No.

ROAD DEVELOPMENT AUTHORITY
MINISTRY OF HIGHWAY & ROAD DEVELOPMENT
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR
RECONSTRUCTION OF FIVE BRIDGES
IN
EASTERN PROVINCE

NOVEMBER 2009

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.

JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.

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PREFACE

Japan International Cooperation Agency (JICA) conducted the preparatory survey on the Project for Reconstruction of Five Bridges in Eastern Province in the Democratic Socialist Republic of Sri Lanka.

JICA sent to Sri Lanka a survey team from February 26 to April 12, 2009.

The team held discussions with the officials concerned of the Government of Sri Lanka, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Sri Lanka in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Democratic Socialist Republic of Sri Lanka for their close cooperation extended to the teams.

November 2009

Toshiyuki Kuroyanagi
Director General
Economic Infrastructure Department
Japan International Cooperation Agency

November 2009

Letter of Transmittal

We are pleased to submit to you the preparatory survey report on the Project for Reconstruction of Five Bridges in Eastern Province in the Democratic Socialist Republic of Sri Lanka.

This survey was conducted by the Consortium of Oriental Consultants Company Limited and Japan Bridge & Structure Institute Incorporation, under a contract to JICA, during the period from February 2009 to November 2009. In conducting the survey, we have examined the feasibility and rationale of the project with due consideration to the present situation of Sri Lanka and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the Project.

Very truly yours,

Hideki Yoneyama
Project Manager,
Preparatory survey team on the Project for Reconstruction of Five Bridges in Eastern Province
The Consortium of Oriental Consultants Company Limited and Japan Bridge & Structure Institute Incorporation

Summary

1. GENERAL

Eastern Province of the Democratic Republic of Sri Lanka has been severely damaged by two tragic incidents, namely the civil war that lasted over 20 years between the Sri Lankan government and the Liberation Tigers of Tamil Eelam (LTTE), and the Indian Ocean Tsunami that occurred in December 2004. Most of the traffic infrastructure (e.g. roads and bridges) in this area was constructed more than 60 years ago in the English colonial period. Many bridges were severely damaged and all maintenance works for traffic infrastructure in the area was inadequate during the civil war. Rebuilding of the infrastructure to improve traffic access is crucial to the realization of development and permanent peace in this area.

2. BACKGROUND OF THE REQUEST

According to the government economic policy; "Mahinda Chintana: Vision for New Sri Lanka, 2006 - 2016", the economic target is to narrow the income gap between peoples and economic gap between districts. Especially in Eastern province, one of the areas most damaged by the Indian Ocean Tsunami in 2004, and also the area most affected by the 20-year conflict, the main target is developing rural areas and poverty reduction by improving rural basic infrastructure including access road.

Japanese government implemented "The Study on Recovery, Rehabilitation and Development Project for Tsunami Affected Trunk Roads on the East Coast" including urgent reconstruction of four causeways on National trunk roads A004 and A015 from 2005 to 2006. Three out of the four causeways were reconstructed; however, reconstruction of Panichchankerni causeway had to be given up due to an escalation in the civil war.

The National Road Master Plan (NRMP) was established in December 2007, and it contains a development plan for the road sector in Sri Lanka. In this master plan, it is recognized that increasing the number of lanes on national roads is one of the highest priorities. National road No.5 (A005) and No.15 (A015) are now planned to be improved as 2-lane roads.

Based on these fundamental plans mentioned above, the Sri Lankan Government requested Japanese Grant Aid for "the Project for the Reconstruction of Five Bridges in Eastern Province" (herein after referred to as "the Project"). The overall goal of the Project is to stabilize and enhance socio-economic activities and to expedite progress and peace in the region by improving traffic access to Eastern Province. The target of the Project is to improve access to the Eastern Province by rehabilitating medium sized to small bridges on national roads A005 and A015.

The five requested bridges of the Project, including Panichchankerni causeway (Bridge No.5), are shown in the following table.

Original Request (2007)	Revised Requested Bridge after JICA Preparatory Study (September, 2008)	
240/4 on A005	Bridge No.1	240/4 on A005
241/2 on A005	Bridge No.2	241/2 on A005
		241/3 on A005*
241/4 on A005		241/4 on A005
	Bridge No.3	247/2 on A005*
283/7 on A005	Bridge No.4	283/7 on A005
59/1 on A015	Bridge No.5	59/1 on A015

*) Additionally requested bridges on September 2008

3. CONTENTS OF THE PROJECT

Responding to the request by the Sri Lankan government on August 2007, the Japanese government decided to make a preliminary survey and to dispatch a study team on September 2008. The original request included the five bridges in Eastern Province as shown in the above table. However, bridges 241/3 and 247/2 were added at the time of the preliminary survey, whereas bridges 241/2, 241/3 and 241/4 were combined as the new bridge No.2 because these three bridges are adjacent to each other within the same river floodplain.

