili is mainly carried by two-axle vehicles, either pickups or small trucks. Movements of ISO containers are predominantly local to Dili and are direct movements between the port and consignee or freight forwarder's yard. The principal export, coffee, is grown in the highland areas inland from Dili and cherry or green bean is carried in pickups or small trucks to the coffee factory for processing. Heavier three-axle and larger vehicles operate on the north coast road. Buses contribute up to 45% of the traffic on some routes.

The high density of roads per unit of area and in relation to population made it necessary to define a core road network of about 1,200 km whose maintenance could be afforded and would be essential for commerce and social welfare. Road maintenance costs comprise agency costs (overheads) including staff, equipment, and facilities. The annual recurrent routine maintenance of the core network would require a total of \$8.8 million, of which \$3.9 million would be for routine and emergency maintenance. This needs to be complemented by a periodic maintenance budget. The periodic maintenance requirement was estimated at about \$7.5 million per annum. Under highly constrained budget conditions similar to those in Timor Leste, governments tend to capitalize this requirement into externally financed rehabilitation projects, a second best option and a more expensive way to funding periodic maintenance from the recurrent budget.

The Government is expected to finance the administration and routine maintenance costs to upkeep the core road network essentially necessary for commercial and social activities and to facilitate poverty reduction and economic development. Road maintenance, under best practices, would need to be expended in accordance with the road asset management system. This would prioritize road maintenance needs based on an annual road maintenance cycle that incorporates annually updated data on road conditions, preparation of road maintenance schedules that focus maintenance on the priority road sections, and implementation of road maintenance schedules by the regional depots of the Ministry of Communications, Transport and Public Works (MCTPW).

The periodic and emergency maintenance requirements are exacerbated in Timor-Leste by the young geology and the weather conditions. Much of the island is composed of sedimentary rocks, which are a fragile basis for roads and when combined with monsoon weather results in roads of fundamentally high maintenance requirements and costs. A number of large braided rivers that change their primary channel through the valleys frequently and unpredictably further deteriorate road erosion. These have interrupted road links during the monsoon season and have caused substantial damage to the river valley crossings.

The approach adopted by the EIRP2 aims to reduce the vulnerability of the network. This program includes geotechnical assessment of the soil conditions and proposes realignments and embankment strengthening works as well as bioengineering action along sections that can be stabilized with these technologies. These programs will have a long lasting impact on the road network and would lead to a reduction in annual road maintenance costs.

## Development Interventions

### 1. Projects

In 1999 and early 2000, immediate, emergency postviolence restoration work was undertaken by the United Kingdom's Department for International Development (DFID), to keep essential roads open until a broader road rehabilitation effort was in place. Subsequently, the Trust Fund for East Timor (TFET)-funded and Asian Development Bank (ADB)-administered EIRP coordinated road rehabilitation activities funded from several sources:

- **the Government of Japan-funded and United Nations Development Programme (UNDP)**-administered project rehabilitated the Dili-Aileu-Ainaro-Cassa road;
- **UNTAET** budget funded road repair and bridge restoration projects; and
- **UNPKF** undertook small works on roads including bridge restoration and gabion construction.

The primary objective of the EIRP supported humanitarian assistance by restoring transport, power, and port infrastructure. Of the three components, the road component was the largest, and accounted for \$20.6 million of the total project cost of \$29.8 million. Implementation of the road component of the EIRP was completed in mid-2002. The roads component objective was to undertake emergency road repair works to facilitate efficient transport of humanitarian aid and security cargo and to induce a revival of economic activity. The EIRP2 was approved to continue the work commenced under the first phase, particularly to strengthen the regional maintenance organization and to stabilize the core road network, where technically possible, to reduce the recurrent maintenance costs.

The EIRP road activities included road repair, equipment for road repair, labor-based and employment generating road and causeway restoration, and rehabilitation and reinstatement of bridges and depot facilities. These diverse actions were undertaken through a number of subcomponents:

- **Bridging Contracts** – continued DFID's emergency maintenance work between the end of DFID's program until the formal commencement of the EIRP's contracts. Work orders were issued for emergency opening of major routes. Though this work was often temporary in nature it served the critical purpose of maintaining access for humanitarian and security services in the early postviolence period. Work involved some 48,000 labor days.

