# *CHAPTER 14*

## *Preliminary Construction Planning and Cost Estimate for Rehabilitation Project*

# Chapter 14 Preliminary Construction Planning and Cost Estimate for Rehabilitation Project

## 14.1 Preliminary Construction Planning for Rehabilitation Project

### 14.1.1 General

Construction planning mainly consists of establishing a construction method and construction time schedule. The results of this work are then utilized to estimate Project construction costs and to establish an implementation schedule.

As a result of discussions with the RDA and JBIC, the rehabilitation of the trunk road between Akkaraipattu and Trikkandimadu and the construction of the New Kallady Bridge will be carried out as one package. Note that the design-build method will be adopted and the contractor will carry out both the detailed design, which will be checked by the Engineer and RDA, and construction in order to reduce total Project time.

### 14.1.2 Construction Area

The Project area, which extends from Akkaraippattu to Trikkandimadu, is located on the East Coast of Sri Lanka and requires a full day's travel (approximately 10 to 12 hrs) from Colombo using AA004 road or AA011 road. The surface condition of these roads is relatively bad, especially in some urban areas and on most sections in or near the Eastern region. Note also that the road alignment is sharp in mountainous areas, making it difficult to haul construction materials and equipment to the Project area.

The Project road, which is located in a lowland area, lies between lagoons and the seashore and it is difficult to find borrow material pits and quarries of sufficient quality nearby. At present, the local RDA (Akkaraippattu, Batticaloa) obtains aggregate for aggregate base course (ABC) and coarse aggregate for concrete from quarries in Mahiyangana and Polonnaruwa, which are approximately 100 km away from the Project area.

The weather pattern for the Project area is as follows:

Rainy Season : From mid October to mid January
Dry Season : From mid January to mid October

In the rainy season, there is a rainfall of over 5 mm on average. Hence, it will be difficult to carry out work during this period. Note that the water level in lagoons rises to a height of approximately 1.0 m or more above the normal water level during the rainy season, meaning that substructure work, especially for the New Kallady Bridge, will have to be implemented during the dry season.

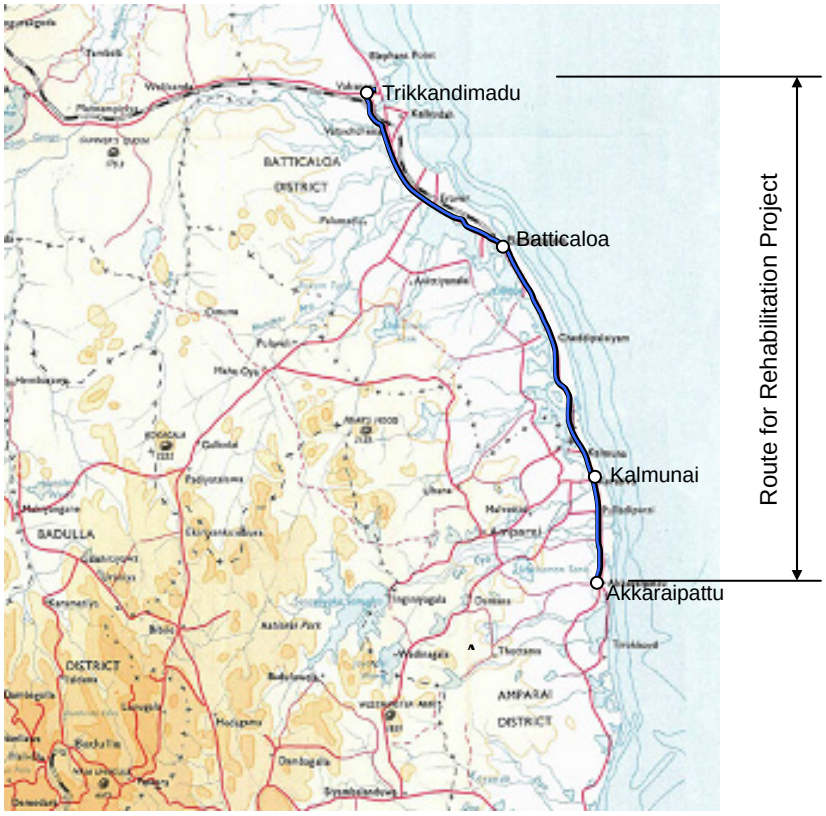



**Figure 10.1.1. Project Area**

In several places along the Project road the LTTE controls territory on either side, and there is borrow and river sand material available in LTTE-controlled areas that could be used for the construction work of the Project. Hence, the Project should come to some sort of an agreement with the LTTE, with the mediation of the local RDA, to procure these borrow and sand materials.

### 14.1.3 Major Work Items and Quantities

The major construction work for the Project road, including the New Kallady Bridge, is based on the results of a feasibility study and are as shown in Table 14.1.1 and 14.1.2.

**Table 14.1.1. Major Works - Road between Akkaraipattu and Trikkandimadu**

| Item | unit | Total |
|---|---|---|
| Earth Filling | cu.m | 94,000 |
| Sub-base | cu.m | 186,000 |
| Aggregate Base | cu.m | 143,000 |
| Asphalt Concrete | ton | 121,000 |
| Bridge, Slab culvert, Box culvert | nr. | 147 |
| Pipe convert | nr. | 58 |

**Table 14.1.2. Major Works - New Kallady Bridge**

| Item | | unit | Total |
|---|---|---|---|
| Bored Pile 56 nr. | Piling 1.2m dia. | m | 720 |
| 5 piers, 2 Abutments | Concrete for Piers and Abutments | cu.m | 1,200 |
| PC box girder L=291m | Concrete for main girder | cu.m | 3,900 |
| | PC bar for main girder | ton | 190 |
| | PC strand cable for main cable | ton | 50 |
| | PC strand cable for cross beam / slab | ton | 13 |
| Approach road L=250m | Earth filling for approach roads | cu.m | 36,000 |
| | Asphalt concrete (incl. bridge surface) | ton | 560 |

## 14.1.4 Rehabilitation Work of Project Road

### (1) General

During construction it is necessary to avoid any hindrance to the public and traffic. Since the minimum constructed road width is 9.0 m, it is possible to carry out the construction in two stages. That is, each side of the road shall be constructed in separate stages as shown in Figure 14.1.2.

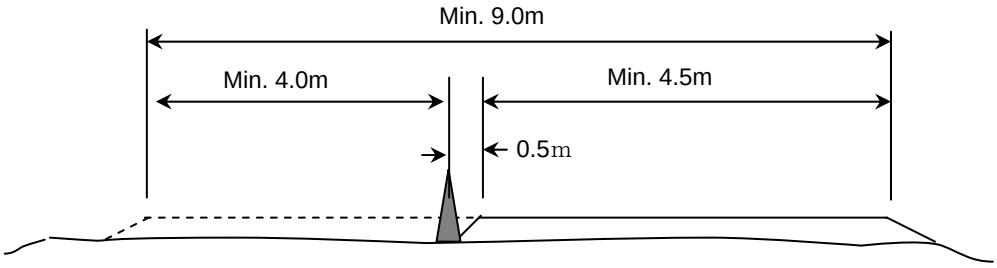



**Figure 14.1.2. Two - Stage Construction**

Rehabilitation work of the Project road will be executed after the relocation/shifting of existing utilities is completed as shown in the flowchart below.

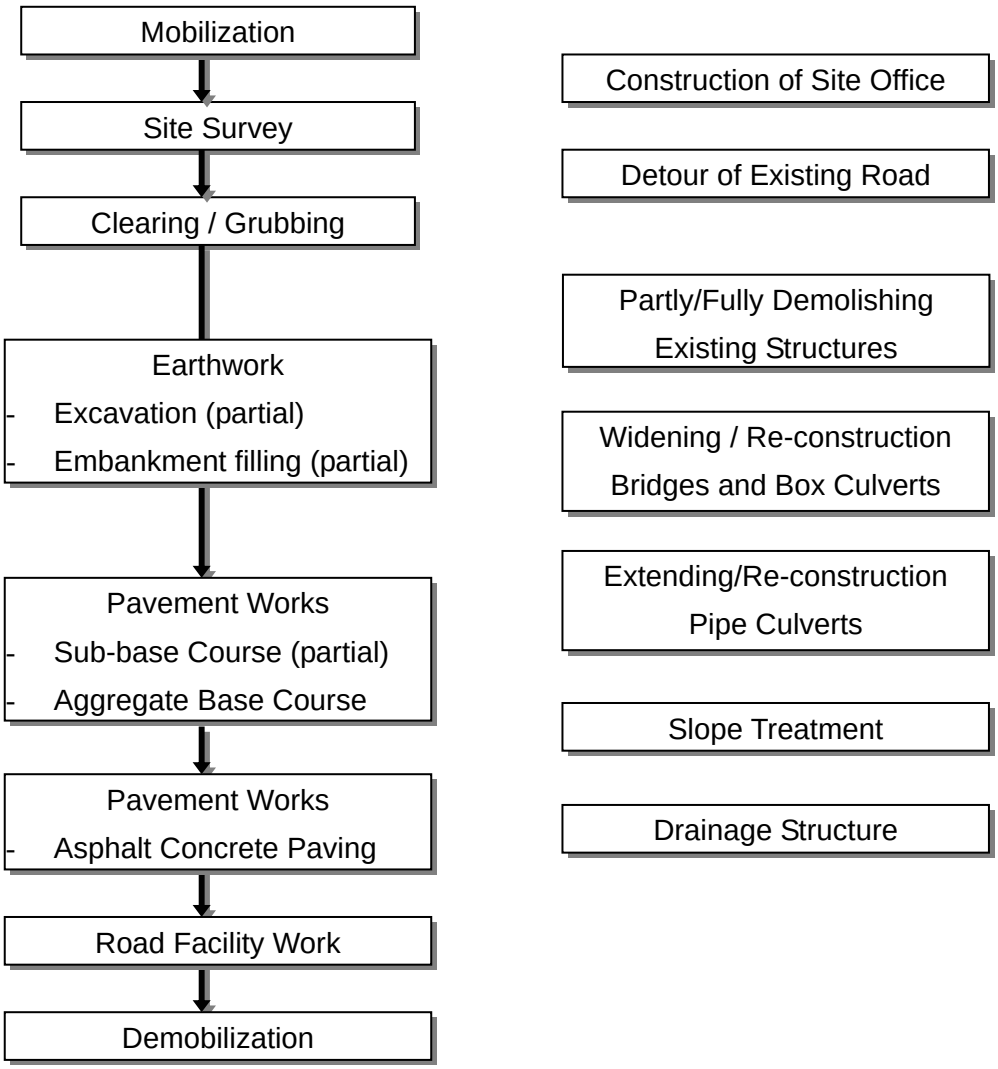



**Figure 14.1.3. Rehabilitation Work Flow**

### (2) Haulage Plan for Borrow, Quarry, and River Sand Material

**Borrow Material**

The embankment filling and soil sub-base materials necessary for the construction of the Project road will be obtained from the borrow pits shown in Table 14.1.3 and Figure 14.1.4. The borrow pits are located at an average distance of approximately 25 km from the respective Project areas.

**River Sand**

River sand pits are shown in Table 14.1.4 and Figure 14.1.4. The average haulage distance is approximately 20 km from the respective Project areas.

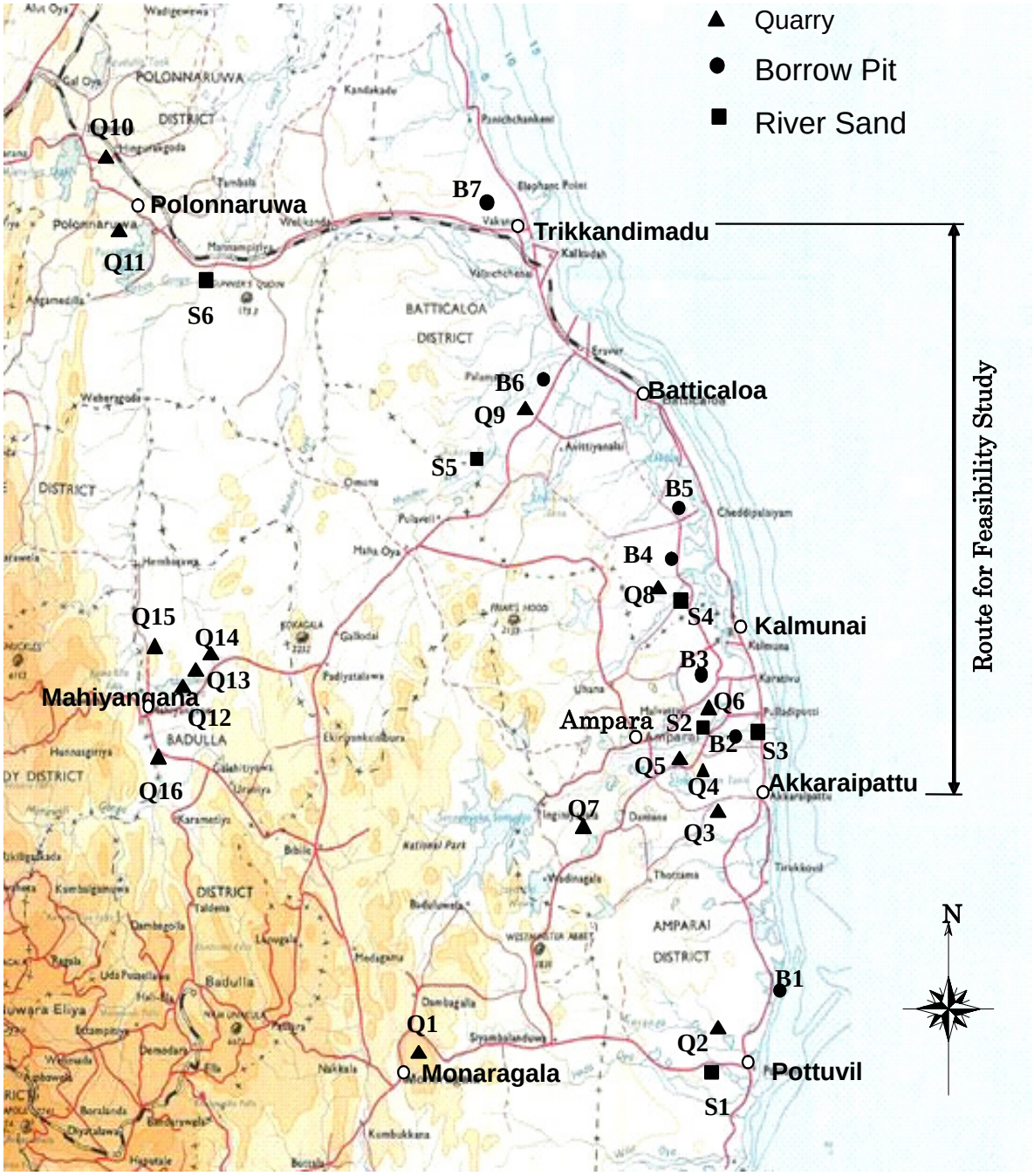
## Table 14.1.3. Borrow Pit

| Name | Borrow Pit 1 | Borrow Pit 2 | Borrow Pit 3 | Borrow Pit 4 | Borrow Pit 5 | Borrow Pit 6 | Borrow Pit 7 |
|---|---|---|---|---|---|---|---|
| **Location** | Komari (Near Komari Causeway) A04 Sta. 334km | Oluvil, Kaliodai Deegawapi Road A4 Sta.374 - 5km | Sammanthura J Block West, Ampara S-15 (Sammanthura) Channel | Virachenai, Palugamam, Periyaporathivu A4 Sta.401 - 7km | Ampillanthurai, Katchelai, Manmunai South West, Pattipalai D.S. Division A4 Sta.401 - 12km | Koduvamadu, Muthuraiadiaatham A5 Sta.279 | Navalady, Korale Pattu Valachcheni D.S.Division A11 Sta.129+500 |
| **Contact Tel.No.** | Mr. Mijwad Office: 067-2278793 Mob: 077-6060180 | Mr. Mijwad Office: 067-2278793 Mob: 077-6060180 | Private | Wellavali, LTTE office | Wellavali LTTE office | Koduwamadu LTTE office | RDA operation borrow pit RDA Batticaloa 065-2224455 |
| **Type of Site** | Operation pit | Operation pit | Non Operation | Operation pit | Operation pit | Operation pit | Operation pit |
| **Quantity* m3** | 100,000m3 | 4,500,000 m3 | 60,000m3 | 12,000 m3 | 25,000 m3 | 500,000 m3 | 2,000,000m3 |
| **Type of Material** | Lateritic soil | Silty Gravel with Sand | Tropical red soil | Silty Sand | Clayey Gravel | Poorly Graded Sand with Silt | Silty Sand |
| **Previous Project to have used this site** | RDA road projects World vision road projects | RDA, RDD road projects NGO Projects | - | RDA, RDD road projects NGO Projects | RDA, RDD road projects NGO Projects | RDA road projects | RDA road projects |

* Approximately amont

## Table 14.1.4. River Sand

| Name | River Sand Pit 1 | River Sand Pit 2 | River Sand Pit 3 | River Sand Pit 4 | River Sand Pit 5 | River Sand Pit 6 |
|---|---|---|---|---|---|---|
| **Location** | Supeweva, Pottuvil from Pottuvil police station 4.5km | Neinakadu, Sammarthura, Deegawapi Road 9 km (Veraiadi Anicut) Government D.S Sammanthura | Oluvil, Kaliodai - Deegwapi Road, A4 Sta. 374km - 5km, Government D.S Uttalachenai | Wellavali, Mandur A4 Sta. 401km - 10km | Mavadioddi, Chenkalady D.S | Devala Junction, Manampitiya A11 Sta.83 |
| **Contact Tel.No.** | Mr. Mijwad (Office 067-2278793, Mob 077-6060180) | Mr. Mijwad (Office 067-2278793, Mob 077-6060180) | Mr. Mijwad (Office 067-2278793, Mob 077-6060180) | Mr. K.Madhivannan (Mob 077-6990426) LTTE office | Karadiyanaru LTTE office | Mr. W.P.Premuda (071-2540306) |
| **Type of Site** | Operation pit | Operation pit | Operation pit | Operation pit | Operation pit | Operation pit |
| **Previous Project to have used this site** | RDA road projects | RDA road projects | RDA, RDD road projects | RDA road projects | RDA, RDD road projects NGO Projects | RDA road projects, Mahaweli projects |




**Quarry Materials**

It is difficult to find quarries of sufficient quality in the Project area. On the other hand, the RDA Ampara office has introduced the possibility of using a Government quarry, which is currently not in operation, as a main quarry for the Project. Note that it would be necessary to carry out an EIA prior to starting the operation of this Government quarry. In general, obtaining EIA approval takes approximately 6 months and the period of time actually required will be critical for the total construction period. Therefore, it is recommended that existing operational quarry sites be used in the early stages of construction, and that the

EIA for the Government quarry be carried out in the pre-construction stage to avoid any effects on the total construction period.