Based on the results of the preliminary survey, the Japanese government decided to conduct a preparatory survey and entrusted the survey to JICA, which sent a Preparatory Survey Team to Sri Lanka from February 27 to April 11, 2009. The survey team prepared a basic design of the Project considering the road designs for adjacent sections of national roads A005 and A015 provided by other funds. A summary of the design for the Project is shown in the next table.

Facility	Contents
1.Bridge	
(1) Bridge length/ Span arrangement	(Bridge No.1) 13.0m+13.0m=26.0m (Bridge No.2) Bridge: 17.0m@5span=85.0m, Box culvert: 7.0m (Bridge No.3) 16.0m (Bridge No.4) 18.0m+18.0m=36.0m (Bridge No.5) 19.0m@5span=133.0m Causeway: Left bank 82 m Right bank 85 m
(2) Bridge width	All bridge: 1.5m(sidewalk)+3.7m@2(carriage way)+1.5m(sidewalk)=10.4m (Separate sidewalk: Mount up type)

Facility	Contents
(3) longitudinal and transverse gradient	longitudinal gradient (Bridge No.1) 2.0%, -2.0% (Bridge No.2) 2.0%, -4.0% (Bridge No.3) 0.75%, -1.50% (Bridge No.4) 1.5%, -0.5% (Bridge No.5) 1.294%, 0%, -1.285% transverse gradient All bridge: 2.0%
(4) Design high water level	(Bridge No.1) 43.9m, (Bridge No.2) 42.6m, (Bridge No.3) 39.6m, (Bridge No.4) 2.2m (Bridge No.5) 1.9m
(5) Design Load	
・Live load	HA load and HB load are applied subject to BS5400
・Seismic Load	No need to be applied
・Other Load	Wind load, Earth Pressure, Water Pressure, Buoyancy
(6) Superstructure	
・Structural type	All bridge: Pre-tension PC simple beam
・Erection Method	Crane method
(7) Substructure	(Bridge No.1) Abutment: Inverse L type, Pier: T type (Bridge No.2) Abutment: Inverse L type, Pier: T type (Bridge No.3) Abutment: Inverse L type (Bridge No.4) Abutment: Inverse L type, Pier: T type (Bridge No.5) Abutment: Inverse L type, Pier: Pile bent method
(8) Foundation (Supporting layer)	(Bridge No.1) Direct foundation (Weathered rock) (Bridge No.2) Bridge section : Direct Foundation (Weathered rock), Box culvert: Direct foundation (Sandy soil) (Bridge No.3) Direct foundation (Sandy soil) (Bridge No.4) Pile foundation (Weathered rock) (Bridge No.5) Pile bent method (Weathered rock)
(9) Auxiliary facilities	Newel Post, Drainage system
(10) Others	Water supply pipe, electric line, telephone line shall be considered for future load are to be applied as auxiliary facilities of loads
2.Approach road	
(1) length	(Bridge No.1) Left bank: 60 m Right bank: 54 m (Bridge No.2) Left bank: 115 m Right bank: 120 m (Bridge No.3) Left bank: 89 m Right bank: 75 m (Bridge No.4) Left bank: 124 m Right bank: 60 m (Bridge No.5) Left bank: 90 m Right bank: 100 m
(2) Basic condition	Road class：Class A (R3), Topography：Plain, Design Speed：70km/h
(3) Road cross section	A005 1.25m (Shoulder)＋+3.0m@2(Carriage way)+1.25m (Shoulder)=8.5m A015 1.0m(Shoulder)+3.1m@2(Carriage way)+1.0m(Shoulder)=8.2m
(4) Geometric Alignment	Geometric Alignment for design speed of 70km/h Minimum curve radius：R=185m, Maximum Gradient：4.0%
(5) Pavement structure	Carriage way：Wearing layer：DBST, Sub-grade 20cm, Base course 15cm, Shoulder：Crushed stone 15cm （Temporary pavement because road improvement of these sections is expected in near future）
(6) Drainage Facilities	None

4. PROJECT COST ESTIMATE AND SCHEDULE

The Project will be implemented in accordance with Japan's Grant Aid scheme and the Project cost will be determined before concluding the Exchange of Note for the Project. The cost borne by Sri Lankan side will be 237.2 million Rs including followings.