- **Emergency Infrastructure Rehabilitation Contracts** – these 5 EIRCs implemented from June 2000 required the contractors to clear any closures of specific road subnetworks within 48 hours during the rainy season in 2000. The contracts covered the districts of Baucau, Viqueque, Manatuto, Natarbora, Aituto, Same, Maliana, Zumalia, and Oecussi. The contracts operated in conjunction with military engineers to repair and reopen roads so that emergency access and critical social and economic links were maintained. This required a flexible, responsive approach to assign resources to priority activities in a timely manner.

Some 71 km of eroded road, 52 landslips, and 45 failed road benches were repaired; 86 km of drainage were cleared; 6,360 m<sup>3</sup> of gabion walls were constructed; 4 bridges, 7 bridge approaches, 7 bridge protection sites, and 3 river training stations repaired; and 82,000 labor days of paid employment were generated.

- **Road Maintenance, Rehabilitation, and Supervision** – This major subcomponent of the EIRP disbursed over \$12 million, or about 60% of the total roads intervention under the EIRP. A total of 66 maintenance and rehabilitation contracts were awarded from December 2000 to July 2002 to address the maintenance backlog and slip repairs throughout the main network and some district roads. The smaller size of contracts facilitated the revival of the local contracting industry and reestablishment of its capacity to undertake such work. All of the contracts were completed by July 2002.

This work ensured that the core network was accessible throughout its length and that extended road closures could be avoided during the 2001–2002 monsoons.

Associated with the road maintenance contracts a total of 39 supervision contracts were also awarded. In addition to ensuring quality of the main civil works contracts the supervision work helped to develop capacity of national engineers to undertake supervisory work. Half of the work was undertaken by national contractors. In addition, international contractors also employed Timorese engineers so that 70% of the supervisors were Timor-Leste nationals.

- **Pilot District Roadworks** – From August 2000 to January 2001, the assistance of three district administrators was secured to identify and implement priority works on district roads. These constituted pilot cases that focused on labor-intensive community engagement for routine road maintenance. This experience provided the basis for later and more substantial community maintenance. The pilot program repaired 40 km of eroded road, 20 landslips, and 15 failed road benches; cleared 300 m of drainage; and built 900 m of gabion walls. Lessons from this experience were incorporated in the larger community road maintenance activity.
- **Community Road Maintenance** – Following the completion of the three pilot cases in January 2001, the main community activity began in May 2001

with the first community engagement contracts. Communities organized themselves as labor contractors rather than participants in management and decision making. Generally, the opportunity was viewed with enthusiasm and the response was positive. The EIRP developed several alternative models for community engagement. The most appropriate model, along the lines of lengths-man principles, was adopted for a nationwide application. In addition to the about 300,000 labor days generated under the EIRP, benefit was received in terms of access to markets and to social services. By the end of June 2002, about 355 villages were engaged to maintain 1,200 km of roads, a substantial proportion of Timor-Leste villages along the core road network. The funding of the routine maintenance program was adopted during the implementation of the EIRP by the Government's recurrent budget. This program to be sustainable requires additional strengthening of the depot engineers' skills for managing the scheme. This support will be implemented under the EIRP2. Community engagement along the adopted lines is sustainable as the communities can benefit from the income-generating employment opportunities offered under a routine road maintenance program that the Government implements on an annual basis. The scheme also provides an affordable method for implementing routine maintenance.

- **Refurbishment of Regional Depots** – Post referendum violence destroyed all field organizational capacity in Timor Leste. This subcomponent aimed to establish the regional maintenance capacity and a field oriented maintenance regime. Regional depots were established by October 2001 in Dili, Baucau, Mailiana, and Same with Timorese regional engineers employed by the Government and assisted by international engineer-trainers under the EIRP. Refurbishment, organized in collaboration with Consolidated Fund of East Timor (CFET) resources, included restoration of the depot offices and yards. All depots were provided with the minimum plant and the associated training by the EIRP. The Government assumed responsibility for recurrent funding of the depot operations since June 2001.

The component successfully established a field organization for the roads functions of MCTPW and to facilitate effective road maintenance. The regional depots are essential for planning road maintenance and managing and monitoring the community road maintenance program that covers 1,200 km of roads.

- **Capacity Building** – the EIRP PMU undertook activities to reestablish capacity in the Government to plan, implement, and maintain road maintenance (Box 2.1).

The rationale for continuing the work of the EIRP under the EIRP2 recognized the relatively high density of the road network and the vulnerable physical conditions combining to make a high maintenance network. The works under the EIRP had addressed emergency maintenance needs resulting from adverse weather conditions and heavy security and humanitarian traffic. It also aimed to support income generation for the returning refugee population.