Quarry sites are shown in Table 14.1.5 and Figure 14.1.4, and the average haulage distance is approximately 65 km. This is because some quarries are in close proximity to the Project road but are in LTTE-controlled areas. Note that the Government has imposed a ban on the use of explosives in these areas, meaning that quarry operation may not be practical and that materials may have to be procured from more distant quarry sites.

**Road Structure Work (bridge, box culvert, pipe culvert)**

Based on the results of this Project's feasibility study, bridges, box culverts and pipe culverts are classified as requiring the following depending on the level of deterioration and design requirements:

(a) **Reconstruction:** Structures will be reconstructed in two stages in order to avoid any hindrance to public traffic.
(b) **Widening:** Structures of insufficient width will also be improved in two stages in order to avoid any hindrance to traffic. Note that the epoxy anchor or mechanical anchor method will be used to connect an exiting structure with a new structure. Concrete sockets will be used to connect an exiting structure with a new structure in the case of a pipe culvert.
(c) **Reconstruction & Widening:** In certain cases, structures will require both reconstruction and widening work. This work will also be staged in order to minimize any inconvenience to road users.
(d) **Re-decking:** Structures where the slab surface has either peeled or worn will be re-decked.

## Table 14.1.5. Quarry Site

| No. | | Quarry site 1 | Quarry site 2 | Quarry site 3 | Quarry site 4 | Quarry site 5 | Quarry site 6 | Quarry site 7 | Quarry site 8 | Quarry site 9 | Quarry site 10 | Quarry site 11 | Quarry site 12 | Quarry site 13 | Quarry site 14 | Quarry site 15 | Quarry site 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | | Valanda Metal Crusher<br>Weliyaya, Obbegoda, Monaragala | S.T Sahibuthambi<br>Mommanakulam, Pottuvil, Inspector Atham Road, Kaltiyatte, A4 Sta . 324km Left | Nithe Crusher Plant<br>5 mile post, Nithe | Bino Metal Products<br>4A, Mohamed Aliya Road, Alli Mulle Junction, Ninthavur A4 Sta. 375km (Right) | Government site<br>Varaipathenai Irrakkaman DS Division, | Government site<br>Sennall Grama 2, Sammanthura Sammanthura DS Area | Crusher Plant: Jayanthi Metal Crusher Ampara, Udaya Pura<br>Quarry site: Ambalanoya Junction (Ampara - Siyabalanduwa 40km) | C. Copal quarry<br>Ammankulam, Wellavali, Mandur | Elilanan Crusher Plant<br>Badulla Road, Karadiyanaru, A05 Sta. 271 | Kapila Metal Crusher<br>Lakshauyana, Pollonnaruwa, A11 Sta.68 -5km | Priyantha Enterprises<br>Kalahagala, Pollonnaruwa, A11 Sta.69 -15km | Siri Jaya sanka Metal Crusher<br>47, Arawatta, Mahiyanganaya | Tam Rock Metal Crusher<br>471/2, Arawatta, Mahiyanganaya | Top Rock Metal Crusher<br>47, Arawatta, Mahiyanganaya | Sunil Metal Crusher<br>Giradurukotte Road, Batalayaya | ICC Metal Crusher<br>Madayaya, Mahiyanganaya |
| Contact Tel.No. | | Mr. W.T Dayananda 055-2276552 072-2585091 | Sahid Savair 063-2248512 | Mr. Mijwad Office 067-2278793 Mob 077-6060180 | Mr. Rahuman Mob 0777-388310 Mr. Majith Mob 0777-705617 | RDA Ampara | Government DS | Mr. Saman 063-222-3674 | C.Copal 077-668-8543 | Kamaraj 077-615-1831 | Office 027-2225981 Mob 077-223020 | Office 078-8752127 Mob 077-7771785 | Mr. Rathnayaka 0777-764086 | Mr. W.H.J.P. Jayathilaka 055-225-7871 Mob. 0777-810151 | Mr. Gunawardane 055-225-71146 Mob. 0777-3069396 | Mr. Sunil 055-225-8251 Mob. 0777-717713 | Mr. Gunathilaka |
| Type of Site | | Operation pit | Operation pit | Operation pit | Operation pit | Non-operation, Government pit | Non-operation, Government pit | Operation site | Operation site (Non-crusher machine) | Operation site | Operation site | Operation pit | Operation site | Operation site | Operation site | Operation site | Operation site |
| Capacity m3/month | | 850 | 250 | 1400 | 560 | Non-operation | Non-operation | 700 | 380 | 380 | 2800 | 1200 | 2100 | 850 | 2,100 | 2,100 | 2,100 |
| Quantity* m3 | | 110,000 (3 sites) | 10,000 | 128,000 | 150,000 | 300,000 | 120,000 | 1,000,000 | 600,000 | 200,000 | 180,000 | 200,000 | Same as site 13 -> | 80,000,000 | <- Same as site 13 | 1,000,000 | 120,000 |
| Type of Material | | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss | Granite Gneiss |
| Previous Project to have used this site | | RDA projects | RDA Projects | RDA Projects | RDA Projects | | RDA Projects | Building Projects | RDA Projects | | RDA projects UDA projects ADB projects | RDA projects | RDA projects SDCC projects ICC projects | RDA projects SDCC projects ICC projects | RDA projects SDCC projects ICC projects | RDA projects SDCC projects ICC projects | RDA projects |
| Available size | 250-500mm | - | | Available | | | | Available | Available | Available | | | | | | | |
| | 150-225mm | - | Available | Available | Available | | | Available | Available | Available | | | Available | Available | Available | Available | Available |
| | 100mm | - | Available | Available | Available | | | | | | | | Available | | Available | Available | |
| | 50mm | - | Available | Available | Available | | | | | | | | Available | | Available | Available | |
| | 37.5mm | Available | Available | Available | Available | | | Available | | Available | Available | Available | Available | Available | Available | Available | |
| | 19mm | Available | Available | Available | Available | | | Available | | Available | Available | Available | Available | Available | Available | Available | Available |
| | 12.5mm | Available | | | | | | Available | | Available | Available | Available | Available | Available | Available | Available | Available |
| | 6.3mm. down | Available | Available | | Available | | | Available | | Available | Available | Available | Available | Available | Available | Available | |
| | Graded (A.B.C) | Available | | | | | | | | | Available | | Available | Available | Available | Available | Available |
| Note | | | | | | Introduction by RDA for the Project | | | LTTE area | | Local RDA (Akkaraippattu, Batticaloa) uses quarry at present for their needs of aggregate for aggregate base course (ABC) and coarse aggregate for concrete. | | | | | | |

* Approximately amount

### 14.1.5 New Kallady Bridge

#### 1) General

Based on the results of this Project's feasibility study, isometric PC box girders are to be erected by the incremental launching method regardingthe superstructure of the New Kallady Bridge. For the pier foundation, cast-in-situ RC concrete piles with all-permanent steel casing are adopted for the piling method in the lagoon.

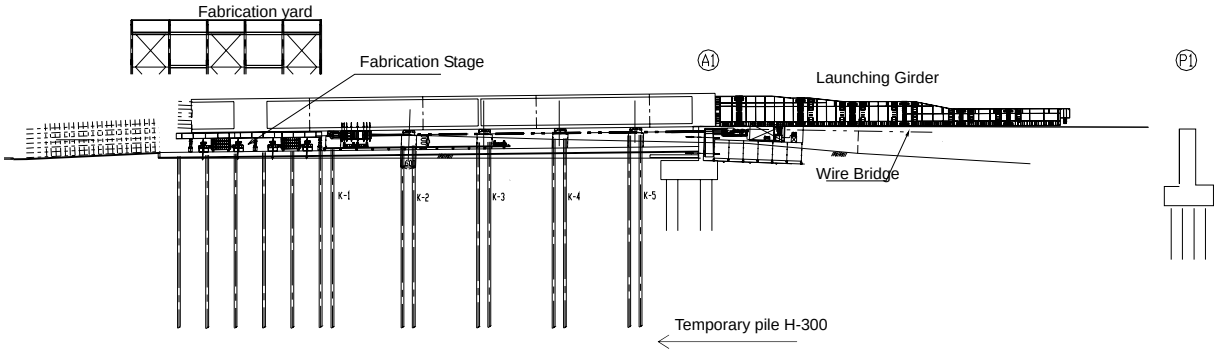



**Figure 14.1.5. Incremental Launching Method**

The overall workflow for the construction of the New Kallady Bridge is as shown in the flowchart below.

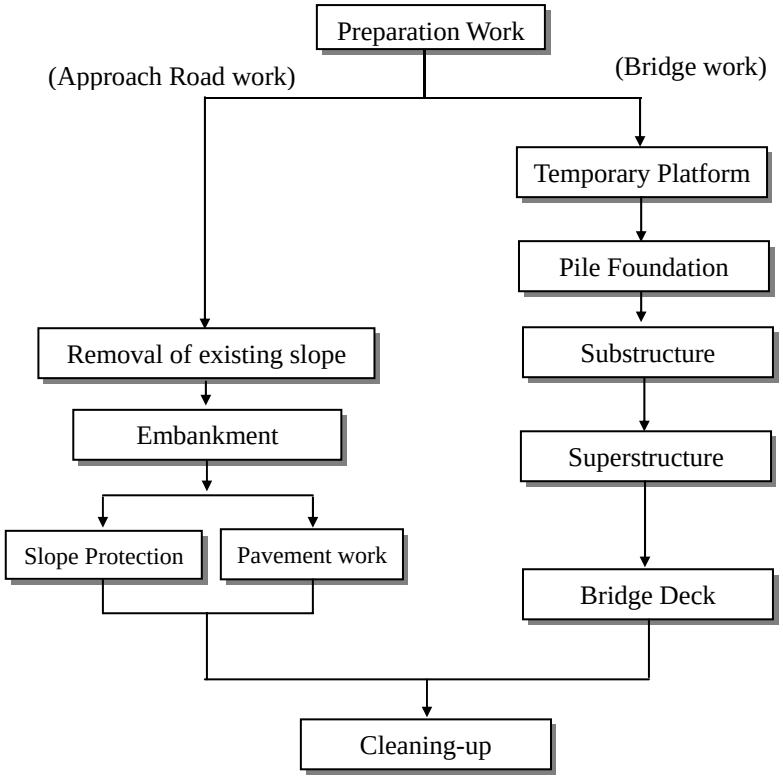



**Figure 14.1.6. New Kallady Bridge Construction Flow**

### 2) Temporary Work and Facilities

A temporary work yard for the site office and facilities, storage of materials and equipment, a workshop, and an open space for the fabrication and erection of the superstructure will be prepared on the bank (which is Government land) on the Kalmunai side (A1 side) of the New Kallady Bridge.

Prior to the substructure works, a temporary platform (jetty) will be erected on the bank of the Kalmunai side toward the center of the bridge and from the bank on the opposite side. The erection of the temporary platform (jetty) will be done in such a way that the center portion is kept open for navigation in the lagoon as shown in Figure 14.1.7.

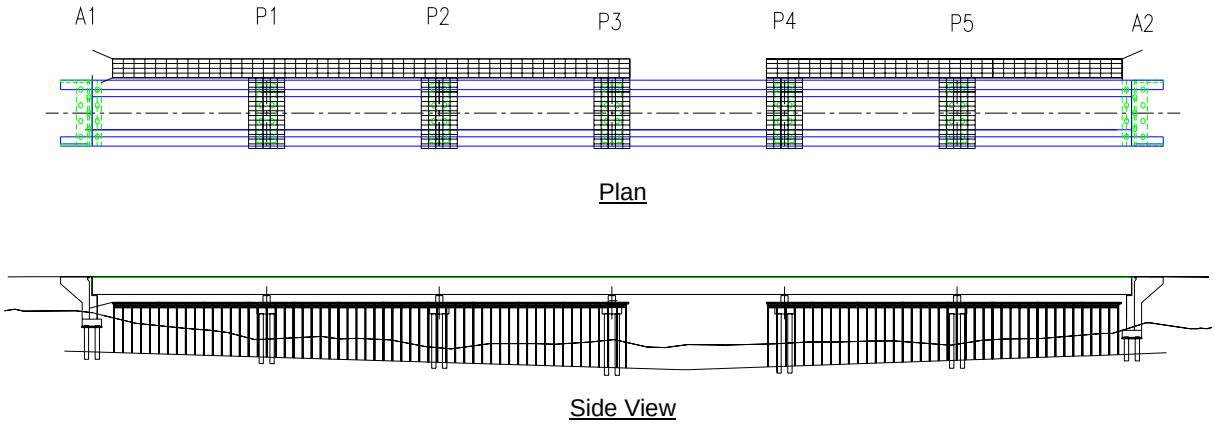



**Figure 14.1.7. Temporary Platform (Jetty)**

Instead of using the above-mentioned jetty, the possibility of using barges as a platform is also examined, since the erection of a jetty is more costly. After consideration, however, it has been determined that barges with adequate capacity for piling work are difficult to find in Sri Lanka. In addition, getting these barges to site poses problems, as it is only possible to do this in the rainy season when the sandbar at the mouth of the Batticaloa lagoon is submerged; otherwise; the tedious process of dredging would have to be carried out.

### 3) Piling Work

In the all-casing method, permanent steel casing will be used in the pile work for the foundation. The steel casing is used to prevent holes bored in sand layers from collapsing and also to cast the concrete in the lagoon. Pile holes will be bored to a depth of 1.2 m in the bearing rock layer, which is equivalent to the pile diameter. Once the hole for the pile is bored to the specified depth, a pre-assembled reinforced-bar will be dropped off through

the casing tubes and the casting of concrete will complete the sequence of the piling work.

**4) Pile Cap Work and Substructure**

All piers of the New Kallady Bridge are located in the lagoon. In the construction of pile caps in the lagoon, a steel formwork or pre-cast concrete panel will be introduced for the bottom formwork and will be supported by H-iron frames that will be assembled in place by using the steel bracket at piles. Likewise, the side steel formwork will be installed through the perimeter of the pile cap. Concrete casting for these pile caps will be done in two or three stages considering the concrete temperature during concrete hydration process and other physical considerations such as strength of the formwork, etc. For casting of every pile cap, construction joint will be treated to remove all the concrete laitance in preparation for next casting. Cast concrete will be cured by the moist burlap or curing compound.

A steel pile cofferdam method will be used for the construction of abutments A1 and A2 to be followed by the concrete works. A parapet wall will be constructed once the superstructure is erected.

A series of critical tasks have to be followed up in the workflow, starting from the piling work. It is essential to track the critical path, which is always linked to the total progress control of the Project.

**5) Superstructure Work**

The incremental launching method will be used for erection of the superstructure with its PC box girders. The fabrication and erection of the superstructure will be carried out both in the dry and rainy seasons. It is essential that the erection work be carefully planned and carried out under a strict quality control in order to provide high sustainability in the future. After erection of the girders is completed, the parapet walls on abutments A1 and A2 will be constructed, and the bridge accessory work, including the pavement work, handrail settings, expansion joints, and drainage setting, will be undertaken in sequence. The steps and flow for the incremental launching method are as shown in Figure 14.1.8 and 14.1.9.