① Preparation of land for construction site (State land will be arranged) :
② Preparation of land for camp & yard (State land will be arranged)
③ Transportation of bailey bridge for No.5
④ Removal & relocation of public utilities
(i) Telecom line (buried) D=150mm
(ii) Electric pole (30kV)
⑤ Removal of existing two bridges
(i) Bridge No.3
(ii) Bridge No.4
⑥ Import tax refund
⑦ VAT refund

Detail design and tendering will require 10 months and construction of the five bridges will take 21 months.

5. BENEFIT OF THE PROJECT

The implementation of the project will effectively contribute to the National Road Master Plan (NRMP) in Sri Lanka, which aspires to improvement of the trunk road network with widening of traffic lanes (NRMP also aspires to 2-lane widening of A005 and A015). Furthermore, the project is conducive to the road infrastructure essential to the life sustenance of the Tamil and Muslim minority ethnic groups in Eastern Province, which is less developed than other provinces. The direct beneficiaries are the inhabitants of Ampara & Batticaloa District, numbering 1,138,000 people. Recipients of indirect benefits are all inhabitants of Eastern Province, including Trincomalee District, and the number of recipients is expected to be 1,493,000.

The following benefits are expected from the implementation of the project:

<u>Direct Benefits</u>

- The traffic volume will increase with widening of carriageways of bridges by this project and roads by other funds. Regarding bridges No.3 and No.5, the allowable types of vehicle will also increase because the existing bailey bridges forbid heavy vehicles with more than three axles.
- Durability of bridges will be improved by replacing the existing damaged bridges. Consequently, the risk of traffic shutdown by bridge collapse will be avoided and periodical maintenance cost for bridges will be reduced.

- Traffic safety on the bridges will be secured with wider carriage ways and pedestrian lanes mounted on each side of the new bridges.

Indirect Benefits

- The economic gap between Colombo (or Central Province) and Eastern Province (between Sinhalese and Tamils) will be reduced by activation of the economy in the Eastern Province.
- Unsettled situation of Eastern Province will be improved by tightening economic relations between the eastern and western areas through road improvement.

6. RECOMMENDATIONS

In order to realize the effect of the Project promptly and sustainably, the Sri Lankan side shall contend with the following matters.

(1) The Sri Lankan side shall detect, locate and clear all unexploded ordnances (UXO) and land mines from the temporary yards, as well as from the bridge sites. The Sri Lankan side shall also acquire official certificates of completion of UXO clearance for all sites, and shall submit them to JICA before construction tendering for the Project.

(2) The Sri Lankan side shall complete necessary reconstruction or reinforcement works for the bottleneck bridges and roads located on the way to each bridge site, including Kayankerni Bridge on national road No.15 (A015) by the end of April, 2010.

(3) The Sri Lankan side shall pay attention to the maintenance of bridges as well as to the maintenance of the approach road pavement (DBST). Concrete bridges are not “maintenance free” and require daily inspection of pipe drainage, expansion joints and bearings. Timely inspection and repair of revetment and scouring are also important especially during the rainy season. No additional organization will be required for these maintenance works since RDA, who is responsible and capable for all national roads maintenance works, will maintain these new bridges accordingly.

Democratic Socialist Republic of Sri Lanka
The Project for Reconstruction of Bridges in Eastern Province

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Perspective: Bridge No.5 and Panichchankerni Causeway

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ABBREVIATIONS

Agency/Organization

ADB	Asian Development Bank
ESD	Environment and Social Division
GOJ	The Government of Japan
GOS	The Government of the Democratic Socialist Republic of Sri Lanka
JICA	Japan International Cooperation Agency
LTTE	Liberation Tigers of Tamil Eelam
MOH	Ministry of Highways & Road Development
PMU	Project Management Unit
RDA	Road Development Authority
UNDP	United Nations Development Program

Others

A/P	Authorization to Pay
BS	British Standard
BOD	Biochemical Oxygen Demand
CAARP	Conflict Affected Area Rehabilitation Program
CBR	California Bearing Ratio
COD	Chemical Oxygen Demand
DBST	Double Bituminous Surface Treatment
D/D	Detailed Design
DO	Dissolved Oxygen
DS	Divisional Secretariat
EIA	Environmental Impact Assessment
EMP	Environmental Management Program
ES	Environmental Specialist
F/S	Feasibility Study
GDP	Gross Domestic Product
IEE	Initial Environmental Examination
NEA	National Environmental Act
NRMP	National Road Master Olan
ODA	Official Development Assistance
PC	Prestressed Concrete
PCU	Passenger Car Unit
Rs.	Rupee
SS	Suspended Solid
TAARP	Tsunami Affected Area Re-building Program
TOR	Terms Of Reference
US$	American dollar
UXO	Unexploded Ordnance