The EIRP2 acknowledges the strong link between road network condition and commercial activities. Inadequacy of past maintenance is recognized and permanent engineering solutions are suggested to reduce annual maintenance costs, and importantly, to reduce the annual event of weather-related road closures of sections built on unstable soil conditions.

The EIRP2, therefore, focuses on extending the EIRP objective to restore the road network to a condition in which recurrent maintenance can effectively be carried out and the economic life of the road network can be extended through routine maintenance. The objective of the EIRP2 is to contribute to stabilization of the road network and to enable it to be left in a condition from which it can be maintained with the relatively modest budget available to the Government. The EIRP2 will also continue programs initiated under the EIRP to establish a viable and efficient maintenance operation through capacity building for the road service, national contractors, and community road maintenance. The scope of work to achieve these objectives (Box 2.2) includes

### Box 2.1: Road Sector Capacity Building

- **Road Asset Management System** – A basic road inventory and asset management program was developed and installed in the road services division of MCTPW. The program provides an effective basis for routine maintenance planning and commenced such work in September 2001. Data has been verified and the program used in budgeting for 2002/2003 and the Ministry has proposed to establish a planning unit for using the system.
- **Contractor Classification and Prequalification** – A prequalification system was established and transferred to the road service division of MCTPW. This system assigns contractors to works categories commensurate with their capacity and enables prequalification of domestic and foreign contractors on the basis of technical and financial capability. This has contributed to the reestablishment of the national road construction industry as the system for a transparent procurement of civil works and enables work to be tendered domestically among appropriately qualified contractors. This action enabled the EIRP to facilitate the recovery of the construction industry and generate employment. Using the small, national contractors is estimated to have created almost 300,000 labor days of employment.
- **Contractor Training** – In parallel with the prequalification, the EIRP provided training to national contractors in bid preparation, estimation, cost control, contract procedures, and management. This enhanced the contractor's ability to prepare bids for the tenders, promoted a more competitive tender environment, and helped revive the Timorese construction sector.
- **Consultant Training** – In order to supervise contracts let under the EIRP, local Timorese consultants were engaged to provide supervisory services. The work of the local consultants was supervised by PMU and international contract Resident Engineers. This facilitated development of local engineers thus promoting capacity building among private sector consultants.
- **Technical Assistance** – Short-term international consultants were engaged to provide advice on river training and geotechnical matters. Advice was used to help design of economic and efficient solutions to problems of bridge abutment damage and landslides.

- (i) preventive civil works and periodic maintenance,
- (ii) support for the establishment of a routine maintenance regime,
- (iii) detailed engineering, and
- (iv) training and project management.

The EIRP2 notes that the infrastructure sectors, and most pressingly roads, suffer from immediate needs that require funding beyond the Project. While the EIRP2 contributes to the backlog and stabilization work required by the core road network, planning for the sector given in the Draft National Transport Masterplan incorporates government funding of the recurrent road sector budget, and civil works under immediate and long-term requirements. Implementation of the Government's recurrent maintenance works in light of the forthcoming rainy season will be critical—in 2003, as well as on an annual basis. A significant success of the EIRP was its establishment of road maintenance capacity in the Government, national contractors, and community maintenance teams, which the Government's maintenance program can now utilize for its road maintenance program.

## 2. Technical Assistance

The main technical assistance (TA) has been provided through the EIRP PMU and project-funded short-term consultants. Broader transport sector issues, including roads, have been proposed to be addressed in two TAs:

- TA 3401-ETM: Transport Sector Restoration, undertaken between March 2000 and March 2002, addressed transport sector issues, and prepared a draft multimodal transport plan that included road transport issues and was developed into the May 2002 Draft Transport Sector Masterplan for East Timor (Box 2.3).
- TA 3731-ETM: Transport Sector Improvement was approved in 2001 addressing sustainable operations and management in the transport sector, including road administration. Implementation of the TA has been deferred due to the presence of alternative sources for advisory services, particularly from UNMISSET and UNDP.