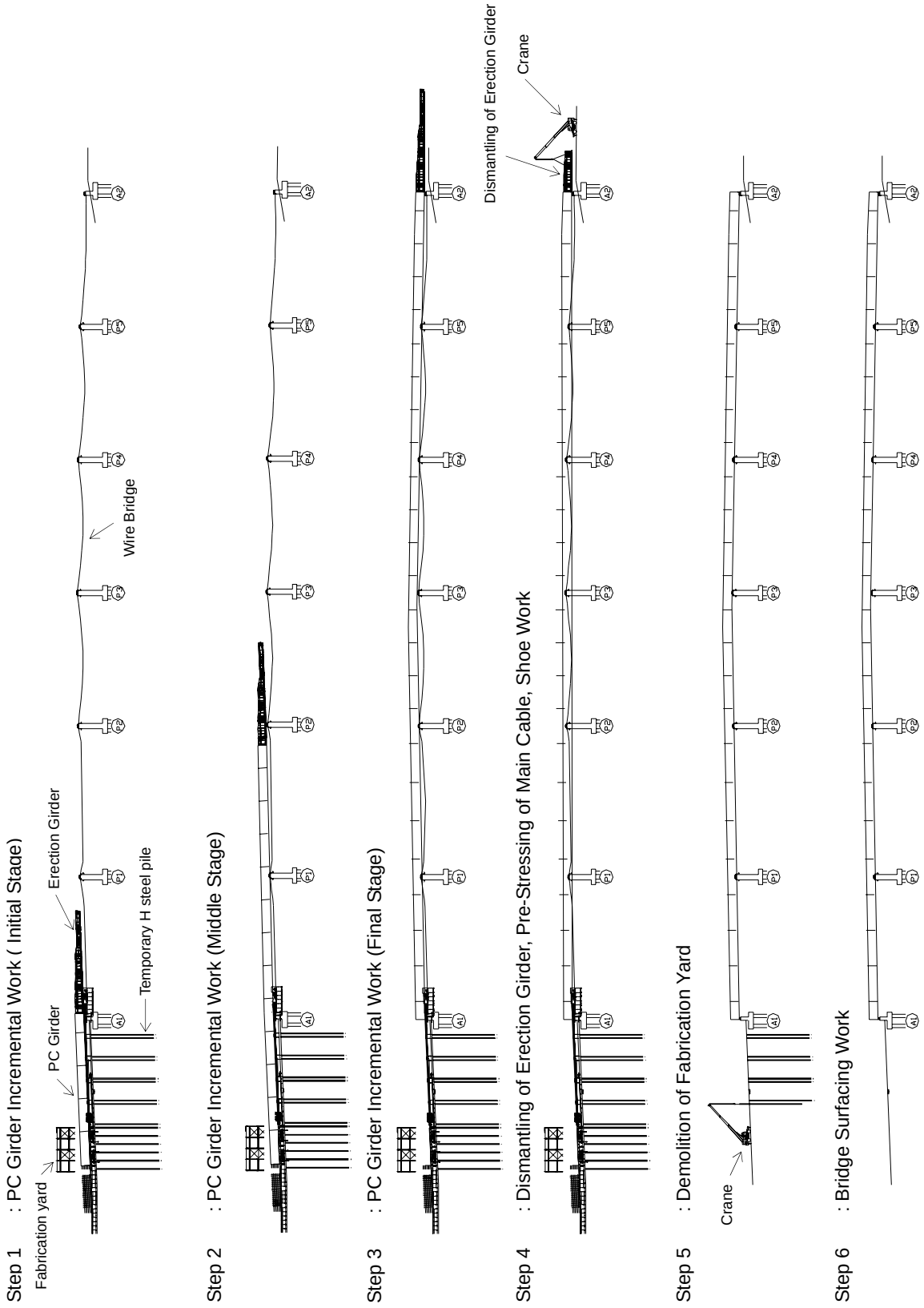



**Figure 14.1.8. Incremental Launching Method**

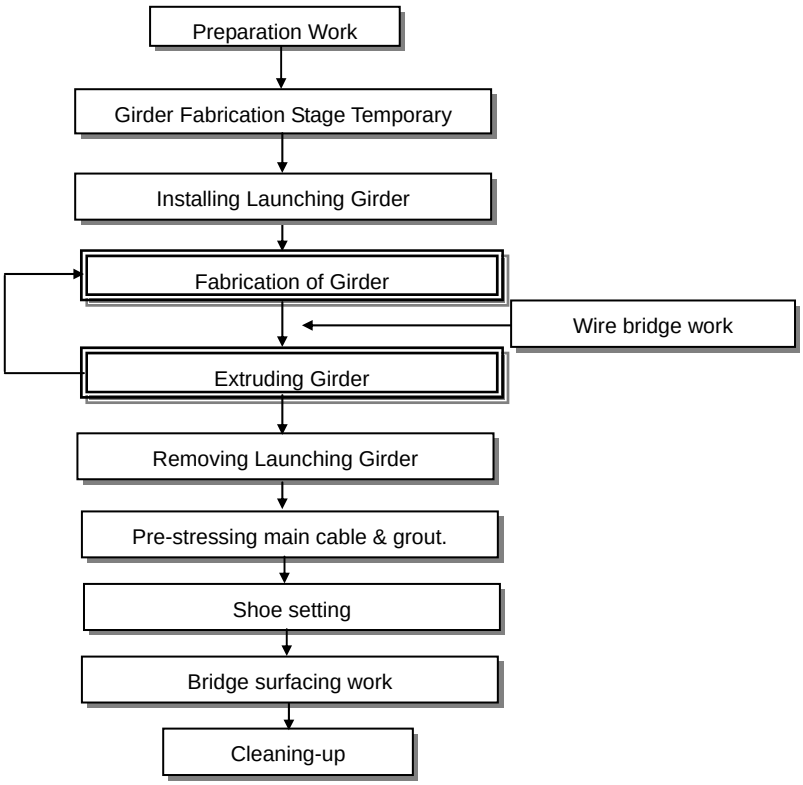



**Figure 14.1.9. Superstructure Construction Flow**

## 14.1.6 Construction Schedule

### 1) Effective Working Days

Working days ratio for the Project is estimated, taking into consideration the rainy days (daily rainfall over 5 mm for earth work and over 10 mm for general work), Sundays and holidays. Tables below show the detail data for the above factors.

**Table 14.1.6. Working Days Rate (daily rainfall over 10 mm)**

| Month | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainy Day (Over 10mm) | | 8.00 | 4.80 | 1.60 | 1.20 | 1.20 | 0.60 | 1.00 | 0.20 | 1.40 | 4.60 | 10.80 | 7.33 |
| Holiday | Sunday (2006) | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 5 |
| | National Holiday | 2 | 2 | 1 | 4 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 2 |
| | Other Holiday | | | | 4 | | | | | | | | |
| Dates of overlaping holiday & rainly day | | 1.81 | 1.03 | 0.26 | 0.52 | 0.27 | 0.10 | 0.19 | 0.03 | 0.23 | 0.89 | 2.52 | 1.66 |
| Monthly dates | | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |
| Number of days worked | | 17.8 | 18.2 | 24.7 | 16.3 | 23.1 | 24.5 | 24.2 | 25.8 | 23.8 | 21.3 | 14.7 | 18.3 |
| Rate of operation | | 0.57 | 0.65 | 0.80 | 0.54 | 0.74 | 0.82 | 0.78 | 0.83 | 0.79 | 0.69 | 0.49 | 0.59 |
| Ave. of Operation Rate | | **0.692** | | | | | | | | | | | |

* Rainfall data: Average btw. 2000 & 2004 (Kalimunai area)

**Table 14.1.7. Working Days Rate (daily rainfall over 5 mm)**

| Month | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainy Day (Over 10mm) | | 9.60 | 5.20 | 2.40 | 2.40 | 1.40 | 1.00 | 1.40 | 0.60 | 1.80 | 5.60 | 13.60 | 8.33 |
| Holiday | Sunday (2006) | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 5 |
| | National Holiday | 2 | 2 | 1 | 4 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 2 |
| | Other Holiday | | | | 4 | | | | | | | | |
| Dates of overlaping holiday & rainly day | | 2.17 | 1.11 | 0.39 | 1.04 | 0.32 | 0.17 | 0.27 | 0.10 | 0.30 | 1.08 | 3.17 | 1.88 |
| Monthly dates | | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |
| Number of days worked | | 16.6 | 17.9 | 24.0 | 15.6 | 22.9 | 24.2 | 23.9 | 25.5 | 23.5 | 20.5 | 12.6 | 17.5 |
| Rate of operation | | 0.53 | 0.64 | 0.77 | 0.52 | 0.74 | 0.81 | 0.77 | 0.82 | 0.78 | 0.66 | 0.42 | 0.57 |
| Ave. of Operation Rate | | **0.670** | | | | | | | | | | | |

* Rainfall data: Average btw. 2000 & 2004 (Kalmunai area)

## 2) Construction Period

Taking into account the volume of work, number of working days, and the need to minimize disturbances to road traffic, the Project construction period for the road between Akkaraipattu and Trikkandimadu, including the construction of the New Kallady Bridge to be carried out in parallel, was set at 2.5 years.

Note that the water level of the Batticaloa lagoon, which rises during November to January, will affect the substructure work of the New Kallady Bridge. Therefore, a review of the construction period is necessary after the exact month of commencement of construction is determined. The tentative construction schedule for the road rehabilitation work between Akkaraipattu to Trikkandimadu and the construction of New Kallady Bridge (including the 250m-approach road) is shown in Table 14.1.8.

**Table 14.1.8. Construction Schedule**

| ITEM | MONTH |
|---|---|
| Description | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 |
| **ROAD WORK between Akkaraipattu and Trikkandimadu** | |
| MOBILIZATION | |
| Establishment of office and Laboratory | |
| Mobilization of plant & Equipment | |
| Temporary works (Surveying) | |
| SITE CLEARANCE | |
| Relocation of Existing Utilities | |
| Cleaning & Grubbing | |
| ROAD WORK | |
| Earth work | |
| Sub base Course | |
| Base Course | |
| Asphalt Paving | |
| ROAD STRUCTURES | |
| Box culvert, Pipe Culvert, | |
| Ditch, etc | |
| MISCELLANEOUS | |
| Road Signs, Road Markings, Lighting | |
| **NEW KALLADY BRIDGE WORK incl. 250m approach road** | |
| MOBILIZATION | |
| Establishment of office and Laboratory | |
| Mobilization of plant & Equipment | |
| Site Surveying | |
| Detailed Design | |
| BRIDGE WORK | |
| Temporary works (Jetty) | |
| Piling work | |
| Pier & Abutment | |
| Preparation work for Superstructure | |
| Girder fabrication work | |
| Girder erection work & Shoe work | |
| Bridge surfacing work | |
| Abutment parapet & wingwall work | |
| APPROACH ROAD WORK | |
| Earth filing work | |
| Pavement, Ditch, etc | |
| **HANDING OVER & DEMOBILIZATION** | |
| Handover & Demobilization | |

## 14.2 Preliminary Cost Estimate for Rehabilitation Project

### 14.2.1 General

Project cost is estimated based on the results of this Project's feasibility study and the implementation plan. To arrive at the total Project cost, unit rate components were prepared applying the Sri Lanka Highway Schedule of Rates (HSR) and the Japanese Cost Estimate

Standard. When these two were not applicable, consultations were held with the relevant contractors to obtain accurate unit cost information. In addition, costs were compared with those for recent major road construction projects funded by international donor agencies in Sri Lanka to confirm their reliability. Total project cost is composed of:

- Construction cost
- Cost of the relocation of public utilities (electricity, telephone lines and water supply)
- Engineering services cost
- Land acquisition cost

Note that the construction cost includes the detail design cost as a preliminary item. The engineering services cost includes the supervising of the construction work. The basic assumptions and methods for estimating the Project costs are as follows:

- Private contractor(s) carries out all construction work.
- The unit cost of each cost component is estimated by applying the HSR for the fiscal year 2005, the Japanese Civil Work Estimate Standard of 2005, and the Japanese Bridge Erection cost estimates of 2004.
- The unit cost of each cost component for the superstructure of New Kallady Bridge is estimated by applying the Standard Cost Estimate for PC Box Girder Incremental Launching Method of 1999 published by the Pre-stressed Concrete Construction Association of Japan.
- When the HSR and Japanese standards are inadequate for providing the unit cost for a particular item, interviews were held with local contractors to gather the necessary data to determine the appropriate cost.
- Physical contingency is estimated to be 10% of the total cost for the construction and engineering services.
- Land acquisition cost is based on market prices and on data from the Sri Lanka Land Acquisition Department.
- Currency exchange rate: JPY 1 = Rs. 0.901 (average for August 2005)
- Taxation: 15% VAT

### 14.2.2 Procurement

#### 1) Labor Force

Local contractors carry out most of the general road works in Sri Lanka, and there is an

ample labor pool with skills in civil works, except when highly specific skills such as that needed for post-tensioned pre-stressed concrete are required. Note that for some of the work of the New Kallady Bridge, skilled workers from oversea countries should be dispatched.

**2) Supply of Machinery**

As it is difficult to procure special/heavy construction machinery and large numbers of regular machinery on the East Coast, machinery will be transported from the Colombo area and overseas countries to ensure the smooth implementation of the Project.

**3) Supply of Construction Materials**

Major materials required for the Project and their availability in Sri Lanka are as shown in Table 14.2.1. The supplier list in Sir Lanka and overseas countries relevant to this Project are shown in Table 14.2.2.

**Table 14.2.1. Availability of Material in Sri Lanka**

| Material | Domestic Production & Supply | Market Availability | Price for Cost Estimate |
|---|---|---|---|
| Cement | Sufficient | Available | Market price |
| Reinforcement | Diameter (D≦32mm) | Available | Market price |
| Shape steel | No product | Only small size available | Market price |
| PC bar, cable | No product | Not available | Imported price |
| Bridge bearing | No product | Not available | Imported price |
| Expansion joint | No product | Not available | Imported price |

**Ready-mixed concrete**

There are no ready-mix concrete plants in the Project area. At minimum, two batcher plants will be set up in order to cover the total 100 km of the Project area.

**Asphalt concrete**

Asphalt concrete will be applied for the Project road's pavement. At present, the Double Bituminous Surface Treatment (DBST) method is used to surface roads on the East Coast, but there are no asphalt plants in the Project area. Taking into consideration transportation distance and time, a single mobile asphalt plant should be supplied to the Project and be moved as needed in accordance with the locations of work.