CHAPTER 1 BACKGROUND OF THE PROJECT

1-1 Background of the Request for Japan's Grant Aid

Eastern Province of the Democratic Republic of Sri Lanka has been severely damaged by two tragic incidents, namely the civil war that lasted over 20 years between the Sri Lankan government and the Liberation Tigers of Tamil Eelam (LTTE), and the Indian Ocean Tsunami that occurred in December 2004. Subsequently Japanese government implemented "The Study on Recovery, Rehabilitation and Development Project for Tsunami Affected Trunk Roads on the East Coast" including urgent reconstruction of four causeways on national trunk roads A004 and A015 from 2005 to 2006, to counteract the latter incident. Three causeways excluding Panichchankerni (A015) were reconstructed as result of this project. However, reconstruction of Panichchankerni causeway had to be given up due to an escalation in the civil war. This area was released from occupation by the LTTE after the victory of the government in July 2007. However, traffic infrastructure (e.g. roads and bridges) were severely damaged by the war and tsunami. Many bridges in this area had been constructed more than 60 years ago in the English colonial period. In addition, implementation of maintenance work was inadequate during civil war. As a result, there are many bridges without capacity to allow smooth traffic. Sri Lankan government designated this area as one of the most important regions for national development. Rebuilding of the infrastructure to improve traffic access became crucial to realize development and permanent peace in this area through securing mutual movement of people and/or cargo between Eastern Province and other areas.

The objective five bridges are located on National trunk roads A005 (4 bridges) and A015 (1 bridge including causeway sections) as shown in Table 1-1-1. These bridges have deteriorated because of inadequate maintenance during the civil war and aging. In addition, the bridge on A015 was severely damaged by the tsunami. Furthermore, although the objective bridges are on A-class National trunk roads, the carriageway widths are insufficient for two directions of traffic. The necessity and validity of reconstruction of the objective bridges are stated below, from the perspective of the above and current crucial situations to promote restoration of peace and further progress of tsunami recovery projects in the Study area.

- National trunk road A005 is the shortest route connecting the western and central economic areas of Colombo and Kandy to Eastern Province. However, adequate maintenance work for roads and bridges had not been implemented for more than 20 years due to the occupation of the LTTE during the civil war. Currently, rehabilitation of

this route as the principal trunk road has become one of the most urgent issues since its release from the LTTE in 2007.

- Several donors' assistances (e.g. international organizations, advanced countries) such as "Tsunami-Affected Areas Rebuilding Project: TAARP" and "Conflict-Affected Areas Restoration Project: CAARP" are under operation simultaneously on national trunk road A015 which is part of the north-south axis of transport (i.e. eastern coastal national road). These projects will be completed by the end of the year 2010 over the whole of the eastern coastal national roads including A015.
- Without any improvement works, the objective bridges are going to be bottlenecks blocking the above goals.

Table 1-1-1 List of the Objective Bridges

Route	Bridge No. in this report	Existing Bridge No.
A005	1	240/4
	2	241/2
		241/3
		241/4
	3	247/2
	4	283/7
A015	5	59/1

1-2 Natural Conditions Surrounding the Study Area

The average monthly rainfall during the rainy season (November – February) is 400mm due to the influence of the north-east monsoon from the Bay of Bengal. Annual rainfall of 1980 mm was recorded in 2008. The rainfall causes flooding of the river in large area including residential area, cultivated land, road surface, and so on. Meteorological data recorded at Batticaloa observatory are shown in Figure 1-2-1, 1-2-2 and Table 1-2-1.

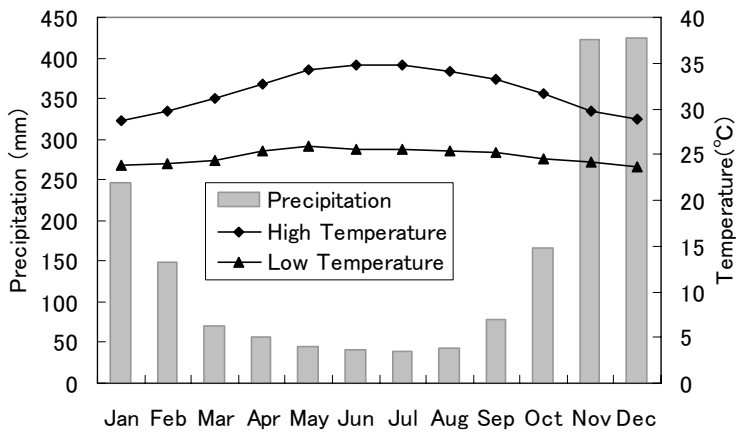

Figure 1-2-1 Monthly Rainfall (Average of 1993 – 2008) & Temperature (2004 – 2008)