## Development Impacts – Current and Prospective

### 1. Poverty Impact

As an emergency intervention, the EIRP addressed the humanitarian and security needs of the whole population. The beneficiaries included the poor for whom, as the most vulnerable members of the communities, the project critically facilitated delivery of humanitarian aid that was essential for survival. The poor were also able to share the benefits of access to social and economic services and employment. The community maintenance active and national contractors generated a large amount of employment

### Box 2.2: Technical Content of Grant 8198-ETM: Emergency Infrastructure Rehabilitation Project (Phase 2) – EIRP2

A grant of \$9 million has been approved for EIRP2, and will be allocated as follows:

Description	Total Cost
<b>A. Civil Works</b>	
1. Backlog and Earthworks	4.02
2. Slip Rehabilitation	1.35
3. Routine Maintenance Program	1.35
<b>Subtotal (A)</b>	<b>6.72</b>
<b>B. Consulting Services</b>	
1. Project Management and Training	1.02
2. Detailed Engineering	0.33
<b>Subtotal (B)</b>	<b>1.35</b>
<b>C. Contingencies<sup>a</sup></b>	
1. Physical Contingency	0.77
2. Price Contingency	0.16
<b>Subtotal (C)</b>	<b>0.93</b>
<b>Total</b>	<b>9.00</b>

<sup>a</sup> Physical (10%) and price (2%) contingencies are included.  
Source: Staff estimates.

- **Backlog and Earthworks** – the largest component, recipient of \$4.02 million, 45% of the total project cost.
  - **Earthworks.** The earthworks rehabilitation will support the reconstruction and minor realignment of short road sections that have become unstable and have potential for technical correction. The soils, topography, and climate combined render the road network vulnerable to landslides. Clearing and repairing these is a major component of the recurrent maintenance activities. Annual repairs cannot effectively and economically reinstate the extensive landslip sites. More permanent solutions are required through improved alignment and fully engineered slope stabilization works and bioengineering techniques. This component will initiate a strategy for preventive civil works for bench failures<sup>1</sup> that are currently absorbing an unacceptable proportion of the recurrent budget. A preliminary list of roads has been identified and includes sections on roads from Baucau to Viqueque Border, Viqueque Border to Viqueque, Tibar to Ermera Border, Ermera Border to Ermera, Maliana to Hauba, and Batugade to Maliana. Detailed design and geotechnical study due to commence in the second quarter of 2003 will support identification of the specific sections.

<sup>1</sup> A bench failure is a slip of the ground beneath the road, where the road was originally formed by a cut into the hillside, caused commonly caused by a slide in the landfill placed on the sloping hillside to create a level bench for the road.

### Box 2.2: Technical Content of Grant 8198-ETM: Emergency Infrastructure Rehabilitation Project (Phase 2) – EIRP2

- **Bioengineering.** Bioengineering techniques will be used to enhance slope stability. Under these techniques, indigenous plants will be identified that will effectively reduce soil moisture, resist surface erosion, and bind surfaces with strong and deep root systems. Once appropriate plants are identified, small nurseries will be established, and optimum planting and care strategies identified, demonstrated, and implemented.
- **Backlog Maintenance.** Periodic maintenance requirements cost about \$12 million per annum. This reinstates road surfaces damaged by traffic abrasion and wet season erosion. Most roads have lost the integrity of their wearing surfaces. Consequently, they deteriorate too rapidly for routine maintenance to be effective, and have become impassable in wet weather. While an ideal periodic maintenance program would resurface about one seventh of the network each year, periodic road resurfacing is required at intervals of 5–10 years. However, no such program has been implemented during the past 4 years, and as much as 60% of the network is overdue for resurfacing treatment. Sites needing work most urgently will be identified and this treatment strategy initiated. A small bridge replacement program will undertake the backlog of repair and replacement needs of substandard and vulnerable major drainage structures on the main roads.
- **Support to Routine Maintenance Regime.** Steep slopes, erodible sedimentary materials, and intense rainfall characterize the road network environment. Under these conditions even minor slips and drain blockages result in road sections becoming impassable after heavy rainfall. Under the EIRP, village groups are responsible for maintaining the road drainage system; eventually, funding for this will be transferred to the recurrent budget of the East Timor Transitional Administration. The EIRP2 provides technical support to establish the community-based maintenance program and related technical capacity in the field organization.
- **Training.** Significant skills upgrading is needed to enable the East Timorese to assume managerial and technical responsibility for implementing the routine and periodic maintenance regime, bio- and other engineering techniques, and financial and administrative accountability for the sector. Under the EIRP, immediate, and medium- and long-term training requirements are being identified under a comprehensive human resource development assessment, which will determine the specific skills required for the planned institutional arrangements for the sector (para. 24). The EIRP2 will provide the technical training to establish the technical capability of the road maintenance organization. However, this program is likely to require additional resources, and the Project Management Unit (PMU) of EIRP2 will make all efforts to identify cofinancing for this purpose.
- **Project Management.** The EIRP2 will be implemented through a Project Management Unit with local and international experts. Gradually, the Ministry of Communications, Transport, and Public Works will integrate project management with the regular operations of the road functions. The PMU will engage geotechnical and design engineering services and other short-term specialists, as required.