## Table 14.2.2. Supplier List

| Item | Company | Location | Contact |
|---|---|---|---|
| Bearing Shoe | UTARACO Structural System | 7E, Pioneer Sector 01, Singapore | Tel .+65- 64 153078 Fax.+65- 68 631928 |
| | Finco Limited | No:291,Modera street,Colombo 15 | Tel. 011-2 546052 Fax. 011-2 546056 |
| PC Strand | Freyssinet | No:8 , Trang Thi, Hanoi, Vietnam | Tel .+84-48 261416 Fax . +84- 48 261118 |
| PC Bar | Freyssinet | Kuala Lumpur, Malaysia | Tel .+603- 79 828599 Fax .+603-79 815530 |
| | VSL India Ltd | 36, Annai Indira Nagar, Thuraipakkam, Chennai -600096, India | Tel.+91- 44 5225 1111 Fax. +91-44 5225 1010 |
| | UTARACO Structural System | 7E, Pioneer Sector 01, Singapore | Tel .+65- 64 153078 Fax.+65- 68 631928 |
| | Southern PC Steel Sdn Bhd | No 4808, Jin Utas 15/7, Seksyen15, 40000 Shah Alam, Selangor, Malaysia | Tel.+603- 55 105166 (ext -221) Fax .+603-55 199702 |
| | Tantri Engineering Co. | No.119, Biyagama Road, Kelaniya | Tel. 011- 2 913716 Fax. 011- 2 910321 |
| | Supuman Imrex | 81/1, Bullers Lane, Colombo 07 | Tel. 011- 2 585865 Fax. 011- 2 580489 |
| Expansion Joints | Access International | 278, Union Place , Colombo 02 | Tel. 011- 2 302302 Fax .011- 2 302333 |
| | UTARACO Structural System | 7E, Pioneer Sector 01, Singapore | Tel .+65- 64 153078 Fax.+65- 68 631928 |
| Teflon Sheet | UTARACO Structural System | 7E, Pioneer Sector 01, Singapore | Tel .+65- 64 153078 Fax. +65- 68 631928 |
| | Oriental Connections | 17, Kian Teck Crescent, Singapore | Tel . +65 67 936366 Fax . +65 67 936355 |
| | Jayesh Industrial Polymers | 92, Nagovi Street, Ground Floor, Mumbai,India | Tele/Fax. +91 22 2311 2949 , +91 22 3951 1454 |
| Pontoon | Tantri Engineering Co. | No.119, Biyagama Road, Kelaniya | Tel. 011- 2 913716 Fax. 011- 2 910321 |
| | Colombo Dockyard Ltd | Port of Colombo, Colombo | Tel. 011- 2 522461 Fax. 011 2 471335 |
| | Master Divers Ltd | 234, Galle Road, Colombo 03 | Tel. 011- 2 445918 Fax . 011-2 445205 |
| Pilling | Sierra Construction | 112, Havelock Road, Colombo 05 | Tel. 011- 2 591287 Fax . 011- 2 502932 |
| | Walkers Piling Ltd | 18, ST.Michael's Road, Colombo 03 | Tel. 011- 2 384559 Fax . 011- 2 337163 |
| | ATIS | 06, Kynsey Road, Colombo 08 | Tel. 011- 2 697904 Fax. 011- 2 687649 |
| Vehicle | Associated Motorways Ltd | 185, Union Place , Colombo 02 | Tel. 011- 2 433371 Fax. 011- 2 304646 |
| | Yoko Rent A Car | 138, De S .Jayasinghe Mawatha, Nugegoda | Tel. 011- 2 821182 Fax. 011- 2 828293 |
| | Toyota Lanka Ltd | 337, Negombo Road, Wattala | Tel. 011- 2 939000 Fax. 011- 2 939005 |
| Machinery | Thilak Machinery & Equipment | 231,Colombo Road, Bolawatta, Waikkala | Tel. 031- 2 277795 Fax. 031- 2 277639 |
| & Equipments | Tropica Construction Co. | 29, Wijerama Mawatha, Colombo 07 | Tel. 011- 2 697068 Fax. 011- 2 697068 |
| | Senok Trade Combine Ltd | 03, RA De Mel Mawatha, Colombo 05 | Tel. 011- 2 501035 Fax. 011- 2 580022 |
| | Bridgeway Enterprises Ltd | 5A, Austin Place, Colombo 08 | Tel. 011- 2 670089 Fax. 011- 2 696445 |
| Communication System | Dynacom Electronics | 451, Kandy Road, Kelaniya | Tel. 011- 2 910703 Fax. 011- 2 910469 |
| Official Furniture | D.R.Manufactoring Co Ltd | Kandy Road, Nittambuwa | Tel. 033- 2 285339 Fax. 033- 2 285681 |
| & Equipment | Singer Mega | 4D, Nawala Road, Nugegoda | Tel. 011- 2 769577 Fax. 011- 2 769578 |
| PVC Pipes | Central Industries Ltd | 10-1/1, Albert Crescent, Colombo 07 | Tel. 011- 2 677286 Fax. 011- 2 677590 |
| | S-lon | | Tel . 011- 2 448354 |
| Geotech Test | Engineering & Laboratory Services Ltd | 62/3, Neelammahara Road, Katuwawala, Boralesgamuwa | Tel /Fax. 011- 2 517037 |
| | Geotech Testing Services Ltd | 13/1, Pepiliyana Mawatha, Kohuwala, Nugegoda | Tel/ Fax. 011- 2 823881 |
| Scaffolding | N-Rich Ltd | 335, Nawala Road, Nawala | Tel. 011- 2 805813 Fax. 011- 2 806387 |
| Gabion Boxes | Finco Limited | No:291,Modera street,Colombo 15 | Tel. 011- 2 546052 Fax. 011- 2 546056 |
| | Reb Mech Ltd | 168/10, Nawala Road, Nugegoda | Tel. 011- 4 402236 Fax. 011- 2 877369 |
| Geotextile | Finco Limited | No:291,Modera street,Colombo 15 | Tel. 011- 2 546052 Fax. 011- 2 546056 |
| Plywood | Mackply | 30, Nawala Road, Nugegoda | Tel. 011- 4 400136 Fax. 011- 4 400135 |
| | Transwood | 27, Quarry Road, Colombo 12 | Tel. 011- 2 342870 Fax. 011- 2 332680 |
| Elastite | Richard Pieris Rubber Product Ltd | 310, High level Road, Nawinna, Maharagama | Tel. 011- 4 310574 Fax. 011- 2 804787 |
| Hand Rails | SD & CC | 07, Borupana Road, Ratmalana | Tel . 011- 2 632786 Fax. 011- 2 632746 |
| PC beam | SD & CC | 07, Borupana Road, Ratmalana | Tel. 011- 2 632786 Fax. 011- 2 632746 |
| RC Pipe | Inland Hume Pipe Co. Ltd | 76, Baily Cross Road, Batticaloa | Tel. 065- 2 222764 |
| Reinforcement Bars | GTB Colombo Corporation Ltd | 16, Boteju Mawatha, Colombo 05 | Tel. 074- 5 18763 Fax . 011- 2 607926 |
| | Ceylon Heavy Industries & Cons Co | Oruwala , Athurugiriya | Tel. 011- 2 772212 Fax. 011- 2 772211 |
| Shaped Steel | Colonial Hardwarwe Stores | 138, Sri Sumanatissa Mawatha, Colombo 12 | Tel. 011- 2 334197 Fax . 011- 4 610260 |
| | Modern Hardware Centre | 43, Abdul Jabbar Mawatha, Colombo 12 | Tel. 011- 2 435468 Fax. 011- 2 431890 |
| | Janatha Steels | 20, Quarry Road, Colombo 12 | Tel. 011- 2 543436 Fax. 011- 2 543436 |
| Road Stud | Access International | 278, Union Place , Colombo 02 | Tel. 011- 2 302302 Fax. 011- 2 302333 |
| Road Marking Material | Finco Limited | No:291,Modera street,Colombo 15 | Tel. 011- 2 546052 Fax. 011- 2 546056 |
| Sing Board | SIGN TECH | 403/2-1, Galle Road, Colombo03 | Tel/Fax. 011- 2 564371 |
| Survey Equipment | BHOOMI-TECH | 213/G - 2/2, Anagarika Dharmapala Mawatha, Dehiwala | Tel. 011- 2 718996 Fax. 011- 2 718996 |
| Cement | Tokyo Cement Company | 469 1/1, Galle Road, Colombo 03 | Tel. 011- 2 500466 Fax. 011- 2 500897 |
| Asphalt Concrete | Maga Engineering Co | 200, Nawala Road, Narahenpita, Colombo 05 | Tel. 011- 2 808835 Fax. 011- 2 808846 |
| | Fumihiko Engineering Construction Co. | 118/10, Maguruwila Road, Gonawala, Kelaniya | Tel. 011- 2 915488 Fax. 011- 2 915488 |
| | Orumix Asphalt Ltd | 658, Danister silva Rd, Dematagoda, Colombo 09 | Tel. 011- 2 269364 Fax. 011- 2 697232 |
| | Maga Neguma | Station Rd, Angulana , Moratuwa | Tel. 011- 2 607739 Fax. 011- 2 610522 |

### 14.2.3 Unit Cost

#### 1) Labor

Table 14.2.3 shows the labor unit rates on the East Coast (data from local RDA) used in estimating the construction cost, which are based on an eight-hour workday.

**Table 14.2.3. Unit Rates for Labor (2005)**

| Classification | Unit rate (Rs.) |
|---|---|
| Engineer (10 years experience) | 60,000/month |
| Skilled Labor (technician) | 650/day |
| Semi-Skilled Labor | 550/day |
| Unskilled Labor | 475/day |

#### 2) Materials

Table 14.2.4 indicates the unit costs for major construction materials in the East coast area.

**Table 14.2.4. Unit Rates for Major Materials (2005)**

| Item | Unit | Unit Rate (Rs.) |
|---|---|---|
| Portland Cement | 50kg | 500 |
| Reinforcement Steel Bar | Ton | 70,000 |
| Borrow material | cu.m | 340 |
| RC pipe 1200m dia. | m | 5,000 |
| RC pipe 600m dia. | m | 1,700 |
| Bitumen 80/100 | Liter | 30 |
| Petrol | Liter | 80 |
| Diesel | Liter | 50 |

### 14.2.4 Preliminary Project Cost Estimate

The construction cost and total Project cost were estimated as the outputs from this Project's feasibility study and were to be shown in Table 14.2.5. Note that the construction cost includes the detailed design cost as a preliminary item, and, consequently, the engineering services cost includes the supervising of the construction work only.

**Table 14.2.5. Preliminary Estimated Project Cost***

| Description | Cost (million Rs.) |
|---|---|
| 1. Road between Akkaraippattu and Trikkandimadu | 2,213 |
| 2. New Kallady Bridge (incl. 250m approach road) | 709 |
| 3. Relocation of existing public utilities | 198 |
| 3.1. Electricity | 118 |
| 3.2. Telephone line | 59 |
| 3.3. Water supply | 21 |
| 4. Contingency | 312 |
| **Total Construction cost (1,2,3,4)** | **3,432** |
| 5. Engineering Services (incl. 10% contingency) | 417 |
| 6. Land Acquisition & Compensation | 50 |
| **Total Project cost (1,2,3,4,5,6)** | **3,899** |

Note: *Excluding VAT and the price contingency, exchange rate Rs.1 = JPY 1.11 (Ave. Aug 2005)

# *CHAPTER 15*

## *Project Evaluation*

# Chapter 15 Project Evaluation

## 15.1 Objective

Given that the Sri Lankan and Japanese Governments have essentially decided that the Project road be improved as part of an emergency effort to rehabilitate Tsunami-affected infrastructure, it is important that cost-effectiveness be considered. For this reason, least cost (LC) analysis is carried out to confirm that the overlay/ABC method recommended in Chapter 12 is economically less costly than reconstruction. After that, the economic viability of the alternative selected in LC analysis is examined applying benefit cost (BC) analysis.

## 15.2 Project Costs & Benefits

Project costs and benefits (including the New Kallady Bridge) are evaluated over the period of 2006 to 2020 for LC analysis, which is based on the Project road design life of 10 years adopted after analysis and discussions with RDA. As for the BC analysis, a 10-year period is too short to sufficiently consider benefits that will flow from the improvement of the Project road.[1] Therefore, 15- and 20-year periods of time for economic evaluation are taken up. The Project costs and benefits examined in this report are as described in Table 15.2.1.

**Table 15.2.1. List of Project Costs & Benefits**

| | |
|---|---|
| Project Costs | Construction cost |
| | Compensation for loss of land use cost |
| | Engineering services cost |
| | O&M cost |
| Project Benefits[2] | VOC saving |
| | Travel time saving |

## 15.3 Cost & Benefit Valuation

The domestic price numeraire is applied for economic evaluation using domestic market prices as the common denominator, with costs/benefits updated to constant 2005 economic prices in Sri Lankan rupees (Rs). It is therefore necessary to breakdown Project inputs/outputs into tradable and non-tradable items. In the case of tradable items the exchange rate from the Bank of Japan (Aug. 2005) of Rs 0.901 to 1.00 Japanese yen is

[1] According to the UK's Transport and Road Research Laboratory, an analysis period of 15 years is normal for most road projects. Note that 20 years is usually considered to be the maximum.
[2] Benefits from reductions in traffic accidents are usually considered, but the Project will not reduce the amount of travel so this is not considered.

applied, together with a shadow exchange rate factor of 1.042 to take into account foreign exchange effects.[3] For Project components purchased in Sri Lanka no conversion factor is needed, since it is assumed that the market is competitive for these resources and also because they do not impact on exports/imports. Note that all taxes/duties are excluded from economic costs. As for Project benefits, since they consist of location-specific intangibles such as time saving, they are considered non-tradable goods and are also evaluated without applying a conversion factor. Other important cost-benefit assumptions are as follows:

- Trips for non-work purpose are valuated at 20% of trips made for work purposes.
- Generated trips are not expected unless the Trikkandimadu to Trincomalee missing link is realized.
- Changes in O&M and residual costs are reflected in the different evaluation periods.

### 15.3.1 Cost Valuation

The assumptions and shadow prices used for converting Project financial costs to economic costs for evaluation are as described in Table 15.3.1. Note that financial costs items are based on the values given in Chapter 14 of this report, with the exception of operation and maintenance costs, which are estimated in Chapter 17.

**Table 15.3.1. Project Economic Cost Evaluation Assumptions**

| Type of Cost | Assumption | Shadow Price |
|---|---|---|
| Construction Cost (exclusive of labor) | ● 53% Tradable Equipment & Material<br>● 47% Non-Tradable Equipment & Material | ● Yes. Tradable items multiplied by 1.042<br>● No |
| Local Labor Cost for Construction | ● 50% Skilled labor<br>● 50% Semi-skilled/ unskilled labor | ● Competitive market no shadow price required.<br>● Yes: SWFR = 0.7.[4] |
| Compensation for Loss of Land Use | ● Compensation in line with market prices. | ● No. |
| O&M Cost (exclusive of labor) | ● All equipment & materials purchased locally at competitive prices | ● No |
| O&M Labor Cost | ● 70% Skilled Labor<br>● 30% Semi-skilled/ unskilled labor | ● Competitive market no shadow price.<br>● Yes: SWFR = 0.7 |
| Engineering Services | ● 53% Tradable<br>● 47% Non-Tradable | ● Yes. Multiplied by 1.042<br>● No: Consists of skilled labor, which is competitively priced. |

[3] Based on *Economics and Research Dept. Technical Note 11*, ADB, February 2004.
[4] Shadow wage rate factor (SWFR) revised after reviewing various documents including: (1) Sri Lanka Power Sector Development Program Report, ADB, RRP-SRI 30207, October 2002; (2) Report on Sri Lanka Secondary Towns and Rural Community-Based Water Supply and Sanitation Project, ADB, RRP-SRI 31501, December 2002.

### 15.3.2 Benefit Valuation

Project benefits, which will flow from the year 2010 after the completion of rehabilitation in 2009, are quantified by comparing the impacts that the rehabilitation and non-rehabilitation of the Project road would have on vehicle operating costs (VOC) and travel time. With rehabilitation, there will be a decrease in VOC as a result of the Project road's improved running surface, together with significant reductions in travel time due to increases in vehicle operation speed (see 11.4 of Chapter 11). A description of each of the measurements regarding VOC and time saving is given below.

#### 1) VOC Benefits

In road projects VOC savings are one of the most important benefits. This benefit is calculated by deriving the reduction in VOC as a result of an improvement in the IRI of the Project road after its rehabilitation. After a review of existing literature and studies, it was decided to estimate the economic price of VOC per vehicle type by updating VOC values from a June 2000 ADB report[5] to 2005 values using the Colombo consumer price index (see Table 15.3.2). Note that the present average IRI of the Project road is 8, and it is expected that this will become 3 after Project completion.

**Table15.3.2. Vehicle Operating Cost (unit: Rs./km)**
**(2005 Constant Economic Prices)**

| Type of Vehicle | VOC per km for IRI of 3 | VOC per km for IRI of 8 |
|---|---|---|
| 1.Passenger Car | 12.0 | 13.6 |
| 2. Motorcycle | 2.4 | 2.7 |
| 3. 3 Wheeler | 3.8 | 4.1 |
| 4. Minibus | 16.1 | 19.2 |
| 5. Bus | 21.6 | 26.2 |
| 6. Light Truck | 10.3 | 12.3 |
| 7. Medium Truck | 14.0 | 18.0 |
| 8. Heavy Truck | 21.9 | 27.3 |

Daily Veh-km for each vehicle type are estimated by applying the user equilibrium traffic assignment model in JICA STRADA for the medium traffic growth case (or base case), and then expanded to annual Veh-km (see Chapter 11).[6] With this information and that in Table 15.3.2, it is possible to calculate the annual VOC savings that would be realized with the rehabilitation of the Project road (see Table 15.3.3).

[5] *Project Performance Audit Report on the Second Road Improvement Project in Sri Lanka*, PPA: SRI 19190, ADB, June 2000
[6] The expansion factor of 300 is applied to expand average daily trips to annual trips and has been used in other studies in Sri Lanka (e.g., *Traffic Demand Estimation for Proposed Colombo-Katunayake Expressway*, Final Report, Univ. of Moratuwa, May 2000).

**Table 15.3.3. VOC Savings for 2010 - 2030 (2005 Constant Economic Prices)**

| Year | Type of Vehicle | Annual Veh-km (millions) | VOC/km Without Rehabilitation (Rs) | VOC/km With Rehabilitation (Rs) | VOC Savings (Rs millions) |
|---|---|---|---|---|---|
| 2010 | Passenger Car | 21.0 | 13.6 | 12.0 | 33.6 |
| | Motorcycle | 46.7 | 2.7 | 2.4 | 14.0 |
| | 3 Wheeler | 9.9 | 4.1 | 3.8 | 3.0 |
| | Minibus | 8.6 | 19.2 | 16.1 | 26.6 |
| | Bus | 14.5 | 26.2 | 21.6 | 66.7 |
| | Light Truck | 4.3 | 12.3 | 10.3 | 8.6 |
| | Medium Truck | 22.6 | 18 | 14.0 | 90.4 |
| | Heavy Truck | 17.1 | 27.3 | 21.9 | 92.1 |
| | Total | 144.7 | - | - | 335.0 |
| 2020 | Passenger Car | 31.6 | 13.6 | 12.0 | 50.6 |
| | Motorcycle | 97.8 | 2.7 | 2.4 | 29.3 |
| | 3 Wheeler | 17.2 | 4.1 | 3.8 | 5.2 |
| | Minibus | 12.5 | 19.2 | 16.1 | 38.9 |
| | Bus | 21.3 | 26.2 | 21.6 | 98.1 |
| | Light Truck | 6.7 | 12.3 | 10.3 | 13.4 |
| | Medium Truck | 36.2 | 18 | 14.0 | 144.7 |
| | Heavy Truck | 27.4 | 27.3 | 21.9 | 147.8 |
| | Total | 250.8 | - | - | 528.0 |
| 2025 | Passenger Car | 38.8 | 13.6 | 12.0 | 62.0 |
| | Motorcycle | 141.5 | 2.7 | 2.4 | 42.5 |
| | 3 Wheeler | 22.8 | 4.1 | 3.8 | 6.8 |
| | Minibus | 15.2 | 19.2 | 16.1 | 47.0 |
| | Bus | 25.8 | 26.2 | 21.6 | 118.9 |
| | Light Truck | 8.4 | 12.3 | 10.3 | 16.8 |
| | Medium Truck | 45.8 | 18 | 14.0 | 183.1 |
| | Heavy Truck | 34.7 | 27.3 | 21.9 | 187.3 |
| | Total | 332.9 | - | - | 664.4 |
| 2030 | Passenger Car | 43.1 | 13.6 | 12.0 | 69.0 |
| | Motorcycle | 218.6 | 2.7 | 2.4 | 65.6 |
| | 3 Wheeler | 27.7 | 4.1 | 3.8 | 8.3 |
| | Minibus | 16.7 | 19.2 | 16.1 | 51.8 |
| | Bus | 24.6 | 26.2 | 21.6 | 113.2 |
| | Light Truck | 11.1 | 12.3 | 10.3 | 22.2 |
| | Medium Truck | 47.0 | 18 | 14.0 | 188.0 |
| | Heavy Truck | 40.4 | 27.3 | 21.9 | 218.0 |
| | Total | 429.2 | | | 736.1 |

Note: Values for 2020 are interpolated from 2010 & 2025 estimates..

As the above table indicates, the rehabilitation of the Project road would produce total VOC savings in the years 2010, 2020, 2025, and 2030 of approximately Rs 335 million, Rs 528 million, 664 million, and 736 million, respectively. Note that the average rate of increase in VOC savings over the 20-year period of 2010 to 2030 is about 4%.