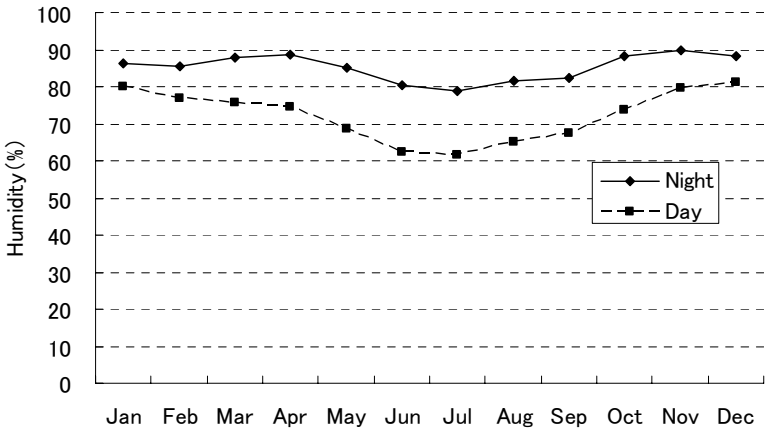

Figure 1-2-2 Monthly Humidity (Average of 2004 – 2008)

Table 1-2-1 Direction & Velocity of Wind (Average of 1998 – 2007)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Direction of Wind (Degree)	12.5	20.3	51.4	94.5	117.1	174.8	162.0	167.9	138.8	110.4	0.2	359.2
Velocity of Wind (km/h)	7.0	6.1	4.8	4.7	4.7	4.7	4.2	4.2	3.8	4.1	4.9	6.8

Note: Direction (angle) is measured from north.

Survey data of river and lagoon for the objective bridges are unavailable due to the long civil war. Therefore, information acquired from site reconnaissance and interview with resident people by the study team, as stated below, is basically used for basic design of the Project.

a) Bridge No.1

The river usually stops flowing during the dry season. However, the rise in water level of the Maha Oya river causes floods around the objective bridge during the rainy season. The water level reaches just under the girders of the existing bridge, though the road surface is not submerged. Further severe scouring and erosion of the substructure has not been observed because that water level rises slowly even in floods.

b) Bridge No.2

Permanent water flow from Kuda Oya river was observed only at KMP241/2 among the existing three bridges (KMP241/2, KMP241/3, KMP241/4). The river flow ceases at the other two bridges except for small puddles around KMP241/3 during the dry season. However, river water flows at KMP241/3 and KMP241/4 due to the rise of the Maha Oya river and Kuda Oya river during the rainy season. Furthermore, the objective bridges and their surrounding area are completely submerged during floods. Around December is the heaviest flood season according to local people. The road embankment section located north-east of KMP241/4 becomes submerged to a depth of approximately 1m and due to the existing vertical alignment of the road. Further, erosion of substructure and damage to handrails and pavement exist on the bridge sections.

c) Bridge No.3

Permanent water flow from the Pulavele Aru river was observed at the existing Bailey bridge. However, high of water level has never reached the superstructure, though the surrounding area is submerged in floods. Currently a fallen truss bridge exists at the bridge site. This bridge fell due to a flood before 1990 according to a letter issued by the local representative. However, the deck of this bridge had been erected, 60cm lower than that of the existing bridge (unconfirmed information).

d) Bridge No.4

The objective bridge is located within a flood affected area of a neighboring lagoon. The river dries up during the dry season. However, the surrounding area of the bridge is submerged due to the rise in water level of the lagoon during the rainy season. The water level rises up to 30cm under the girders of the existing bridge every year, and road surface has never been submerged according to local people.

e) Bridge No.5 (Bridge and Causeway)

The objective bridge is located 3km away from the river mouth of Batticaloa lagoon. This bridge was severely damaged by the Tsunami, particularly by the loss of fill from behind the abutment. Furthermore, the retaining wall of the causeway and the culvert were heavily damaged. The center of flow seems to be toward the east according to the land shape of the lagoon in front of the bridge. Damage to the part of the causeway was worse than to the west part, supporting the above assumption about the flow. The causeway section has been submerged to depths of 1.0 – 1.35m height every rainy season according to local people.