### Box 2.3: Draft Transport Masterplan for East Timor

The assistance financed by the Trust Fund for East Timor through the Emergency Infrastructure Rehabilitation Project, in conjunction with the road and port sector projects funded by the Government of Japan, involved 2 years of sustained effort to restore the transport infrastructure of Timor-Leste to an operable and maintainable condition, and to assist in developing government administrative structures, legislative framework, sector policies, and investment planning for the transport sector. Additionally, ADB provided technical assistance for Transport Sector Restoration that aimed to (i) prepare a comprehensive transport sector study covering the three transport modes in Timor-Leste, and (ii) develop an integrated plan for an efficient and effective multimodal transport system to support long-term development and growth potential of the territory. The Multimodal Transport Sector Master Plan was one of the many outputs of the planning work, produced as a final report in May 2002.<sup>1</sup>

The aim was to consolidate a multimodal transport sector strategy and agenda of policy and institutional recommendations that contributes to the Government's planning and preparation of the National Development Plan and sector development framework. The strategy covers physical planning for the transport sector, and also considers institutional development, legal framework, cost recovery, and other policy issues. The report has been organized into three sections, Part A covering general and cross-modal issues, Part B dealing with physical development of the road network and the roads administration, and Part C with land transport, maritime and aviation sectors.

<sup>1</sup> UNTAET/Asian Development Bank, Transport Sector Restoration Project ADB TA3401-ETM, Multimodal Master Plan, Final Report, October 2001.

throughout the country. The timing of the EIRP activities increased the social and economic benefits as employment opportunities, especially in rural areas, were then very few. As expected under its objectives, the EIRP facilitated humanitarian aid and security by restoration and maintenance of roads access in the postviolence period and helped sustain communities and the social fabric.

As a result of the EIRP, many of the aid-funded measures were able to access places that would not have been possible at all without the project.

## 2. Institutional and Capacity Development

When the EIRP commenced there was no effective road maintenance capacity in Timor Leste and road maintenance has been grossly neglected since 1997. The PMU was established as the executing agency, and had to act, effectively, as the roads department in order to undertake project activities. During implementation of the EIRP, significant capacity has been established:

- **The Government** now has a core of staff implementation of road maintenance projects and has benefited from the reestablishment of five engineering depots, a road asset management system, and a system of

contractor classification. Technical and managerial training is, however, still required to enable effective road agency operations. The EIRP2 would continue to upgrade management and technical skills under its human resource development component.

- **National contractors** have been encouraged to tender under transparent and clear procurement processes for construction and supervision contracts individually and in joint-ventures. The classification and prequalification system has made it easy for the Government to include them in invitations to tender and contractor training has increased their ability to prepare bids, and win and implement contracts. Transparent tender processes need to be continued and actively supported.
- **Community engagement** has employed communities to provide routine maintenance in a cost-effective manner for work that could not be undertaken otherwise. Community-based maintenance is sustainable and provides a source of income generation that carries a considerable poverty reduction impact. The EIRP2 will strengthen and further regularize this community engagement model.

### 3. Lessons Learned

Lessons learned from the implementation of the EIRP suggest:

- Flexibility in project design is important in conditions of uncertainty, particularly in the initial, emergency phase when humanitarian and security needs were not predictable. Subsequently, changeable weather, unknown geological conditions, landslides, and road closures determined priorities at short notice and could only be addressed through a flexible and responsive process.
- Capacity building for local contractors and communities necessarily involves risks of inexperience and resulted in the need to redo work. To mitigate these risks a program of training in procurement, work management, and quality control needs to be undertaken from the outset. Early establishment of a contractor prequalification system and monitoring performance with full supervision improves both implementation capacity and the quality of work done.
- In an immediate postconflict situation unconventional project implementation arrangements are necessary in view of the absence of capacity and facilities of the recipient government. Substantial executive responsibility was assumed in project management that allowed successful implementation and supported both donors and government in budgeting, coordination and capacity development. As normal conditions are being reestablished and government capacity is being created, the implementation arrangements need adjustment.

#### 4. A Way Forward

The National Development Plan (NDP) promotes development of an integrated system of road infrastructure and road transport services that supports the sustainable development of Timor-Leste and favors the more disadvantaged social groups. This involves development of infrastructure and services for land, air, and sea transport to create sustainable conditions for other areas of the economy and to promote employment opportunities in the areas of land, air, and sea transport and to develop technical and scientific specialization and knowledge in the sector (Box 2.4).