## 2) Time Saving Benefits

Time saving is calculated by multiplying the value of time (VOT) and travel time reductions per vehicle type that would be achieved with Project road rehabilitation. First,

VOT for work trips is set using average national income per capita (excluding the Western Province[7]). Second, the VOT for non-work trips is then valued at 20% of that for work trips.[8] Third, since passenger VOT by mode of travel will vary, this is determined taking the bus mode as the base mode of travel, which has a passenger VOT for work trips equal to Rs 16 per hour. The results of this process, which produced average passenger VOT per vehicle type, are as shown in Table 15.3.4.

**Table 15.3.4. Ratio of Work Trip VOT for Other Modes to Bus Mode & Average VOT**

| Vehicle Type | Ratio of Work Trip VOT by Vehicle Type to Bus Work Trip VOT | Passenger VOT for Work Trips (Rs/hour) | Ratio of Work Trips per Day | Average VOT per Passenger (Rs/hour) |
|---|---|---|---|---|
| Passenger Car | 9.2 | 149 | .60 | 101 |
| Motorcycle | 1.7 | 27 | .67 | 20 |
| 3 Wheeler | 1.7 | 27 | .28 | 11 |
| Minibus/Bus | 1.0 | 16 | .45 | 9 |

Note: The ratio of work trips per day is derived from the traffic survey data of the JICA Study Team

Using the above information, average VOT per vehicle type is determined as shown in Table 15.3.5 by multiplying average VOT per passenger and average vehicle occupancy per vehicle type, which is based on data from the traffic survey carried out by the JICA Study Team. Note that VOT for truck drivers is not considered since it is included in vehicle operating cost.

**Table 15.3.5. Average VOT by Vehicle Type (2005 Economic Prices)**

| Type of Vehicle | Average VOT per Passenger (Rs) | Average Vehicle Occupancy[1)] | Average VOT per Vehicle (Rs) |
|---|---|---|---|
| Passenger Car | 101 | 2.61 | 264 |
| Motorcycle | 20 | 1.48 | 30 |
| 3 Wheeler | 11 | 0.33 | 4 |
| Minibus | 9 | 20.00 | 180 |
| Bus | 9 | 40.00 | 360 |

1) Drivers for passenger cars, buses, and 3 wheelers not included as their VOT is considered in VOC.

Daily vehicle travel time (Veh-hr) data is obtained and expanded in the same manner as that for Veh-km data. As Table 15.3.6 indicates, the rehabilitation of the Project road would produce total time saving in the years 2010, 2020, 2025, and 2030 of approximately Rs 56 million, and Rs 106 million, Rs 146 million, and Rs 184 million, respectively. Note that the

[7] Average income per capita for Western Province is significantly higher than the rest of the country and would skew the VOT if used.
[8] According to the 1988 *Overseas Road Note #5* of the Transport and Road Research Laboratory of the UK, non-work travel time should be valued at 0 to .45 of travel time for work. The value of 0.2 was applied here after reviewing the values for non-work time in other Sri Lankan studies, which according to the 2004 ADB *National Highways Development Project* is also considered acceptable to the Department of National Planning of Sri Lanka

average rate of increase in time saving for the first 10 years (2010 – 2020) is approximately 6.5% and in the second 10 years (2020 – 2030) about 5.7%, indicating that the rate of time saving decreases as the overall road network becomes more congested.

**Table 15.3.6. Time Saving for 2010 - 2030 (2005 Constant Economic Prices)**

| Year | Type of Vehicle | Reduction in Veh-hr With Rehabilitation | Average Vehicle VOT (Rs) | Time Savings With Rehabilitation (Rs millions) |
|---|---|---|---|---|
| 2010 | Passenger Car | 83,100 | 264 | 21.9 |
| | 3 Wheeler | 192,300 | 30 | 5.8 |
| | Motorbike | 38,400 | 4 | 0.2 |
| | Minibus | 40,200 | 180 | 7.2 |
| | Bus | 58,200 | 360 | 21.0 |
| | Total | | | 56.0 |
| 2020 | Passenger Car | 154,175 | 264 | 40.7 |
| | 3 Wheeler | 503,038 | 30 | 15.1 |
| | Motorbike | 84,253 | 4 | 0.3 |
| | Minibus | 69,863 | 180 | 12.6 |
| | Bus | 102,286 | 360 | 36.8 |
| | Total | | | 105.5 |
| 2025 | Passenger Car | 210,000 | 264 | 55.4 |
| | 3 Wheeler | 813,600 | 30 | 24.4 |
| | Motorbike | 124,800 | 4 | 0.5 |
| | Minibus | 92,100 | 180 | 16.6 |
| | Bus | 135,600 | 360 | 48.8 |
| | Total | | | 145.7 |
| 2030 | Passenger Car | 270,300 | 264 | 71.4 |
| | 3 Wheeler | 1,059,000 | 30 | 31.8 |
| | Motorbike | 128,100 | 4 | 0.5 |
| | Minibus | 99,600 | 180 | 17.9 |
| | Bus | 172,800 | 360 | 62.2 |
| | Total | | | 183.8 |

Note: Values for 2020 are interpolated from 2010 & 2025 estimates.

## 15.4 Least Cost Analysis

Prior to BC analysis, LC analysis is first carried out as shown in Table 15.4.1. Note that a discount rate of 12% is applied, as this is standard practice. As the table indicates, the net present value (NPV) for the cost of the reconstruction alternative is approximately Rs. 2,361 million, while the NPV for the cost of the overlay + ABC alternative is about Rs.2,138 million (or 9.5% lower). Based on this, it is recommended that the overlay + ABC alternative as described in Chapter 12 of the report be implemented to rehabilitate the Project road.

**Table 15.4.1. Least Cost Analysis of Reconstruction & Overlay + ABC Alternatives (Constant 2005 Economic Prices)**

| Year | Reconstruction Alternative | | | Overlay + ABC Alternative | | |
|---|---|---|---|---|---|---|
| | Capital Costs | O&M Costs | NPV of Total Costs (12% Discount Rate) | Capital Costs | O&M Costs | NPV of Total Costs (12% Discount Rate) |
| 2006 | 25.00 | 0.00 | 25.00 | 25.00 | 0.00 | 25.00 |
| 2007 | 1429.73 | 0.00 | 1,429.73 | 1,357.07 | 0.00 | 1,357.07 |
| 2008 | 2045.94 | 0.00 | 2,045.94 | 1,939.66 | 0.00 | 1,939.66 |
| 2009 | 905.95 | 0.00 | 905.95 | 861.22 | 0.00 | 861.22 |
| 2010 | 0.00 | 10.31 | 10.31 | 0.00 | 10.31 | 10.31 |
| 2011 | 0.00 | 10.31 | 10.31 | 0.00 | 10.31 | 10.31 |
| 2012 | 0.00 | 10.31 | 10.31 | 0.00 | 10.31 | 10.31 |
| 2013 | 0.00 | 10.31 | 10.31 | 0.00 | 10.31 | 10.31 |
| 2014 | 0.00 | 10.31 | 10.31 | 0.00 | 10.31 | 10.31 |
| 2015 | 0.00 | 10.31 | 10.31 | 0.00 | 10.31 | 10.31 |
| 2016 | 0.00 | 10.31 | 10.31 | 0.00 | 10.31 | 10.31 |
| 2017 | 0.00 | 10.31 | 10.31 | 0.00 | 10.31 | 10.31 |
| 2018 | 0.00 | 10.31 | 10.31 | 0.00 | 10.31 | 10.31 |
| 2019 | 0.00 | 10.31 | 10.31 | 0.00 | 10.31 | 10.31 |
| 2020 | (2755.30) | 606.88 | (2,148.42) | (2,755.30) | 606.88 | (2,148.42) |
| Total | 1,651.33 | 709.99 | 2,361.32 | 1,427.65 | 709.99 | 2,137.63 |

## 15.5 Benefit Cost Analysis of Selected Least Cost Alternative

BC analysis is carried out for the three evaluation periods of 10, 15, and 20 years (see Table 15.5.1). As the table indicates, the economic internal rate of return (EIRR) increases the longer the evaluation period. In the case of a 10-year period, the EIRR is only 7.76%, meaning that the Project road is not economically viable. On the other hand, the EIRR for the 15- and 20-year periods is 9.40% and 10.06%. In terms of economic justification an EIRR of at least 10% should be obtained, meaning that the Project satisfies the bare minimum if a 20-year evaluation period is applied.[9]

**Table 15.5.1. EIRR by Evaluation Period**

| Evaluation Period | EIRR |
|---|---|
| 10 Years (2010-2020) | 7.76% |
| 15 Years (2010-2025) | 9.40% |
| 20 Years (2010-2030) | 10.10% |

Note: The above values are 8.00%, 9.48%, and 10.32%, respectively, in the case when non-work trips are evaluated as zero.

Note also that with the lack of sufficient time-series data for the Project road, the margin of error in regards to benefits could reach 20%. This could perhaps push the EIRR up to 12% for the 20-year evaluation period, which is an acceptable time period given that changes in the basic infrastructure in this area are not rapid and that the trip patterns of the Project road

[9] An EIRR of 12% is usually considered to be the threshold for economic viability. On the other hand, in the case where there are significant non-quantifiable benefits an EIRR greater than 10% may be acceptable to international donors.

are strongly linear in nature. That is, the assumed trends in trip making can be extended for a longer length of time with no complications. Details of the analysis of the EIRR and NPV for the 20-year time period are as shown in Table 15.5.2.

**Table 15.5.2. EIRR & NPV of Project Road**

**(Constant 2005 economic prices, domestic price numeraire, Rs millions)**

| Year | Costs | | | | Benefits | | | Results |
|---|---|---|---|---|---|---|---|---|
| | Capital Costs | O&M Costs | Compensation Costs | Total Costs (A) | VOC Savings | Time Savings | Total Benefits (B) | Net Benefit (B-A) |
| 2006 | | | 25.0 | 25.0 | | | | (25.0) |
| 2007 | 1344.6 | | 12.5 | 1357.1 | | | | (1357.1) |
| 2008 | 1927.2 | | 12.5 | 1939.7 | | | | (1939.7) |
| 2009 | 861.2 | | | 861.2 | | | | (861.2) |
| 2010 | | 10.3 | | 10.3 | 335.0 | 56.0 | 391.0 | 380.7 |
| 2011 | | 10.3 | | 10.3 | 356.9 | 62.0 | 419.0 | 408.6 |
| 2012 | | 10.3 | | 10.3 | 378.9 | 68.0 | 446.9 | 436.6 |
| 2013 | | 10.3 | | 10.3 | 400.9 | 74.0 | 474.8 | 464.5 |
| 2014 | | 10.3 | | 10.3 | 422.8 | 80.0 | 502.8 | 492.5 |
| 2015 | | 10.3 | | 10.3 | 444.8 | 85.9 | 530.7 | 520.4 |
| 2016 | | 10.3 | | 10.3 | 466.7 | 91.9 | 558.7 | 548.4 |
| 2017 | | 10.3 | | 10.3 | 488.7 | 97.9 | 586.6 | 576.3 |
| 2018 | | 10.3 | | 10.3 | 510.7 | 103.9 | 614.6 | 604.2 |
| 2019 | | 10.3 | | 10.3 | 532.6 | 109.9 | 642.5 | 632.2 |
| 2020 | | 606.9 | | 606.9 | 554.6 | 115.8 | 670.4 | 63.6 |
| 2021 | | 10.3 | | 10.3 | 576.6 | 121.8 | 698.4 | 688.1 |
| 2022 | | 10.3 | | 10.3 | 598.5 | 127.8 | 726.3 | 716.0 |
| 2023 | | 10.3 | | 10.3 | 620.5 | 133.8 | 754.3 | 744.0 |
| 2024 | | 10.3 | | 10.3 | 642.5 | 139.8 | 782.2 | 771.9 |
| 2025 | | 10.3 | | 10.3 | 664.4 | 145.7 | 810.2 | 799.8 |
| 2026 | | 10.3 | | 10.3 | 670.6 | 153.3 | 823.9 | 813.6 |
| 2027 | | 10.3 | | 10.3 | 676.7 | 161.0 | 837.7 | 827.4 |
| 2028 | | 10.3 | | 10.3 | 682.9 | 168.6 | 851.4 | 841.1 |
| 2029 | | 10.3 | | 10.3 | 689.0 | 176.2 | 865.2 | 854.9 |
| 2030 | (1377.6) | 1098.4 | | (279.2) | 695.2 | 183.8 | 878.9 | 1158.1 |
| | | | | | | | EIRR= 10.10% | |
| | | | | | | | NPV at 12% = -478 million | |

Given the above, it is recommended that sensitivity analysis be carried out for the 20-year evaluation time period. However, prior to that, the potential economic impact (or EIRR and NPV) of the Trikkandimadu - Trincomalee missing link on the Project road, which would result in new trips being generated, is estimated (see Table 15.5.3) applying the following assumptions:

- New trips will be generated on the Project road as a result of the large improvement in accessibility between Trikkandimadu and Trincomalee. That is, it is estimated that travel time will decrease from the present 6 hours to approximately 2 hours.

- It is assumed that the price elasticity of demand for transport regarding the above improvement, which will result in a decrease of about 60% in door-to-door transport costs for trips coming from and going to Trincomalee, is -2. That is, for every 1% decrease in transport cost there would be a 2% increase in the number of trips that currently travel between the Project road and Trincomalee area.[10]
- In line with accepted economic theory, the value of generated trips is considered to be equivalent to half of that of normal trips.[11]
- The benefits considered are only those related to travel and do not take into consideration possible land development benefits.

**Table 15.5.3. EIRR & NPV of Project Road (with Trikkandimadu-Trincomalee Link)**

**(Constant 2005 economic prices, domestic price numeraire, Rs millions)**

| Year | Costs | | | | Benefits | | | Results |
|---|---|---|---|---|---|---|---|---|
| | Capital Costs | O&M Costs | Compensation Costs | Total Costs (A) | VOC Savings | Time Savings | Total Benefits (B) | Net Benefit (B-A) |
| 2006 | | | 25.0 | 25.0 | | | | (25.0) |
| 2007 | 1344.6 | | 12.5 | 1357.1 | | | | (1357.1) |
| 2008 | 1927.2 | | 12.5 | 1939.7 | | | | (1939.7) |
| 2009 | 861.2 | | | 861.2 | | | | (861.2) |
| 2010 | | 10.3 | | 10.3 | 348.1 | 57.9 | 406.1 | 395.8 |
| 2011 | | 10.3 | | 10.3 | 370.1 | 63.9 | 434.0 | 423.7 |
| 2012 | | 10.3 | | 10.3 | 392.1 | 69.9 | 462.0 | 451.6 |
| 2013 | | 10.3 | | 10.3 | 414.0 | 75.9 | 489.9 | 479.6 |
| 2014 | | 10.3 | | 10.3 | 436.0 | 81.8 | 517.8 | 507.5 |
| 2015 | | 10.3 | | 10.3 | 458.0 | 87.8 | 545.8 | 535.5 |
| 2016 | | 10.3 | | 10.3 | 479.9 | 93.8 | 573.7 | 563.4 |
| 2017 | | 10.3 | | 10.3 | 501.9 | 99.8 | 601.7 | 591.4 |
| 2018 | | 10.3 | | 10.3 | 523.9 | 105.8 | 629.6 | 619.3 |
| 2019 | | 10.3 | | 10.3 | 545.8 | 111.7 | 657.6 | 647.3 |
| 2020 | | 606.9 | | 606.9 | 567.8 | 117.7 | 685.5 | 78.6 |
| 2021 | | 10.3 | | 10.3 | 589.7 | 123.7 | 713.4 | 703.1 |
| 2022 | | 10.3 | | 10.3 | 611.7 | 129.7 | 741.4 | 731.1 |
| 2023 | | 10.3 | | 10.3 | 633.7 | 135.7 | 769.3 | 759.0 |
| 2024 | | 10.3 | | 10.3 | 655.6 | 141.6 | 797.3 | 787.0 |
| 2025 | | 10.3 | | 10.3 | 690.0 | 150.3 | 840.3 | 830.0 |
| 2026 | | 10.3 | | 10.3 | 696.2 | 157.9 | 854.1 | 843.8 |
| 2027 | | 10.3 | | 10.3 | 702.3 | 165.5 | 867.8 | 857.5 |
| 2028 | | 10.3 | | 10.3 | 708.5 | 173.1 | 881.6 | 871.3 |
| 2029 | | 10.3 | | 10.3 | 714.6 | 180.7 | 895.3 | 885.0 |
| 2030 | (1377.6) | 1098.4 | | (279.2) | 721.5 | 189.6 | 911.0 | 1190.2 |
| | | | | | | | EIRR= 10.43% | |
| | | | | | | | NPV at 12% = -398 million | |

[10] According to the UK's Transport and Road Research Laboratory, the range in developing countries for the price elasticity of demand for transport is -0.6 to –2.0, with an average of about –1.0. It was decided here to apply the maximum value given the large improvement in accessibility.

[11] The logic behind this is that some generated traffic will occur at the margin of any reduction in transport cost while other generated traffic will not develop unless the entire reduction is realized. This is also known by economists as the "Rule of Half", which states that benefits of additional travel are worth half the per-trip saving of existing trips.

As Table 15.5.3 and 15.5.2 indicate, with the Trikkandimadu-Trincomalee link the EIRR of the Project Road increases from 10.10% to 10.43% and the value of NPV improves by Rs. 80 million. Overall, the gross benefits of the Project road increase by about 3%.

## 15.6 Sensitivity Analysis

Sensitivity analysis is carried out for the Project road without and with the Trikkandimadu-Trincomalee link for a 20-year evaluation period in Tables 15.6.1 and 15.6.2, respectively.