**Road Maintenance.** Road maintenance comprises routine tasks that can be accomplished through community labor such as drain clearing and grass cutting, and spot surface and shoulder repairs. Included in the routine maintenance cost budget is the clearance of and repairs of slips. This has been a very large item over the past 2 years, in part due to one very wet season in 2000, during which a lot of damage occurred. The drain clearing and grass cutting tasks should be accomplished within a budget of \$600/km/year. The pavement repairs double this to around \$1,200/km or \$2.2 million for the main road network. An allowance for slip clearance on top of this should be based on an average over several years but, allowing for the steep terrain and runoff characteristics, an allowance for slip clearance at 75% of the routine maintenance tasks is advisable. This makes the cost of routine maintenance over the whole network \$3.9 million.<sup>1</sup>

Road maintenance has been funded mainly from TFET, the Government of Japan, and UNPKF until mid-2002 with the bulk of the expenditure channelled through the EIRP. CFET funds were directed mainly at the district level network over this period. Increasingly, however, the Government's recurrent budget would be required to fund the national roads.

The road infrastructure suffers from immediate needs that require funding beyond the EIRP and the limited bilateral funding. Government resources alone are not able to meet recurrent requirements, leaving an ongoing need for financial support of maintenance work. While the national contractors and communities can do most of the routine and periodic maintenance work using local materials, international inputs will be needed for major works that include geotechnical and major earthworks. External funding will be required to support major works in the future. Bilateral resources, particularly from Japan, have made significant contributions and are expected to continue to support the sector.

In addition to the need for civil works and equipment, there is also a continuing need for capacity building for the Government. The EIRP2 will identify human resource

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<sup>1</sup> Estimating the future costs of road maintenance is complicated by the artificial cost environment that has been created during the period of restoration. Unit rates for materials and labor have been driven up, compounded by dollarization. Consequently, experience from this period should not be assumed to continue into the future.

### Box 2.4: National Development Plan Policy Actions for the Road Sector

- Formulate legal provisions for vehicle weights and dimensions; vehicle construction, inspection and use; and a Road Code.
- Introduce a fiscal system for roads and vehicles, in conjunction with the Ministry of Finance.
- Introduce a legal framework for the commercial carriage of goods.
- Formulate a policy and legal framework for entry to the road transport industry, passenger and heavy goods service vehicle licensing, and taxi services.
- Formulate a policy and legal framework for public passenger transport—urban, suburban and interurban, defining the licensing regime for operators and imposing minimum regulations for safety and quality.
- Analyze the need to create an urban public passenger transport company for the city of Dili, in the form of a public company or of a concession.
- Organize and improve public passenger transport terminals in the city of Dili.
- Develop an integrated road safety policy and its legal and institutional framework.

development needs and, though it will address some of those needs, additional resources are expected to be necessary.

Periodic maintenance covers the full overlay of the road surface at intervals to provide one or more of the following: strength improvement, smoothed running surface, and rejuvenation of the existing surface layers. The whole road surface needs a periodic treatment about every 5 years for a low volume gravel road and every 10 years for a low volume sealed road. Periodic treatment can be done in large sections of gravel resheeting or overlay, or piecemeal as the needs become apparent, which is perhaps less efficient but more conserving of materials. In the case of periodic maintenance, there is no real expectation that it can be met from government recurrent expenditure. The estimate would fund the national road periodic maintenance requirement, and once all of the restoration works are complete, district roads be left unfunded and only about half of the sealed network would receive periodic treatment. Overall, a shortfall in both the routine and periodic maintenance budgets is expected over the next 5 years unless external assistance is provided. Road maintenance costs are shown in Table 2.1.

**Short-Term Road Improvements.** A short-term plan was developed under the Draft Transport Sector Masterplan with the objective of restoring roads that have deteriorated. It also identified specific improvements, such as short lengths of realignment, to reduce loss of service and to decrease future maintenance requirements. The short-term plan covers 1,170 km of national roads and involves expenditure of \$46.5 million over 6 years, or \$7.8 million per year, in selected upgrading, split evenly between road and bridge works. The short-term plan assists in reducing the longer

Table 2.1: Funding Needs for Road Maintenance, \$ million/year

Road Category	Length (km)	Maintenance (\$ million)		
		Routine	Periodic	Total
National Roads	1245	2.6	5.0	7.6
Main District Roads	632	1.3	2.5	3.8
<b>Main Network</b>	<b>1,876</b>	<b>3.9</b>	<b>7.5</b>	<b>11.4</b>
Other Roads				
Paved	780	1.2	2.3	3.5
Gravel	514	0.9	0.8	1.7
Earth	1,989	1.6	–	1.6
<b>Subtotal</b>	<b>3,283</b>	<b>3.7</b>	<b>3.1</b>	<b>6.8</b>
<b>Total Network</b>	<b>5,159</b>	<b>7.6</b>	<b>10.6</b>	<b>18.2</b>

term maintenance costs as well as providing lower vehicle operating costs, improved journey times and induced agricultural production benefits and was calculated to give a rate of return of 17% overall. Recognizing short-term budget limitations, a realistic plan for short-term improvements based on the assessed benefits and capital costs are shown in Table 2.2. This requires a capital expenditure of \$1.3 million/year to fund the highest rate of return projects, which are improvements on the main roads from Dili to the west as far as Batugade and south to Ermera. For an expenditure of \$4.5 million/year improvements to the road from Dili to Manatuto to Baucau to Lautem to Los Palos are the next highest priority, together with the road south from Dili to Aileu and as far as Maubisse, and the route from Ermera to Hauba. This plan will be funded only in part under the EIRP2.

The short-term improvements do not consider urban roads, particularly the needs of Dili, and some provision in the short-term capital works plan is highly desirable. Recognizing that there will be limited budget available, a total of \$2 million over 6 years, or an average of \$0.33 million per year, should be sufficient to arrest the deterioration and make progress toward restoration of the paved urban road network. While this would include a small provision for district towns, the majority of the expenditure would be in Dili.

Additionally, the Natabora and Cassa bridges require a relatively minor percentage of their total cost to complete and so gain all of the benefits. For this reason, if capital funds become available from an international or bilateral source either as grant or at attractive concessionary rates, then completion of these two bridges should be considered. A further small allowance should be made for support to the Road Safety Plan, which should primarily be driven from MCTPW. Road safety improvements are generally found to be highly beneficial in terms of savings in medical costs, and the social costs to victims and relatives. A small allocation of initially \$50,000/year was proposed under the Draft National Transport Masterplan.

Table 2.2: Priority Short-Term Improvements Over 6-Year Period

Priority	Route	Road Link		Short-Term Improvements \$M			Internal Rate of Return Total
					Roads	Bridges	
1	A3	Tibar	Liquica	1.0	0.2	1.2	52.2%
2	A3	Dili	Tibar	0.6	0.2	0.8	33.7%
3	A4	Tibar	Ermera	1.5	0.5	2.0	27.7%
4	A3	Liquica	Batugade	2.5	1.4	4.0	25.0%
5	A1	Dili	Manatuto	1.5	0.7	2.2	24.8%
6	A2	Dili	Aileu	1.7	0.1	1.8	23.3%
7	A12	Hauba	Zumalai	0.9	0.0	0.9	23.0%
8	A10	Ermera	Hauba	3.0	1.1	4.1	22.3%
9	A1	Manatuto	Baucau	2.6	0.2	2.8	21.1%
10	A1/A8	Baucau	Los Palos	3.9	1.9	5.8	20.6%
11	A2	Aileu	Maubisse	0.9	0.2	1.1	20.1%
							\$M/yr
Total	> 20% IRR			20.3	6.5	26.7	4.5
Total	> 25% IRR			5.7	2.3	8.0	1.3

Source: Multimodal Master Plan.

The short-term capital budget estimated under the Draft National Transport Development Plan is shown in Table 2.3.

**Medium- to Long-Term Investment Planning.** In the long term, the ability of Timor-Leste to implement improvements to the road network will be constrained by revenue, the share of government revenue allocated to the transport sector, and the country's capacity and willingness to take advantage of concessionary funding from multilateral and bilateral donors. Also, as a first principle, available funds should go into maintenance and improvement tasks in the following priority order:

- **Routine Maintenance** is relatively low cost and very important in preventing, particularly, flood damage; prompt patching of potholes avoids accelerated degradation that is more expensive to repair later. The conclusion is that a roads appropriation of at least 10% of the recurrent budget is required to fund maintenance alone on the main national and district network. The revenue position would be improved by the establishment of a Road Fund and with fuel excise and annual licensing fees set to levels that recover at least part of the cost of maintaining the road system. The Draft National Transport Plan estimates that an aggressive introduction of road user charges could raise about \$15 million over a 6-year period, equivalent to about 65% of the routine maintenance expenditure requirement.
- **Periodic Maintenance** - The policy of overlaying full sections of roads when they start to exhibit distress from vehicle loading or embrittlement, but before