**Table 15.6.1. Sensitivity Analysis (without Trikkandimadu-Trincomalee Link)**

| Scenario | EIRR (%) | NPV (Mil. of SLR) | Switching Value |
|---|---|---|---|
| Sensitivity Tests | | | |
| Benefits | | | |
| +10% | 11.19 | (186) | Base X 1.1774 |
| +20% | 12.23 | 61 | |
| Costs | | | |
| -10% | 11.31 | (143) | Base X 0.8493 |
| -20% | 12.78 | 148 | |

**Table 15.6.2. Sensitivity Analysis (with Trikkandimadu-Trincomalee Link)**

| Scenario | EIRR (%) | NPV (Mil. of SLR) | Switching Value |
|---|---|---|---|
| Sensitivity Tests | | | |
| Benefits | | | |
| +10% | 11.54 | (108) | Base X 1.1435 |
| +20% | 12.59 | 157 | |
| Costs | | | |
| -10% | 11.66 | (72) | Base X 0.8745 |
| -20% | 13.14 | 219 | |

As the above tables indicate, the Project road is slightly more sensitive to variations in cost than benefits. In the case of the missing link not being constructed, however, benefits would have to increase by about 18% or costs decrease by about 15% before the NPV would become positive and the EIRR exceed 12%. In the case of the missing link being constructed, an increase in benefits of about 14% or a decrease in costs by about 13% would be required for the NPV to become positive. In the opinion of the consultant, either of these scenarios is possible given the variability of the data and the fact that land development impacts were not considered. Therefore, the Project should not be delayed for the sole reason of the EIRR being less than 12%.

# *CHAPTER 16*

## *Community Support Program for Rehabilitation Project*

# Chapter 16 Community Support Program for Rehabilitation Project

## 16.1 Community Support in Eastern Trunk Roads Rehabilitation

The Eastern Trunk Road Rehabilitation Project has been designed primarily as an engineering project to improve a 100km stretch of the National Highway AA004/AA015 between Akkaraipattu in Ampara District and Trikkandimadu in Batticaloa District. However, there has been a strongly felt need to examine ways of including projects and programs to address urgent local issues primarily non-engineering in nature, as this stretch of road traverses through several villages, townships and two major urban agglomerations. First and foremost, it is imperative that all works associated with the road rehabilitation duly consider impacts they have on the human settlements. Whilst the impacts per se are dealt with elsewhere (Chapter 5) in this report, this chapter focuses on possible community support projects and programs to, at least, partially address these impacts and to demonstrate as to how the Project would contribute towards the medium to long-term development of the communities concerned.

The community support being proposed in by the Rehabilitation Project consists mainly of providing livelihood opportunities to tsunami affected people via income that can be earned from the construction of the Project road. This may include employment opportunities for skilled and unskilled persons from adjacent settlements and, indirectly, opportunities for local producers to supply goods and services to be consumed in the Project. Complementing this, the Kalmunai Township Redevelopment (KTR) project currently being conceived under a parallel JICA study (*Recovery, Rehabilitation and Development Project for Tsunami Affected Areas of Northern and Eastern Region* – referred to as JICA NorthEast Study) is expected to make significant positive impacts on the socioeconomic development of the general community (including people affected by the tsunami) over the mid and long term.

At the time of this report being prepared, the KTR proposal was still in the process of being finalized. Many new features were being considered and others already considered were being modified. Besides, the investments required for the implementation of the various elements in the proposal is expected to be drawn from a number of different sources. JICA's investment in resources and expertise by way of funding this KTR study by itself is considered a significant support to the Kalmunai community residing along the route AA004. Hence, this proposal and its many features are discussed in this report.

## 16.2 Context of Kalmunai Township Redevelopment in Eastern Trunk Roads Rehabilitation

The Municipality of Kalmunai - with a population of 94,457 in 2001, expected to grow to 114,000 by 2010 (Eastern Region Physical Plan 2004, National Physical Planning Department) - is situated almost two-thirds of the way towards Akkaraipattu on the 100km stretch of road to be rehabilitated. It is the most densely populated segment of the AA004 and is considered one of the densest of all urban agglomerations in Sri Lanka (see Fig 12.2.1). It comprises three Divisional Secretary divisions – Kalmunai Tamil, Kalmunai Muslim and Saintahamaruthu, which extend from the seacoast on the east to beyond the west of AA004 and run parallel to each other (see Fig 12.2.2). A matter of significance is that the coastal belt of this municipality was the worst hit in all of Sri Lanka by the December 2006 tsunami (see Fig 12.2.3). Thus, the KTR project is being conceived, on the one hand, with consideration for recovery and reconstruction from the tsunami damage and, on the other, with long term consideration for Kalmunai to develop as a progressive disaster-resistant city. The dense residential settlements to the east of AA004 are expected to gradually move westwards beyond route AA004 and the KTR plan incorporates features to stimulate such a transition.

## 16.3 Conceptualizing the Kalmunai Township Redevelopment Plan

In conceptualizing the KTR plan it was imperative that certain basic principles and on-the-ground conditions were taken into consideration. These are elaborated below.

### 16.3.1 Governing Principles

In order to ensure that the KTR conforms, and is sensitive, to all relevant local conditions, needs and aspirations of the local community and, yet, be unique in nature, the following four governing principles have been strictly adhered to in the preparation of the KTR Plan.

1. The KTR is to reflect not only the recovery, rehabilitation and reconstruction of all tsunami affected areas, but also the opportunities and constraints for socio-economic progress and enhanced environmental protection and management of the area.
2. The KTR is to explicitly express natural disaster resistant features.


**Figure 16.2.1. Aerial Photo of Post-tsunami Kalmunai Township**

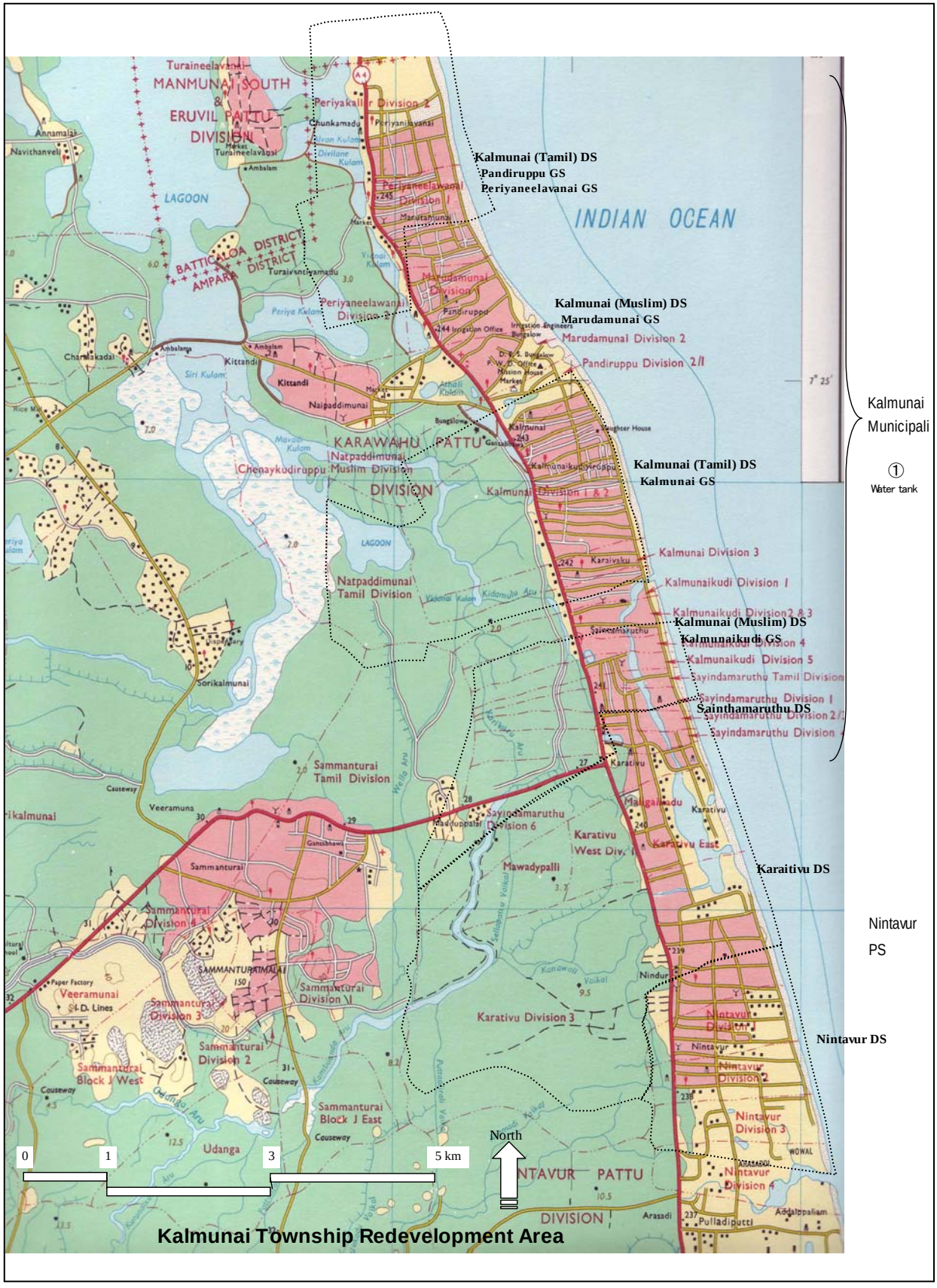



**Figure 16.2.2. Map of Kalmunai Municipality & Surroundings**

Kalmunai - Inland Waterway – "Thona"

Inland Waterway – "Thona" – Dried up at Sea

Kalmunai - Tsunami Destruction of Coastal Housing

Kalmunai - Tsunami Destruction of Coastal Housing

Kalmunai - Tsunami Destruction of Coastal Housing

Kalmunai - Tsunami Destruction of Coastal Housing

Kalmunai - Tsunami Destruction of Coastal Housing

Kalmunai - Tsunami Destruction of Coastal Housing

**Figure 16.2.3. Tsunami Destruction in Coastal Areas of Kalmunai Township**

3. The KTR planning process is to be essentially community driven, technologically adequate and environmentally sound.
4. The KTR is to be compatible with the "Eastern Province Physical Plan (2004)" and "Master Plan for Ampara District (ongoing)" initiated and conducted by the Sri Lankan government.

### 16.3.2 Basic Considerations for KTR Concept Plan

In conceiving the KTR Plan, the following "on-the-ground" conditions are taken into consideration along with the above-mentioned Governing Principles:

1. The existing Kalmunai Township, with its conspicuous ethnic divide in extremely high density settlements mainly along the seacoast, has grown unplanned over the years and, consequently, urban services and facilities are inappropriately located and developed, which calls for urgent regularization and upgrading of these services and facilities.

2. A significant proportion of the community that is dependent on fishing and related activities are desirous of continuing to live along the coastal belt, despite the devastating impact of the tsunami, for easy access to the sea and in order to be able to protect their fishing vessels and equipment stored on or near the beach, as there is a lack of formal and secure landing facilities.

3. The annual monsoonal floods limit agricultural production to a single harvest per year on most inland areas west of the National Highway AA004 due to the poor storm water drainage system making these lands uneconomical to be maintained exclusively for agricultural purposes, which has prompted a desire among some land owners to reclaim these lands for more lucrative urban development.

4. Previous studies on Kalmunai Township development by government agencies and local community groups have consistently identified land to the west of AA004 for reclamation and urban development.

5. The impact of the tsunami has been such that, in addition to a massive depreciation of the housing stock requiring urgent large-scale re-housing and resettlement, several public institutions and facilities also need reconstruction or rehabilitation. In addition, the twenty-five year planning period adopted for the KTR requires additional housing

and upgrading of other communal facilities to accommodate the growth and redistribution of population in the municipal area.

6. While continuing to develop the existing fisheries and agriculture-based local economy for the foreseeable future, opportunities need to be created to sustain and enhance cottage industries, such as handloom weaving and gold jewelry manufacturing currently unique to Kalmunai.

7. In recognizing the total lack of natural disaster preparedness in the highly dense municipal area, a comprehensive disaster mitigation and management plan needs to be developed and implemented.

## 16.4 Potential Community Support Sub-Projects in Kalmunai Township Redevelopment Project

Thus, the conceptual plan for KTR, guided by the above-mentioned governing principles and directed by "on-the-ground" conditions, and prepared in consultation with community-based stakeholders at several meetings, have the following features:

Maintaining the National Highway AA004 as the axis, all new development would be planned to the west and reconstruction and rehabilitation would be pursued to the east while maintaining the 65 meter buffer zone as stipulated by the Government of Sri Lanka. Housing for those to be displaced from the buffer zone area as well for increase in population over the planning period to 2030 would be located in high density development along the AA004 and in the **new residential areas on the west.**

On the west, less productive agricultural land and marshy areas close to the National Highway AA004 would be **reclaimed for future urban development**. All public institutions in the east of AA004 destroyed by the tsunami would be reconstructed on the west. Land uses on the west would be planned according to **zoned precincts for various urban functions – institutional, residential, commercial and recreational**. The urban development would also include a **multi-function centre – "Michinoeki"-** at an appropriate transportation node to provide rest and recreation facilities to long-distance public transport users as well as a facility for producers of indigenous goods to popularize and market local goods. These land use precincts would not only fill the currently felt urgent needs of the community but would also be planned in such a manner to accommodate future growth.

On the east, the buffer zone would be developed into a series of **beach parks** and a **Tsunami Memorial** would be sited there. Suitable **safe landing facilities and anchorages** would be constructed for the fishing community, which would be complemented with **appropriate fish handling facilities including ice plants.** The inland waterways (locally referred to as "thonas") would be rehabilitated and beautified to serve as **potential areas for local recreation**. A feasibility study would also be carried out to examine if the "thonas" at the sea-end (currently dreid up) could be developed into **fisheries marinas with canals dredged to the sea** allowing fishing boats to be brought into the "thonas" for anchoring.

## 16.5 Prioritizing Community Support in Proposed Rehabilitation Project

As was described in Chapter 5, the current state of underdevelopment in the Project area is, partly due to persistent and chronic levels of poverty and the serious inadequacy with respect to basic infrastructure, and partly due to the destruction caused by the tsunami, which further aggravated the underdeveloped situation. Whilst the emergency aid that trickled into the eastern region following the tsunami appears to be making some impact on the condition of basic infrastructure, support towards improvements to the community's overall quality of life has been rather sporadic and uncoordinated. Note that any anticipated spin-off from major infrastructure investments in the Project area is likely to get siphoned out of the area through goods and services being procured externally.

Hence, in order to ensure that the proposed Rehabilitation Project (100kms of AA004/AA015 rehabilitation) also provides an avenue to direct significant positive impacts on the community life, it is desirable that community support is well programmed at desirable levels. This may be achieved indirectly by ensuring that, at least, some of the economic benefits accruing from Rehabilitation Project investments would be absorbed into the local economy through the employment of local labor and procuring locally available goods, such as construction materials and services, such as transport and the supply of heavy machinery. In addition, certain direct support to the community could be programmed along the lines of the Kalmunai Township Redevelopment (KTR) project described above. However, it is most likely that community support projects would compete for scarce resources and, unless a system of prioritizing is in place, there would be a tendency for resources to be wasted. In such a situation it would be highly desirable to rank order projects and programs on the basis of their focus on a community's survival, functioning or progress.

### 16.5.1 Support for Survival

In any development context, it is paramount to ensure that all members of the target community, whether individually or collectively, have the right environment to survive economic, social, environmental and political upheavals. This means that projects and programs directed at a community must endeavor to eradicate or influence the eradication of conditions that sustain poverty. In the proposed 100 km road Rehabilitation Project, direct and indirect income earning opportunities discussed above are expected to address this issue to a very great extent. However, unless appropriate instructions are given to contractors and sub-contractors with regards to hiring those members of the local community from the vulnerable group in the construction works and to give preference, where appropriate and possible, to procuring goods and services produced and/or provided by this particular group within the community, the expected outcome may not be achieved.

The KTR project mentioned above, if implemented, would contribute towards survival support for the community. With a large number of households displaced by the tsunami and a further number likely to relocate as a result of the strict implementation of the buffer zone, housing to be provided under that project would greatly support the community's chronic housing needs. There were also some public institutions, such as hospital, schools and government offices, completely demolished by the tsunami. These would have to be rebuilt in appropriate locations to bring the lives of the community back to normalcy.

Further, being conceived as a disaster-resistant plan, the KTR would address all urgent environmental issues and provide protection against potential environmental disasters. Although the annual monsoonal floods have not been a serious concern with regards to fatalities, they have had serious impacts on livelihoods, particularly of the lower income groups. When the township gets developed with due consideration for mitigating annual floods, there would be greater certainty in the income patterns of the vulnerable groups

### 16.5.2 Support for Functioning

Supporting a community to merely survive is not adequate. The community should be able to function without unnecessary constraints. In this respect, health, educational, recreational and other religious and social functions should be accessible to all members of the community and be performing at optimal levels.

The proposed Rehabilitation Project, by improving the accessibility to and from all human settlements along the route AA004, no doubt would be enhancing the community's ability to function better than in the past. In addition, the proposed KTR project would have the opportunity to reorganize land uses bringing about some orderliness to an urban agglomeration that had grown unplanned and spontaneously.

The multi-function centre (*Michinoeki*) proposed in the KTR project would provide a badly needed improvement to existing public transport nodes, which appear to have spontaneously sprung up in the centre of the township and, thus, cause severe inconvenience to not only the public transport users but also to all others having to come into the centre of the township for various activities. The proposed *Michinoeki*, strategically located, would provide adequate rest and restaurant facilities to the travelers using public transport, especially to those on long distance journeys. The *Michinoeki* would also have facilities for local producers of indigenous goods and services to exhibit and market their products and services to those passing through the township. This popular Japanese concept to serve long distance travelers rest and recreation facilities, *Michinoeki* – translated as Road Stations, has recently been endorsed by the World Bank as a useful tool for regional development in developing countries.

For those who had traditionally depended on fishing and associated activities for a livelihood, the tsunami had dealt the severest blow. Not only were their boats and other fishing gear completely destroyed, so were the boat landing and anchoring facilities. Most families have returned to their normal fishing activities since having received generous assistance towards replacing the lost boats and gear. However, there are no proper landing and anchoring facilities which make fishing in these areas unsafe and inconvenient. In this context, the KTR project proposes to develop adequate and appropriate facilities for not only landing and anchoring of boats, but also for fish handling and cold storage.

### 16.5.3 Support for Progress

A community having survived and functioning optimally would look forward to making progress. In this respect the KTR proposal features several long term plans. These include, but not limited to, regularizing the internal road network, supply of reticulated water supply and sewerage where necessary and providing/upgrading other basic infrastructure.

The KTR proposal also contains features to beautify the township and introduce recreational areas. In the 65 meter buffer zone beach parks for local residents would be created, which would also include a tsunami memorial monument in memory of all the lives lost in the tsunami. The inland waterways ("thonas") between AA004 and the coast, which serve to release flood waters into the sea during the monsoon season but remain dormant and unsightly with solid wastes dumped and decaying, would be rehabilitated to serve as local recreational facilities. These "thonas" are also to be developed as fisheries marinas for which feasibility studies are to be carried out.

# *CHAPTER 17*

## *Plan for Maintenance of Rehabilitated Road Facilities*

# Chapter 17 Plan for Maintenance of Rehabilitated Road Facilities

## 17.1 Present Status

The total length of Class A and B road in Eastern Province totals about 1143.06 km, with 619.23 km of this being Class A and 523.83 km being Class B. The former serves as an inter-provincial trunk road network that connects major cities & ports, while the latter serves as an intra-provincial arterial road network linking major urban areas. The organization in charge of maintaining these roads in Eastern Province is the RDA Eastern Provincial Office (RDA-EPO). The line of command for the RDA's Dept. of Maintenance Management & Construction (MM&C), which is responsible for the entirety of the Class A and B road network in Sri Lanka, and the RDA-EPO is as shown in Figure 17.1.1.

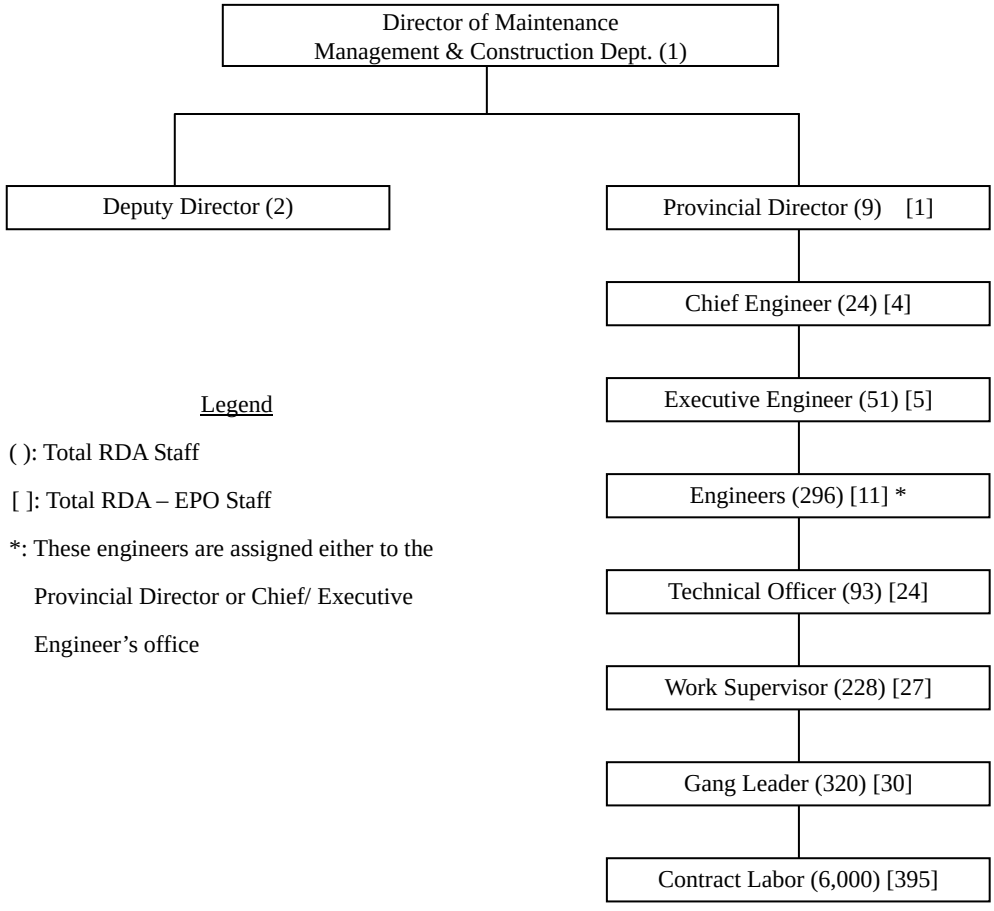



**Figure 17.1.1. Line of Command for RDA Department of Maintenance Management & Construction and RDA-EPO**

As the above figure indicates, the director of the Dept. of MM&C is the person ultimately in charge, with two deputy directors assisting him at RDA headquarters, as well as nine provincial directors (PD), including the provincial director of the Eastern Province, that

support him in administering the maintenance of the Class A and B roads in each of Sri Lanka's provinces. Under the PDs, there are 24 chief engineers (CE) in charge of maintenance in the districts of the provinces. The actual execution and supervision of maintenance in the field then takes place from the offices of the 51 executive engineers (EE), with each CE having on average two to three EEs working for him. Note that technical officers are stationed at the offices of both the EEs and CEs, while Work Supervisors and Gang Leaders stationed at the offices of the EEs. As for manual labor, it consists on average of about 6000 workers for the whole of RDA, with approximately 6.6% of this labor force used in Eastern Province. Note that these workers are registered with the EEs and procured on a daily basis and reimbursed for actual days worked. Details on the staffing of the two District Offices of Batticaloa and Akkaraipattu of the RDA-EPO, which are responsible for the maintenance of the Project road, is as shown in Figure 17.1.2.

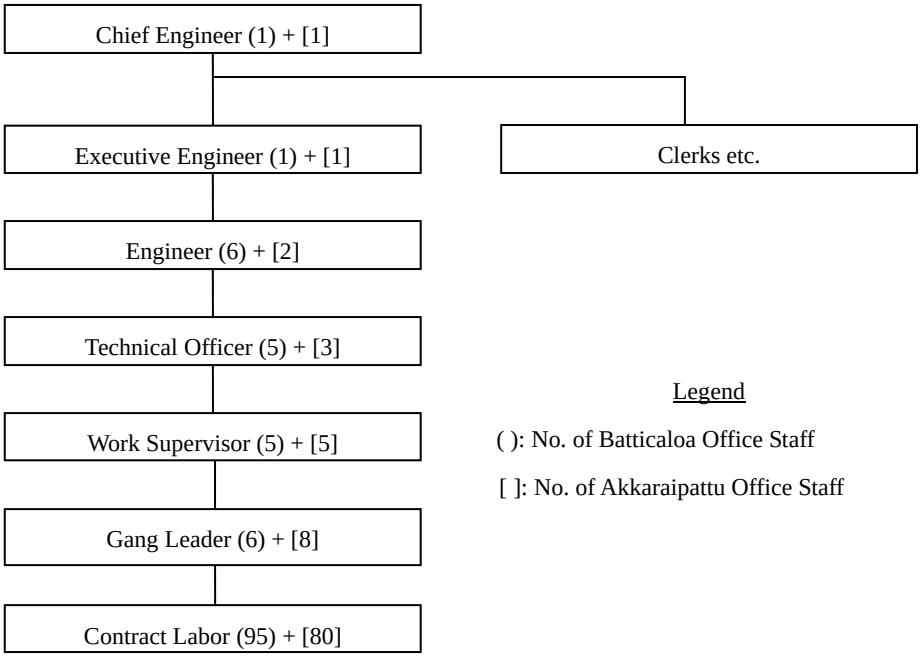



**Figure 17.1.2. Organizational Chart for Batticaloa & Akkaraipattu District Offices**

Each district office has three depots (see Figure 17.1.3), which store materials and equipment for maintenance work. On the other hand, most of the equipment needs to be repaired, which in the past was carried out by the Pallekele Workshop in Kandy District. However, this workshop was closed down two years ago with the liquidation of RCDC, meaning that the only way to get non-functioning equipment repaired is either to bring it to Colombo or to have a technician and the necessary spare parts sent out from there. Unfortunately, this is not happening and non-functioning equipment has been left in a permanent state of disrepair.

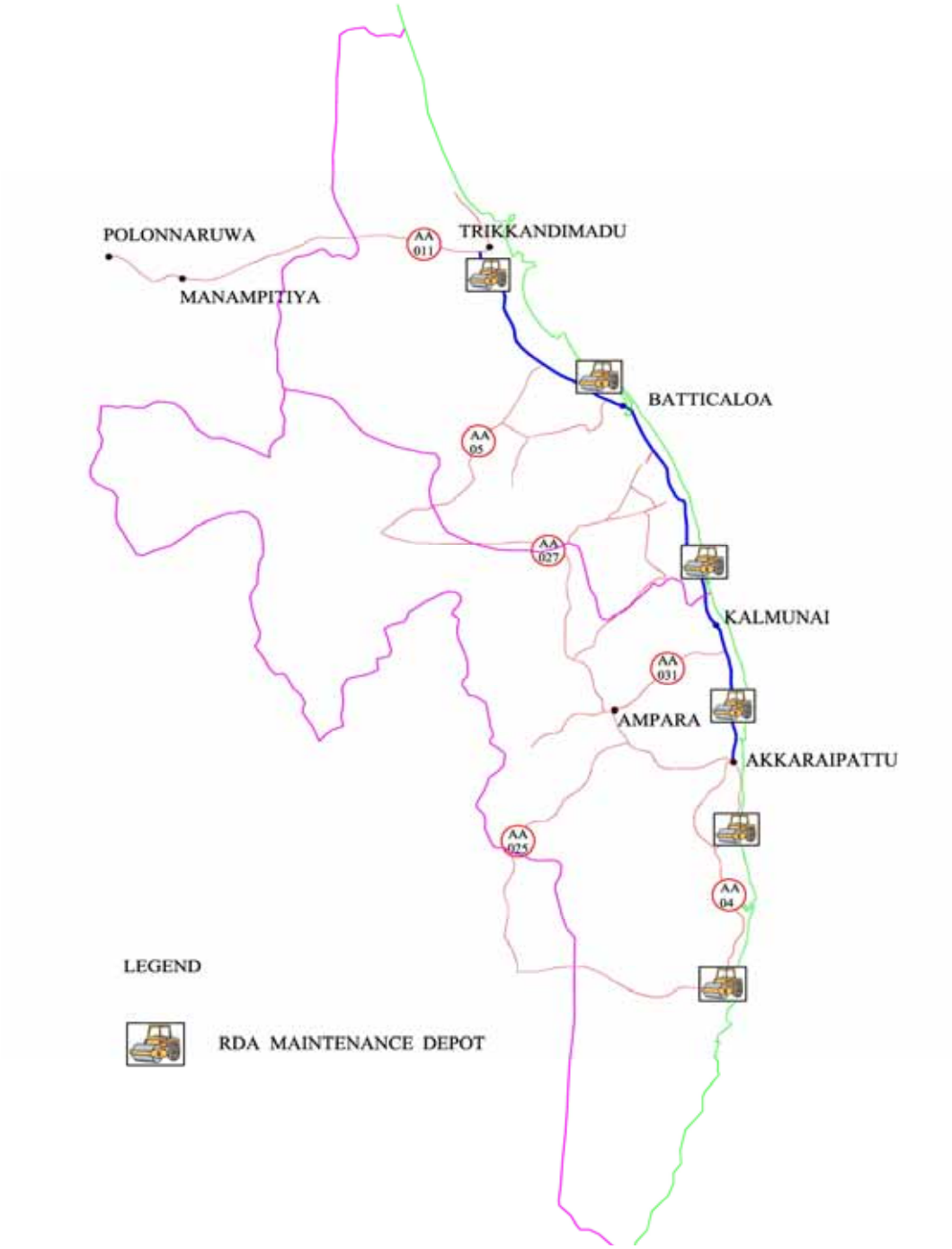



**Figure 17.1.3. Location of Depots for the Batticaloa & Akkaraipattu Offices**

The average annual budget request of the RDA-EPO and the percentage of that actually allocated is as shown in Table 17.1.2. As the table indicates, the RDA-EPO only receives about 55% to 60% of what it requests, meaning that it is unable to carry out all the maintenance work required. Of the maintenance work that is executed, about 66% is routine and 34% periodic. Note that all routine and periodic maintenance works are carried out by RDA-EPO as force account using leased equipment.

**Table 17.1.2. RDA-EPO Average Annual Budget & Actual Expenditure**

| Item | | Ave. Annual Data (2000-2004) |
|---|---|---|
| Budget Request & Allocation | Ave. Annual Budget Request | Rs. 22,711,000.00 |
| | Ave. Percentage of Budget Request Actually Allocated | 55% - 60% |
| Ave. Annual Share of Expenditure | Routine Maintenance | 66.30% |
| | Periodical Maintenance | 33.70% |

## 17.2 Maintenance Plan

### 1) General

The purpose of maintenance is to ensure the preservation of the road facilities as well as the safety of those who use it. The facilities and maintenance work that should be considered, but not be limited to, are classified in Table 17.2.1.

**Table 17.2.1. Basic Types of Facility Maintenance & Objectives**

| Type of Facility Maintenance | Facilities Concerned | Objective |
|---|---|---|
| Pavement Maintenance | ・ Surface and underlying layers of carriageway. | ・To provide a safe roadway surface, preserve the capital investments of the government, maintain a satisfactory riding quality to road users. |
| Shoulder Maintenance | ・ Portion of road adjacent to carriageway used for the accommodation of stopped vehicles, emergency use, and lateral support of base and surface courses | ・To ensure a smooth transition between the carriageway and shoulder for safety reasons. |
| Roadside Maintenance | ・ Areas between the outside edges of shoulders and right-of-way boundaries. | ・Removal of trash to provide a safe and attractive right-of-way.<br>・Vegetation management carried out in an environmentally sensitive manner to ensure a safe and attractive right-of-way. |
| | ・ Drainage facilities (e.g., ditches, gutters, side drains, outlets, irrigation ditches) | ・To ensure normal runoff is collected and removed form roadway and/or right-of-way. |
| | ・ Guardrails & fencing | ・To replace or repair when unable to function as intended to ensure driver safety. |
| Bridge Maintenance | ・ Any structure erected over a depression or obstruction, such as water, a highway, or railway, usually 6m or more in length. | ・To provide safe reliable passage over a depression or obstruction by preserving bridges as close as possible to their original condition. |
| Traffic Operation Maintenance | ・ Highway signs (e.g., regulatory, warning signs) | ・To ensure that any missing or damaged (warning/regulatory) signs are replaced or repaired as soon as practical in order to ensure driver safety. |

The timing and the work of the types of maintenance that would be carried out for the facilities described above are shown in Table 17.2.2

**Table 17.2.2. Types of Maintenance**

| Type of Maintenance | Description | Timeframe |
|---|---|---|
| Routine Maintenance | Consists of work such as grass cutting, drainage cleaning, road sweeping, culvert maintenance, road sign maintenance, pot-hole repair, patching, edge repair, and crack sealing | Required on a daily basis or at frequent intervals during a one-year period |
| Periodic Maintenance | Resealing, road surface marking | Required at intervals of several years |
| Urgent Maintenance | Consists of work such as the removal of debris and other obstacles, the placing of warning signs, diversion works, etc. | Executed as needed to deal with emergencies and problems requiring immediate attention |

**2) Cost Considerations**

Here, the O&M costs for the rehabilitated Project road are considered using current prices.[1] In Table 17.2.3, the unit costs for routine maintenance are calculated after examining and extrapolating from RDA unit cost data for similar Class A roads. As the table indicates, it is estimated that Rs 9 million will be required annually for maintenance to keep the road in good condition.

**Table 17.2.3. Estimated Annual Routine Maintenance Cost for Project Road**

| Work item | Annual Unit Cost (Rs.) | Unit of Measurement | Quantity | Annual Routine Maintenance Cost (Rs.) |
|---|---|---|---|---|
| ①Spot Patching | 10,500 | Lane-km | 196 | 2,058,000 |
| ②Cleaning & Clearing Works | 5,000 | Km | 98 | 490,000 |
| ③Repair of Guardrail | 180,000 | Km | 0.25 | 45,000 |
| ④Minor Repairs (incl. marking) | 60,000 | Km | 98 | 5,880,000 |
| ⑤Shoulder Maintenance | 5,000 | Km | 98 | 490,000 |
| Total | | | | ≒9,000,000 |

①, ③, ⑤: based on Baseline Road Maintenance expenditures; ②: 3 times actual expenditure; ④: based on actual expenditures

As for operation costs, these were also calculated after a careful examination and extrapolation from actual operational data provided by the RDA-EPO for the existing Project road between Akkaraipattu and Trikkandimadu. As Table 17.2.4 shows, approximately Rs 1.3 million will be required annually to pay for the necessary administrative costs of the Project road.