Table 2.3: Short Term Capital Budget<sup>a</sup>

Item	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Total
<b>Budget</b>							
Selected Road Upgrading		1.00	1.10	1.21	1.33	1.46	6.10
Urban Roads	0.20	0.40	0.44	0.48	0.53	0.59	2.64
Road Safety Projects		0.05	0.05	0.05	0.05	0.05	0.50
Cassa, Natabora Bridges	0.90	0.90					1.80
South Coast, Oecussi bridges			0.45	4.00	4.45		8.90
Oecussi Roads FS				0.10			0.10
<b>Subtotal</b>	<b>1.10</b>	<b>2.35</b>	<b>2.04</b>	<b>5.84</b>	<b>6.36</b>	<b>2.10</b>	<b>20.04</b>
<b>TFET</b>							
Ossu – Viqueque	0.50	1.00					1.50
Maliana – Bobonaro	0.30	0.70					1.00
<b>Subtotal</b>	<b>0.80</b>	<b>1.70</b>					<b>2.50</b>
<b>Total</b>	<b>1.90</b>	<b>4.05</b>	<b>2.04</b>	<b>5.84</b>	<b>6.36</b>	<b>2.10</b>	<b>22.54</b>

<sup>a</sup> Note: Excludes periodic maintenance, shown under the maintenance budget but part of the CFET capital budget submission; TFET is capital project costs only, excludes PMU costs and support to regional engineers, training and design services and contingencies

they deteriorate so far as to need more extensive rehabilitation or reconstruction, may be difficult to achieve within the funding constraints. It will be important to preserve the pavement strength and life by protection from axle overloads, and a reduced load limit on the cross-island (north/south) roads. It would also be necessary to consider whether low cost treatments for surface rejuvenation are possible, where ageing is the primary deterioration mechanism. Over the short to medium term it may be necessary to accept a higher proportion of patching and a rougher surface than is normally desirable, so that periodic maintenance funds are conserved.

- **Unstable and Flood Damaged Sections** – a large proportion of the expenditure in the past 2 years has been directed at repairing flood damage at stream and river crossings and in areas of unstable geology. In the case of land instability, there is an urgent need for geotechnical inspection and testing of difficult sections, so that solutions can be designed that are cost-effective. Geotechnical and detailed engineering design study will be conducted under EIPR2. In some cases, however, it may be cheaper to accept the instability and continued maintenance, possibly leaving sections unpaved, rather than invest in expensive realignment or stabilization works that have a risk of failure.
- In the case of river crossings, there is a need to evaluate the catchments, concentration of runoff and stream bedloads, before deciding on design solutions. In some cases, a higher capital cost solution (longer span or realignment) may be warranted rather than constantly rebuilding temporary or inadequate lower cost works. However, inadequate design and poor

construction quality appears to have been as much responsible for premature failure of structures installed in the past 2 years. While this may have been, to some extent, understandable in the prevailing conditions, future works should have tighter design and construction control. The EIRP2 will address the most imminent abutment, major culvert, and small bridge failures.

- **Upgrading and New Construction** - while improvements to the national road network are desirable, and may in some circumstances be economically justified, upgrading and new construction should be undertaken only from funds remaining once maintenance work has been adequately funded. This may require MCTPW limiting the extent of the network that it attempts to maintain, so that this can be done adequately, rather than spread funds too thinly.
- At present the 1,200 km of national and possibly an additional 600 km of main district roads are regarded as the core network. Currently, however, there are insufficient funds to maintain this extent of network from the Government's budget. It is possible that unit rates for maintenance will fall once the inflationary effects of the international presence are removed. Also there may be scope for cost-efficiencies in the techniques employed. However, the Government should be prepared to reduce the size of the core network if necessary, noting that road access to all district capitals from Dili could be maintained with a network of less than 1,000 km. As an alternative to reducing the extent of maintained network, the Government could also look to international funding on a grant or concessionary loan basis to bridge the gap over the short to medium term.

**Implementation Capacity Constraints.** The capacity to implement road maintenance and improvement work is also constrained by the Government's capacity to administer programs and of the contracting industry to undertake them. The current road functions of MCTPW has had some difficulty in disbursing its appropriations and could be read as a constraint on implementation capacity. However, it does point out the need for MCTPW to build its internal management over the next 18-month period, so that it can assume a larger program as the TFET-funded program runs down.