[1] Note that inflation as calculated with the Colombo Consumer's Price Index has been on average about 9.2% for the period of 1994 to 2005.

**Table 17.2.4. Annual Operational Costs for the Project Road**

| Work item | Annual Operational Cost (Rs.) |
|---|---|
| ①Overhead including office staff salaries & rent | 900,000 |
| ②Maintenance of vehicles including driver salaries | 450,000 |
| Total | 1,350,000 |

①:10% of annual routine maintenance costs
②: 5% of annual routine maintenance costs

Finally, as for periodic maintenance costs, it is assumed that a functional overlay for the Project road would cost approximately Rs. 618 million and is calculated based on unit rates applied for Chapter 14. This overlay would be conducted 10 years after the completion of the Project's rehabilitation work and consists of laying asphalt concrete together with prime and tack coats. A more costly structural overlay, which is also calculated using the above-mentioned rates, is estimated to cost Rs. 1,120 million and would be carried out in 2030 with the purpose of restoring the road and would include repair work to the base course.

## 17.3 Implementation Issues

As described in Chapter 12, the design life of the Project road is to be ten years. This is a relatively short amount of time. After this period, the road will most likely have to receive a functional overlay. Of course, routine maintenance is required throughout in order to keep the road in good condition. However, the RDA, including the RDA-EPO, faces the two following major problems that will affect its ability to do this:

- **Lack of Funding:** Although the Sri Lankan Government agreed in July 2003 to implement a Road Fund that would be able to finance the maintenance of important facilities such as the Project road, there is no sign of this being done.[2] It is highly recommended that the Government put in place this mechanism as quickly as possible. Otherwise, it seems highly unlikely that the necessary monies to maintain the Project road, as well as other roads, will be realized.
- **Lack of Equipment:** As mentioned in 17.2, most of the existing equipment at the depots along the Project road is non-functioning. As a result of this, the RDA-EPO has been forced to lease equipment on an ad-hoc basis to carry out needed maintenance work. It is suggested that a study be carried out immediately to help decide whether an efficient system of leasing or the rehabilitation and purchasing of equipment, including the construction of a workshop, is better.

[2] By a decision of the Economic Policy Committee of the Cabinet of Ministers, the Government decided on 23 July 2003 to implement a road fund.

# *CHAPTER 18*

## *Project Implementation Plan*

# Chapter 18 Project Implementation Plan

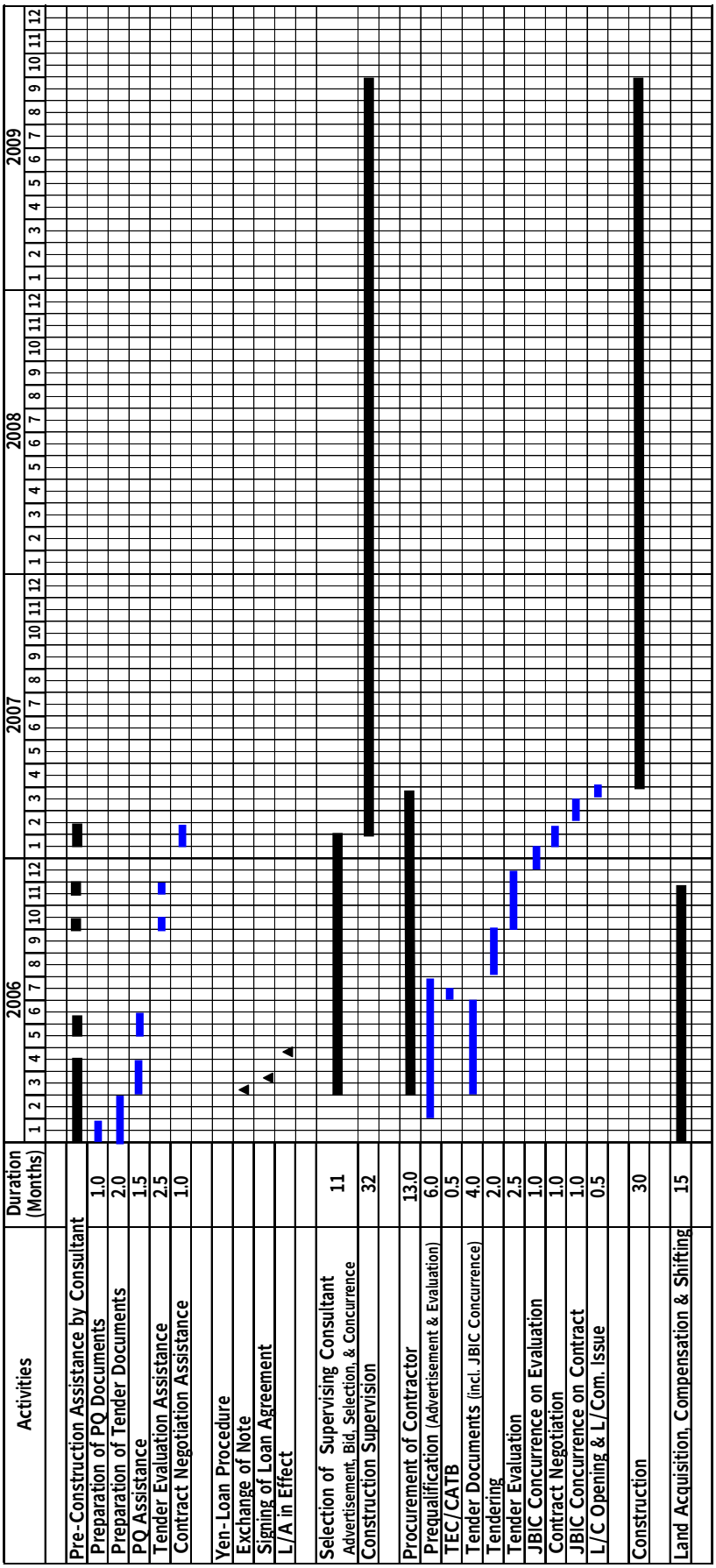
According to the Minutes of Discussion agreed upon between the JBIC Appraisal Mission and the Government of Sri Lanka on 11th November, 2005, the two components of the Rehabilitation Project, —— the rehabilitation of the 100 km long Eastern Trunk Road and the construction of the New Kallady Bridge, —— are to be adopted jointly as a single Japanese Yen-Loan project for the Fiscal Year of 2006. The Exchange of Notes for this Yen-Loan between the two countries is due in March, 2006. The Loan Agreement will be signed and take effect some time after it.

Upon the strong request of the Ministry of Highways of Sri Lanka for the earliest commencement of the civil works, JBIC has agreed and decided that the period for the pre-construction procedure, which usually requires 11 months for selection of the supervising consultant, 2.5 months for prequalification of contractors, 11 months for tender for civil works, and half a month for the Letter of Credit and the Letter of Commitment, consequently 25 months in total, be shortened to a possible maximum extent

Accordingly, by employing a separate consultant initially at the beginning of 2006 both for preparation of the prequalification and tender documents and for tender assistance, JBIC and RDA had decided that somewhat expedited procurement of the contractor be undertaken simultaneously in parallel with the selection of the supervising consultant within 13 months from March 2006 through March 2007. As shown in Figure 18.1, the procurement of the contractor includes prequalification for six months, advertisement and tendering for two months, tender evaluation for 2.5 months, JBIC concurrence on tender evaluation for one month, contract negotiation for one month, JBIC concurrence on contract award for one month, and opening of the Letter of Credit and issue of the Letter of Commitment for half a month.

Thus, the construction will be started in April 2007 and completed 30 months later in September 2009.

**Figure 18.1. Project Implementation Plan**



# *PART 4*
# *CONCLUSIONS & RECOMMENDATIONS*

# *CHAPTER 19*

## *Conclusions & Recommendations*

# Chapter 19 Conclusions & Recommendations

## 19.1 General

The Emergency Recovery Project, concerned with the recovery from the temporary repairs to the permanent structures of four damaged causeways, had been completed in May 2005.while the Rehabilitation Project, which is a feasibility study on rehabilitation of the Eastern Trunk Road and construction of a New Kallady Bridge has been subsequently implemented and reported in November 2005 and February 2006.

## 19.2 Conclusion —— Emergency Recovery Project

### (1) Overview of Emergency Recovery Project

The preliminary design of the selected road facilities for the Emergency Recovery, Komari, Periya Kallar, Koddaia Kallar, and Panichchankeni causeways, had been completed at the end of May 2005. As the construction was required to start and be completed as early as possible, it was decided that the Project would be implemented by the design-build method.

### (2) Preliminary Design, Construction Plan and Cost Estimate

The construction work of the causeways should be planned avoiding the flood season from mid-December to mid-January. Diversion roads have to be constructed for the public traffic. Also, cofferdams for the construction of retaining walls and bridge substructure of the causeways are required. Taking into account the weather, water levels at the Causeways and the urgency of rehabilitation, the possible construction period was set at 15 months. The total construction cost was estimated as JPY 812 million.

### (3) Preparation of Draft Tender Documents

The draft tender documents were prepared based on the principles that the Project be implemented by JICS, applying the Design-Build system, limiting the tenderers to Japanese contractors, requiring the employment of tsunami victims as labor force, local contractors as subcontractors, and local products and services to the maximum extent

possible, with the contract on a lump sum fixed price basis.

### (4) Community Support Program and Social Environmental Consideration

The Study Team devised a mechanism to employ as many local residents as possible who were affected by the tsunami and who lost the means of earning as workers for the emergency recovery works to be contained in statement of prioritized employment in the draft tender documents. The contractor expects to employ around 150 persons at any one time during the construction. The selection of this labor force would be expected to follow the policy complying with the JICA requirement. To monitor and evaluate the community support program, a set of indicators has been developed, which includes the Economic Indicators, Social Indicators, Operating and Organizational Indicators, Technical Indicators, and Environmental Indicators.

Environmental study for the Project has not been carried out in detail due to the emergency of the Project. But given the vulnerability of ecosystem of seaside lagoons, the construction activities should be conducted carefully with appropriate mitigation measures for the anticipated negative impacts.

## 19.3 Conclusion —— Rehabilitation Project

### (1) Overview of Rehabilitation Project

As medium- and long-term rehabilitation programs for trunk roads on the East coast, the sections of AA004 from Akkaraipattu to Batticaloa and AA015 from Batticaloa to Trikkandimadu, as well as the Kallady Bridge on AA004 to the south of Batticaloa, were selected, through the negotiation between JICA and RDA.

### (2) Environmental and Social Consideration

The two components of the Rehabilitation Project, namely, the rehabilitation of the Eastern Trunk Road and the construction of the New Kallady Bridge, are exempted from IEE and EIA studies as per the environmental regulations of Sri Lanka. JICA, however, encourages recipient countries to give due consideration to environmental and social aspects as specified in its "*JICA Guidelines*". After a general examination, both components were classified as "Category B". Therefore, initial environmental examinations (IEE) for the Projects were conducted in accordance with the "*JICA Guideline*".

## (3) Traffic Demand Forecast

The traffic surveys were carried out for getting the information about the existing traffic in the Project area. The existing daily traffic volumes for the Project road have been found out that the area near Kalmunai has the largest daily traffic flow with a total of 8080 vehicles per day (vpd). The average vpd for the Project road is about 4120, with about 16% of this traffic being heavy vehicles.

A simplified traffic demand model for the Project road was used to obtain the final output consisting of daily traffic by road link, daily vehicle-hours for work/non-work trips, and daily vehicle-kilometers for the entire Project area. Overall traffic growth for vehicle trips made within the Project area is predicted to grow from a low of 5.9% to a high of 7.6% over the period of 2005 to 2025. The traffic evaluation criteria of daily vehicle-kilometers (Veh-km), vehicle-hours (Veh-hr), and average area speed are used to assess the impact of the rehabilitation of the Project road. In 2025, travel speeds without rehabilitation range from a low of 53 km/h to a high of about 56 km/h, while with rehabilitation speeds would be in the range of 64 km/h to 68 km/h. Also, there is a significant decline in daily travel time (Veh-hr), ranging from about 15% in 2010 to 17%-19% in 2025.

## (4) Preliminary Design of Eastern Trunk Road

The Project road shall basically be kept along the existing alignment due to the nature of the rehabilitation work. However, as there are some inundated areas during the rainy season, these sections shall be raised higher than the inundation levels. The minimum ROW is basically 11.0 m wide with the pavement width of 10.0 m. However, a wider existing ROW shall be maintained with a wider pavement width in the town areas, while, where the existing ROW is narrower, the absolute minimum ROW of 9.0 m with the pavement width of 8.0 m shall be secured.

The design life for the Project road was decided in consultation with RDA to be 10 years. Through a cost comparison, it was concluded that for a thickness of less than 130 mm an overlay is more economical than reconstruction. As for the overlay type for the Project road, which requires an average required overlay thickness of 80 mm, an asphalt overlay (a thickness of 5 cm) + the aggregate base course (ABC) was appropriately cost-effective and recommended.

## (5) Preliminary Design of New Kallady Bridge

The basic design policy for the New Kallady Bridge is summarized such that the total width is 14m, consisting of a 7.4 m wide dual carriageway and, at both sides, a sidewalk (1.8 m) + a cycle lane (1.5 m), and the total length is 289.5 m, as same as the existing bridge, while the girder soffit shall be higher than that of the existing bridge for keeping present navigational clearance. Also, horizontal navigational clearance shall secure the present span length of the existing bridge.

### (6) Preliminary Construction Plan and Cost Estimate

To arrive at the total Project cost, unit rate components were prepared applying the Sri Lanka Highway Schedule of Rates (HSR) and the Japanese Cost Estimate Standard. The construction cost and the total project cost were estimated as the outputs from this feasibility study, but their figures are kept confidential by RDA at this stage of the Project.

### (7) Project Evaluation

The results of the LC analysis, which applies a discount rate of 12%, is that the net present value (NPV) for the reconstruction alternative is approximately Rs.2,361 million, while the NPV for the overlay/ABC alternative is about Rs.2,137 million (or 9.5% lower). Based on this, it is recommended that the latter be implemented to improve the Project road.

BC analysis is then carried out for the three evaluation periods of 10, 15, and 20 years. In the case of the 10-year period, the EIRR is only 7.76%, meaning that the Project road is not economically viable. On the other hand, the EIRR for the 15- and 20-year periods is 9.40% and 10.10%. In terms of economic justification an EIRR of at least 10% should be obtained, meaning that the Project satisfies the bare minimum if a longer evaluation period is applied.

### (8) Community Support Program

In the Rehabilitation Project, the intended community support mainly takes a form of provision of major elements of overall area-wide community support to be derived from the Kalmunai Township Redevelopment (KTR) project. Basic consideration for KTR concept plan consists of urgent regularization and upgrading of basic infrastructure, services and facilities; development and implementation of a comprehensive disaster mitigation and management plan, and so on. The conceptual plan for KTR maintains the AA004 as the axis and has main features proposed on either side of the highway, such as

the tsunami related resettlement housing on the west, a multi-function centre – "Michinoeki"- at an appropriate transportation node, and so on.

### (9) Project Implementation Plan

The rehabilitation of the 100 km long Eastern Trunk Road and the construction of the New Kallady Bridge are to be adopted jointly as a single Japanese Yen-Loan project for the Fiscal Year of 2006. Upon the request of GOSL, JBIC has agreed and decided that the period for the pre-construction procedure be shortened to a possible maximum extent Consequently, construction will be started in April 2007 and completed 30 months later in September 2009.

## 19.4 Recommendations

As the Emergency Recovery Project is ongoing, recommendations are given below only for the Rehabilitation Project.

It is planned for the rehabilitation of the 100-km Eastern Truck Road, which includes the construction of the New Kallady Bridge, to be completed by September 2009 via a loan to be provided by JBIC. Note that other donors are funding the improvement of sections of road north and south of the Project road as well. As a result, the road facilities along Sri Lanka's East Coast will see a vast improvement within the next several years that should produce large economic benefits.

### 1) Scheduling

The Project is expected to begin in April 2004 and to require 30 months for completion. Construction time is shorter than usual as civil works is to be carried out essentially on a design-build basis. However, note that the detailed design should be based on the conceptual designs contained in this report. On the other hand, when the design for a particular piece of infrastructure is not clearly indicated, the Contractor should quickly carry out his detailed design based on sound engineering principles. It is important that design concepts described in the preliminary design stage be strictly adhered to while allowing for enough flexibility in other matters so that the merits of design and build are realized. Finally, it is vital that the design process be carried out speedily and effectively; otherwise, there could be adverse impacts on the construction schedule.

### 2) Cost Management

This Project, in estimating the cost required for implementation, carefully carried out a comparative analysis in order to determine the most cost-effective pavement structure. Therefore, it is important that due attention be paid to the design and materials of the Project in order to ensure costs are approximately in line with the preliminary design estimates.

### 3) Community Support

As part of the overall support system for tsunami affected people, the Contractor for the Project is to exert his effort to provide income-earning opportunities for both skilled and unskilled workers.

### 4) Maintenance

The design life of the Project road is ten years. In order to keep it in good condition, it is important that routine maintenance, in addition to the respective execution of structural and functional overlays 10 and 20 years after Project completion, be diligently carried out. For this reason, it is important to have the necessary budget, implementation mechanism, and materials, and it is therefore recommended that the Road Fund for Sri Lanka be realized and made operational as quickly as possible.